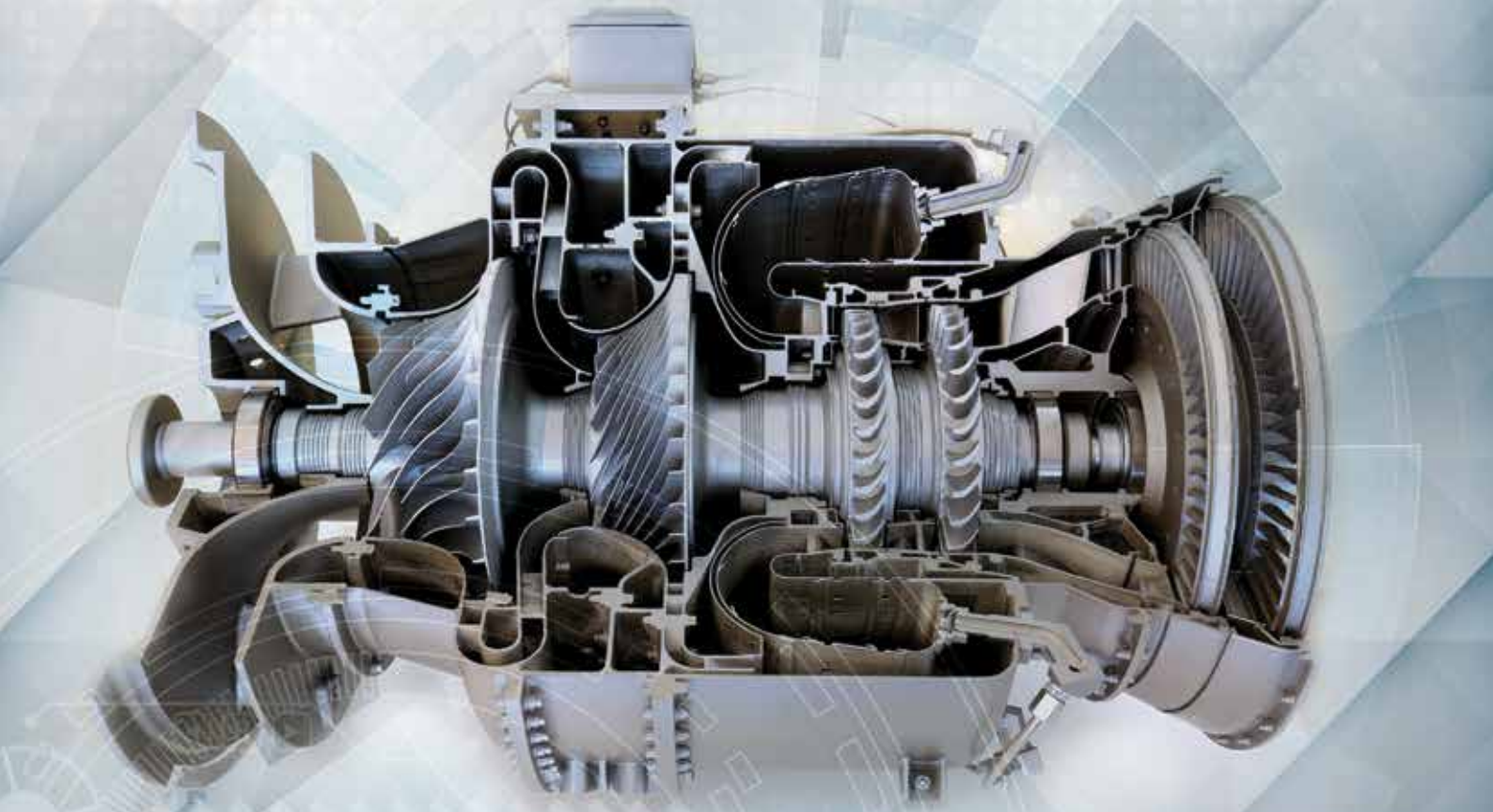
TEI POST
The periodical of TUSAS Engine Industries, Inc. (TEI).
ISSUE 132 2017

TEI IS DEVELOPING THE FIRST DOMESTIC TURBOSHAFT ENGINE



TEI TAKES THE INITIATIVE FOR GROUND TESTS OF PD170 ENGINE

SIGN - OFF PROCESS COMPLETED FOR JSF PROJECT

WOMEN OF AVIATION WEEK CELEBRATED WITH VARIOUS EVENTS

TUSAŞ MOTOR SANAYİİ A.Ş.
TUSAŞ ENGINE INDUSTRIES, INC.

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EDITORIAL

Dear TEI Post Readers,

We are happy to meet you again with the first issue of 2017. Before telling you of the contents of this issue, we would like to inform you that we have changed our publication period from bi-annual to tri-annual in line with your feedback you have communicated to us through TEI Post Satisfaction Survey. We are very happy to meet you more frequently.

Our "Cover Story" in issue 132 focuses on "Turboshaft Engine Development Project" which was signed - off on February 7. The heading "Activities & Projects" provides information regarding the projects we carry out to satisfy the needs of the domestic defense industry, and to decrease our international dependency.

In the section "Travel", our employees share their experiences they have had in Maldives and Antalya, intending to give you an inspiration for your vacation plans in these sweltering days.

See you in our next issue...

For and On Behalf of TEI
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WE PROCEED STEP BY STEP TO OUR GOAL TO BECOME THE LEADING ENGINE MANUFACTURER

The first 4 months of 2017 witnessed some important developments for our company. Probably, the most important development was completion of the execution process in "Turboshaft Engine Development Project". The project will be carried out under the leadership of Undersecretariat for Defense Industries (UDI) Department of Sub - Systems, under which design, development and testing infrastructure for gas turbine engines will be generated in our country on one hand, and the 1400 shp original and national engine with applicable type certificate will be developed by our company in order to be integrated into the Indigeneous Helicopter, on the other hand. Marking an important milestone to achieve our vision of "becoming a leading engine company globally", this project will enable Turkey to be among the few countries which are able to manufacture their own gas turbine engines. Serving in this project both imposes a severe duty on our shoulders and enables us to take pride in substantially.

On the other hand; sign - off process was completed for Joint Strike Fighter (JSF) Project Engine Final Assembly Line Establishment, Activation and 1st ASMC Command T-11 Test Cell Modification Phase Project, which marks another important development arising in this period. JSF project, described as the largest defense industries supply project of all times, will be carried out by TEI, acting as the main contractor, and multiple domestic and foreign sub - contractors, under which the 1st ASMC Command will be the first center to be established for the purpose of providing heavy maintenance and repair services for JSF aircraft of all users across the European region.

We completed successfully the first ground test of the PD170 engine, the first domestic turbodiesel UAV engine of Turkey developed through completely national opportunities and resources including the control system and software. Following the start - up, we optimized the engine software parameters in a manner to put the engine to its full power in a short time, and became happy to see that the expected power and fuel consumption values could be easily met. I would like to thank all my colleagues for their valuable contributions in this achievement.

We can attain and realize all new projects and achievements with the devoted efforts of TEI's valuable employees. All these achievements are recognized and appreciated by the Undersecretariat for Defense Industries, which is proved best with the "First Prize by Undersecretariat for Defense Industries" we were granted two years in a row in consequence of assessment of the data for 10 different categories.

In addition to these achievements we attained in our fields of activity, we also carried out many social responsibility projects. One of the most important projects was the organizations we held to encourage female students to the aviation industry with the supports extended by the Provincial Directorate of National Education in Eskisehir as part of the "Women of Aviation Worldwide Week", like the one we did last year. I have full faith that this project will be a source of inspiration for our students who will be the women of aviation in future.

Upon getting off to a flying start, we filled the first 4 months of 2017 with great achievements. I would like to take this opportunity to extend my thanks to each and every member of TEI family who have devoted their efforts to all these achievements. I am confident that each of our employees will carry exerting themselves during the whole year to contribute to our company's vision of "becoming a leading engine company globally".

Greetings and best regards,

Prof. Mahmut F. Aksit
President & CEO, TEI

TEI IS DEVELOPING THE FIRST DOMESTIC TURBOSHAFT ENGINE

As part of the "Indigeneous Light Utility Helicopter Program" carried out by Undersecretariat for Defense Industries in order to satisfy the need of Turkish Land Forces Command, "Turboshaft Engine Development Project" was initiated with the aim of meeting the engine need of the helicopter with domestic means.

Sign - off process was completed on February 7, 2017 upon the ceremony held with attendance of Prof. Ismail Demir, Undersecretary for Defense Industries, and Prof. Mahmut F. Aksit, President and CEO of TEI, for Turboshaft Engine Development Project initiated with the aim of satisfying the engine need of the helicopter, developed for Turkish Land Forces Command, with domestic means. Participants from the Turkish General Staff, Turkish Land Forces Command, Undersecretariat for Defense Industries, TUSAS and TEI were present at the ceremony.

The project will be carried out under the leadership of Undersecretariat for Defense Industries (UDI) Sub - Systems Department, under which design, development and testing infrastructure for gas turbine engines will be generated in our country on one hand, and the 1400 shp original and national engine with applicable type certificate will be developed by our company in order to be integrated into the Indigeneous Helicopter, on the other hand.

The project will be carried out for 8 years by a team of approximately 250 engineers all of whom are TEI employees serving at TEI's Engineering Offices in Eskisehir, Ankara and Istanbul. Developed by the design team consisting of the disciplines of Aerothermal Engineering, Structural Engineering, Product Engineering, Engine Prototype and Test, Electrics / Electronics - Control and Embaded Systems, this product will start to power the helicopter with the superior manufacturing capabilities and powerful domestic suppliers of TEI in the following period.

Under the scope of this project, 2 certificated, 1400 shp turboshaft engines will be developed. Turboshaft engine will be integrated into the indigeneous helicopter, and certificated.

Furthermore, we will gain many values with Turboshaft Engine Development Project:

• Our country will gain experience and know - how in turboshaft engine design,
• The testing infrastructure, to be established, can be used in gas turbine engine development projects in classes up to 2000 shp horse power,
• Materials Database for Engines will be created,
• Design and testing software will be developed,
• Engine certification experience will be gained,
• Domestic suppliers will be strengthened.

On the other hand; Turboshaft Engine Development Project will utilize all gains to be derived from the below-given projects, carried out by TEI with the support of Undersecretariat for Defense Industries;

• Modeling and Process Development of Direct Metal Laser Sintering Process for Aero - Engine Applications - YAKUT Project
• Development of Advanced Manufacturing Technologies for Nickel - Based Superalloy Turbine Blades - KRISTAL Project
• Development of Titanium and Nickel Based Superalloy Forging Technologies - ORS Project

With this project, Turkey will be one of the few countries which manufacture its own gas turbine engine. Any future derivative of the engine may be utilized to power the national platforms such as Atak and Hurkus. Core technology of the engine will form the basis for the engine needed for "National Training / Fighter Aircraft - T/FX". The capabilities, gained under Turboshaft Engine Development Project, will be supplemented as necessary, and enable the domestic aircraft engine to be developed in a period to satisfy the need. Under the scope of this project which will allow for international sales of the engine, the first engine run-up will be accomplished in the second year, and the engine will be certificated fully in the eighth year.

Gas Turbine engines play an important role in the fields of defense, aviation and energy. Being the most important component of aviation platforms, gas turbine engines are composed of 5 main modules.

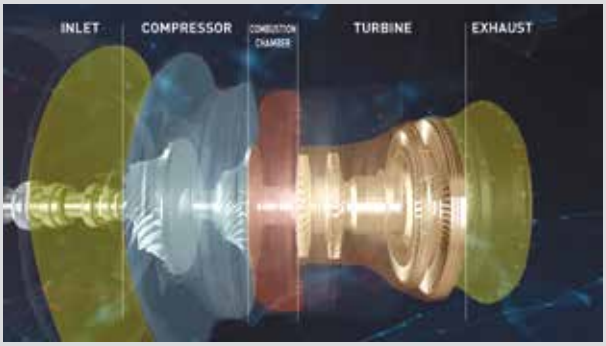
• Air Inlet
• Compressor
• Combustion Chamber
• Turbine
• Exhaust

Compressor, combustion chamber and turbine are the most challenging functional components of gas turbine engines.

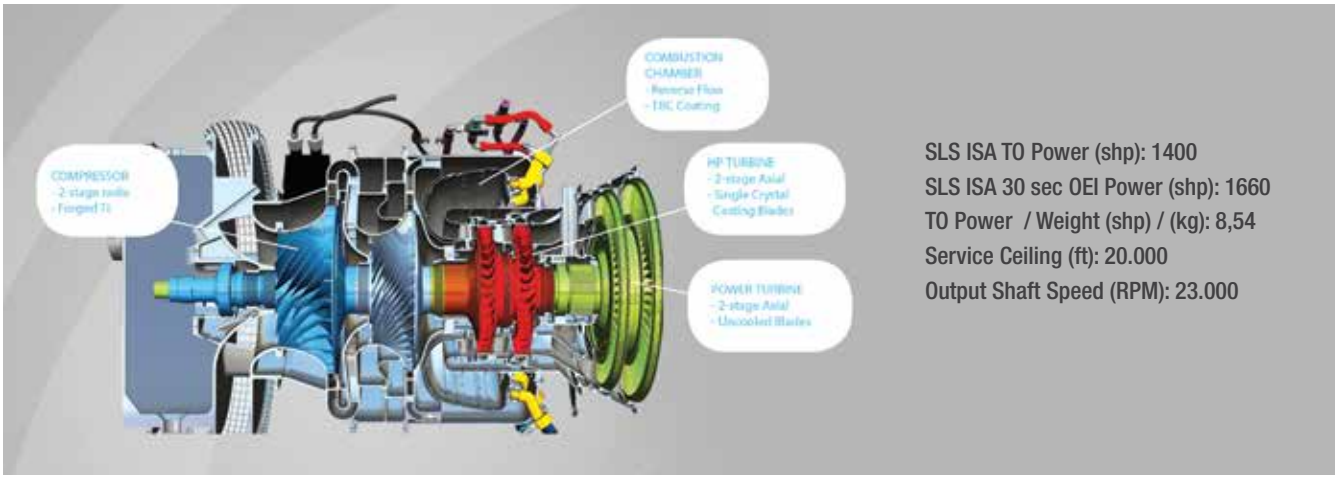
Compressor is the module of the gas turbine engine which compresses and pushes the air backwards. The compressed air may reach up to 15 bars.

Combustion chamber is the part where fuel is added to the compressed air, and then combusted, enabling that high-pressure air is transmitted to the turbine at a high temperature.

After the heat of around 1300 °C and high-pressure air reach the turbine, the power to be needed by the aircraft will be generated.



TECHNICAL SPECIFICATIONS OF TS1400 ENGINE



SLS ISA TO Power (shp): 1400
SLS ISA 30 sec OEI Power (shp): 1660
TO Power / Weight (shp) / (kg): 8,54
Service Ceiling (ft): 20.000
Output Shaft Speed (RPM): 23.000

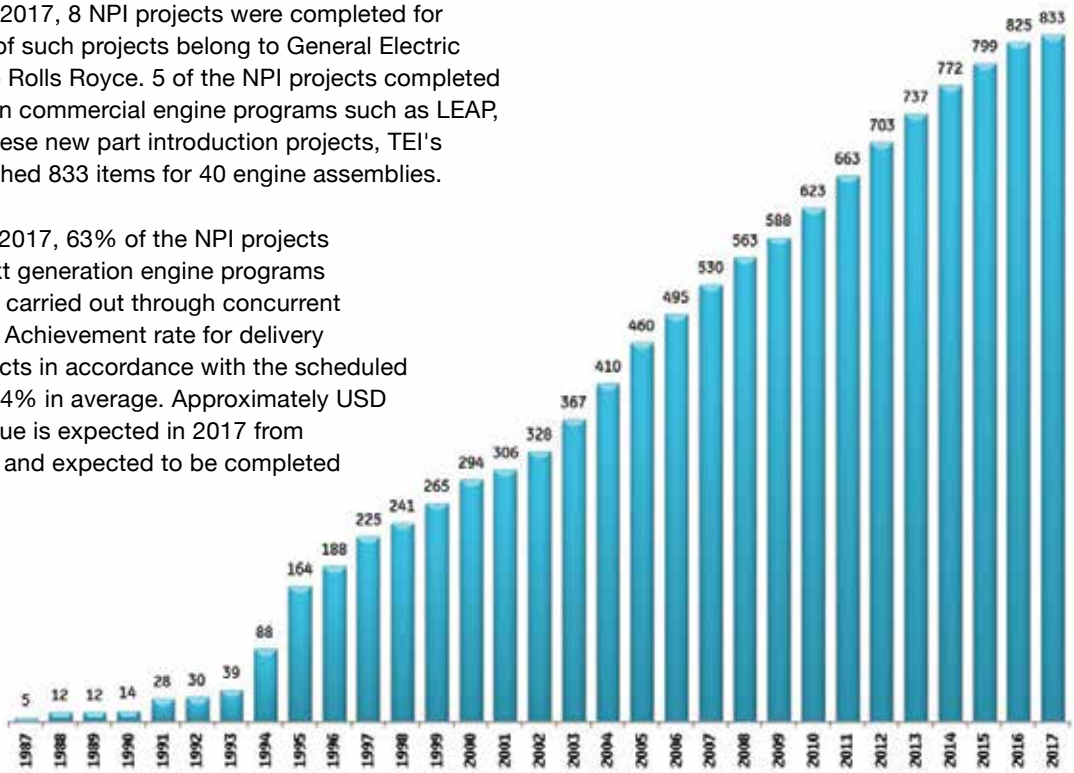
ACTIVITIES FOR THE **FIRST 4 MONTHS OF 2017**

PART AND MODULE MANUFACTURING

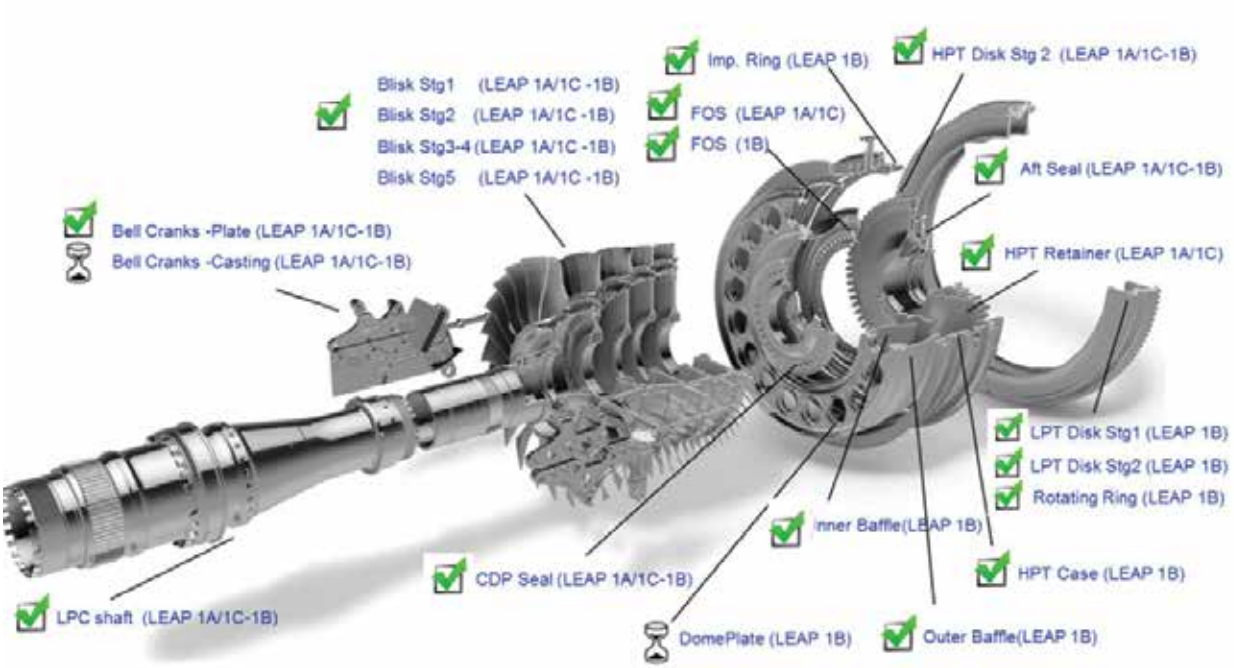
NEW PART INTRODUCTION (NPI)

In the first 4 months of 2017, 8 NPI projects were completed for international clients. 6 of such projects belong to General Electric (GE), 1 to Snecma, 1 to Rolls Royce. 5 of the NPI projects completed were for next generation commercial engine programs such as LEAP, Silvercrest, etc. With these new part introduction projects, TEI's product range has reached 833 items for 40 engine assemblies.

In the first 4 months of 2017, 63% of the NPI projects completed were for next generation engine programs and such projects were carried out through concurrent engineering processes. Achievement rate for delivery deadlines of such projects in accordance with the scheduled engine programs was 94% in average. Approximately USD 13.2 million sales revenue is expected in 2017 from the projects completed and expected to be completed in 2017.



NPI Product Diversity



NPI projects for the LEAP engine assembly, which is intended to replace CFM56, currently being the most preferred commercial engine by airline operators, were carried out together with Safran and GE through concurrent engineering processes. So far, 26 different NPIs and 43 different configurations were completed for the LEAP engine program.

TEI is the leader part manufacturer of LEAP engines worldwide with 31 different parts, for which it has assumed manufacturing responsibility, and with backlog volume of 2.2 billion dollars. In the first 4 months of 2017; the NPI projects for outer baffle, inner baffle, forward outer seal, and new configuration project for the stage 2 HPT disc were completed.

As part of the Turboshaft Engine Development Project (TEDP), 107 new part introduction projects for the first prototype engine are being carried out within the organization of TEI. Based on the project plan, manufacturing processes on 58 dummy parts were completed. Also, in April, the first material procurement processes were performed, and the work for commissioning the 7 new parts on real material was completed.

TECHNOLOGY / INVESTMENT WORKS FOR IMPROVEMENT / NEW INTRODUCTION

In the first four months of 2017, works for new introduction were also carried out. Accordingly;

- Ultrapolishing process was developed.
- Investment in the Rapid Drilling EDM was made, and process development works were completed.
- Effective Gear inspection capability was acquired by the new investment.
- New visual measurement method Blue Etch Anodize (BEA) was developed.
- CSM (Curved Slot Milling) application was adapted to TEI.
- Stabber process capability was acquired by the new investment.
- Manufacturing project monitoring and management system for part manufacturing, carried out under TEDP, was put into use together with the relevant software.
- New nonconformity monitoring system was put into use together with the relevant software.

As part of the investment plan;

- AFM (Abrasive Flow Machining) to be used in Abrasive Flow operations for disc parts of the LEAP engine,
- The horizontal multitasking machines to be used in the multitasking operations for the disc parts of the LEAP engine,
- The horizontal multitasking machine, in which investment has been made in order to be used for part manufacturing under TEDP,
- The 2nd milling and cornering machine to be used in the LEAP HPT disc line,

Rapid Drilling EDM

- The gear measuring machine to be used in the measurement of precision spline geometries,
- 2 robotic rounding and chamfering machines to be used in the rounding and chamfering operation for the blisk parts of the LEAP engine,
- The second 5-axis milling (CSM) machine to be used in the CSM (Curved Slot Milling) operation for the blisk parts of the LEAP engine,
- Wenzel - CMM measuring machine,
- In the building B1000, new Titanium Etching system and Fluorescent Penetrant Inspection system,
- In the building B1000, new automatic part cleaning system were put into use.

Gear Measuring Machine

PROJECTS

GROUND TESTS FOR PD170 ENGINE INITIATED

Operative UAV Engine Development Project was initiated in January 2013 upon assignment of TEI by the Undersecretariat for Defense Industries in order to meet the mid - and long- term engine needs for national Operative UAVs. PD170 engine, the first national turbodiesel UAV engine of Turkey, not only provides the opportunity to carry the performance parameters such as working load capacity, climbing speed, altitude capability and endurance even further, but also removes the critical external dependency in engines.

Manufactured through utilization of domestic resources to the maximum extent, the engine was developed through completely national opportunities and resources including the control system and software. The supply and production chain were organized in a manner not to cause critical external dependency in any subpart.

Before proceeding with performance of qualification and certification tests, it was decided to produce the preliminary prototypes, the first one of which was run successfully in January 2017, marking a highly-important phase of the project. Following the start - up performed smoothly in consequence of the long - term and well thought out works, the engine software parameters were optimized to give full power to the engine in a short span of time, and it was observed that the power and fuel consumption values, as expected from the engine, were satisfied easily. Featuring with its power, fuel consumption and weight values far above the contract requirements, PD170 engine will have the competitive technical specifications when compared to the other engines in its class. Tests under altitude conditions will be launched in June, 2017 for the engine that is expected to yield performance values far beyond the existing engines especially in terms of altitude power values.

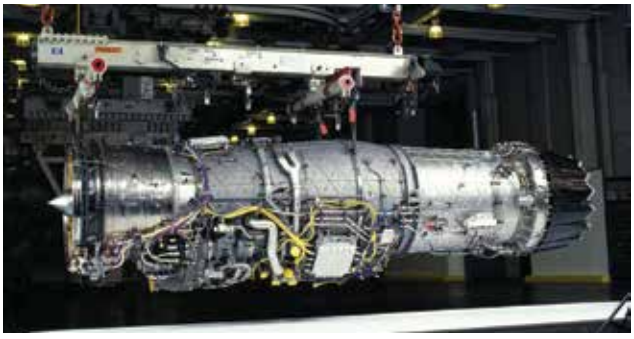
In the upcoming period; an extensive software calibration process will be initiated in order to enable that the engine will generate the intended power and fuel consumption values steadily and without exceeding the mechanic limits of the engine under various environment and load conditions. The parameter optimization (calibration) of the error trapping (diagnostic) functions will be performed. This experimental optimization works will last for about 1.5 years, and require performance of tests on the bench for a few thousands of hours. Moreover; the endurance tests will be carried out intensively in the first half of 2018 in order to verify endurance of the engine. Any design improvement works will be performed during this process if and when so required. The qualification tests, to be performed for verification of the client's requirements, and the certification tests, to be performed for confirmation of compliance with EASA CS-E, are aimed to be completed in 2018, and that the engines will be delivered in the first months of 2019. Throughout this development process, it is aimed to manufacture approximately 15 prototypes except for the engines to be delivered, and to carry out the tests for these prototypes that will last for more than 5000 hours.

A team consisting of more than 100 persons is assigned dedicatedly for design, manufacturing, supply, quality, assembly, testing and project management functions.

SIGNING CEREMONY FOR JOINT STRIKE FIGHTER (JSF) PROJECT ENGINE FINAL ASSEMBLY LINE ESTABLISHMENT, ACTIVATION AND 1ST ASMC COMMAND T-11 TEST CELL MODIFICATION PHASE PROJECT

Signing ceremony for 'Joint Strike Fighter (JSF) Project Engine Final Assembly Line Establishment, Activation and 1st Air Supply Maintenance Center (ASMC Command) T-11 Test Cell Modification Phase Project' was held on March 23, 2017, at the Undersecretariat for Defense Industries upon attendance of Prof. Ismail Demir, Undersecretary for Defense Industries, and Prof. Mahmut F. Aksit, President and CEO of TEI.

Upon execution of this agreement following the planning and management phases completed as part of the initiatives for Engine Final Assembly / Check - Out Line and Establishment of the Depot - Level Maintenance Center for the European Region, TEI will realize 1st ASMC Command T-11 Test Cell Modification and Engine Final Assembly / Check - Out (FACO) Line Assembly within a period of three - year project schedule at the 1st ASMC



Command in Eskisehir. The capabilities acquired as part of the project, to be carried out under the leadership of Aircraft Department of the Undersecretariat for Defense Industries, will serve for not only assembly and testing processes of any engines, to be included in the inventory of the Republic of Turkey, but also establishment of a facility and infrastructure for regional engine maintenance, repair, overhaul and testing processes at the 1st ASMC Command.

JSF project, described as the largest defense industries supply project of all times, will be carried out by TEI, acting as the main contractor, and multiple domestic sub - contractors, under which the 1st ASMC Command will be the first center to be established for the purpose of providing heavy maintenance and repair services for JSF aircraft of all users across the European region.

HUMAN RESOURCES PROCESSES

WORKS FOR EMPLOYMENT FROM UNIVERSITIES

TEI, undertaking the task of designing and producing the domestic helicopter engine for Turkey's national needs, needs a lot of new employees in this scope. Various works are being carried out in order for realization of successful students and acquisition of the same as part of TEI while continuing their university education.

As part of such studies, TEI participated in various events such as career days, fairs and similar activities of the universities in order to increase the awareness of TEI among the university students, and to inform the students about the projects of the company, and also to raise students' curiosity about the aviation industry and TEI's activities.

Events participated in:

Event Title	Date
Istanbul Technical University (ITU) Career Days (Ayazaga Campus and Gumussuyu Campus)	21 - 22, 2017
Middle East Technical University (ODTU) Career Days	March 2 - 3, 2017
Ege University Aviation and Electrical Systems Development Conference	March 11, 2017
TOBB University of Economics and Technology (TOBB ETU) Career Days	March 23 - 24, 2017
Yildiz Technical University Career Fair	March 28, 2017
Istanbul Teknopark Career Fair	March 30, 2017
Eskisehir Osmangazi University (ESOGU) Career Day	2017 April 27, 2017

Participation in similar events will continue in the upcoming period, and different meeting will be organized with the successful student.

ANNUAL PERFORMANCE OF EMPLOYEE COMMITMENT AND SATISFACTION SURVEY

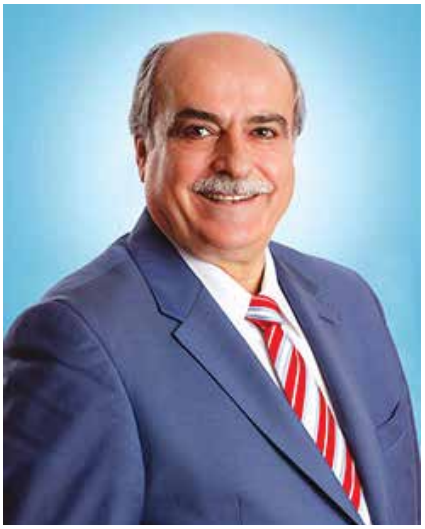
As part of Strategic Human Resources Management, in December 2016, the employee's commitment to the company was measured for the first time in addition to the Employee Satisfaction Survey. The employees committed to the company are defined as the employees, who speak positively about the company, and who associate their future to the future of the company, and who are willing to make extra effort for the company. New structure of Employee Commitment and Satisfaction Survey is intended to be developed annually.

TURKISH EMPLOYMENT AGENCY (ISKUR) ON-THE-JOB TRAINING PROGRAM

In 2016, 116 trainees were trained through Turkish Employment Agency (ISKUR) On – Job - Training Programs, and 80% of such trainees were employed accordingly. As a consequence of such successful works, in 2017, a new On – The - Job Training Program was initiated in collaboration with Turkish Employment Agency (ISKUR). There are 36 trainees trained under the program, and they are intended to be evaluated for the purpose of employment upon completion of their course in August. The initiatives have been started for the purpose of performance of a second program within the year.

BOARD OF DIRECTORS OF TEI

Assoc. Prof. Temel Kotil
Starting to hold office as Chairman of the Board of Directors of TEI as of March 27, 2017, Assoc. Prof. Temel Kotil, serves as President & CEO of TAI - Turkish Aerospace Industries, Inc.



Assoc. Prof. Osman Saim Dinc
Starting to hold office as Member of the Board of Directors of TEI as of March 27, 2017, Assoc. Prof. Osman Saim Dinc serves as Deputy Chairman of the Board of Directors and General Manager of Calik Enerji.

Muharrem Dortkasli
We would like to thank Mr. Muharrem Dortkasli for his valuable services as Chairman and a Member of the Board of Directors between 2014 - 2017 at our company.

(R) Air Com. Col. Yalcin Kilinckaya
We would like to thank Mr. Yalcin Kilinckaya for his valuable services as a Member of the Board of Directors between 2016 - 2017 at our company.

6 SIGMA TRAININGS UNDER KALDER COMPLETED

6 Sigma trainings, provided to university students designated by KalDer (Turkey Society for Quality) with the support of TEI, were delivered by Bahadir Ozdemir, serving as Technical Leader - Quality at TEI, and completed in April. This training covered the phases of define, measurement, analyse, improvement and control in parallel with the methodology of 6 Sigma. Four students, being entitled to yellow belt certification upon completion of the training, were granted with their certificates by Specialist MD. Burak Erdinc, Chairman of the Administrative Board of Eskisehir Branch of KalDer, and Bahadir Ozdemir. Two students, who were required to complete their projects for green belt certification, were granted with the opportunity to serve their internship at TEI, and they were assigned in the ongoing projects across TEI. The other two students, completing the program, are continuing to serve their internship at another entity.

QUALITY AND CERTIFICATION ACTIVITIES

OVERVIEW TO TEI NADCAP ACCREDITATIONS

Eight different Nadcap audits were performed at TEI by Performance Review Institute (PRI) in 2016, yielding successful outcomes. Electro - Chemical Grinding and Localized Heat Treatment processes were subject to audit and included in the scope of accreditation by Nadcap for the first time. During the first quarter of 2017, material testing processes were audited in order to include "High Temperature Tensile Test" in the scope of laboratory accreditation. The audit was completed successfully, and the revised certificate was issued.

Nadcap is a unique program developed in cooperation with industry in order to decrease quality assurance costs while increasing quality in aviation and defense industry. Accordingly; suppliers are encouraged to identify individuals who will represent them as Supplier Voting Members on Nadcap Task Groups. Yasemin Seref Cizioglu, Technical Leader, and Aysin Aras, Expert Engineer in Quality and Certification Leadership at TEI, participated in the Nadcap meeting held on February 20 - 23, 2017 in New Orleans, USA.

In consequence of this meeting, TEI became a member to two new Task Groups. Special process groups covered under our membership to Task Groups; CMSP (Conventional Machining as a Special Process) M&I (Measurement and Inspection) and MTL (Material Testing Laboratories).

CURRENT NEWS ON NADCAP PROGRAM

Additive Manufacturing Process is now under Nadcap

Additive Manufacturing is growing increasingly across the aviation industry, and more and more companies try to manufacture parts at more affordable prices and more rapidly through especially powder bed method. Nadcap Welding Task Group participates in a project in order for auditing of the companies, which are engaging in laser and EB powder bed additive manufacturing operations, in accordance with compelling aviation regulations.

Nadcap additive manufacturing audit checklists were issued together with manuals under the Welding Group at the end of 2016. In 2017, LAI International Inc. became the first company to be accredited in line with Nadcap Additive Manufacturing Checklist AC7110/14. TEI plans to include additive manufacturing process in its welding accreditation scope in the upcoming years. Additionally, additive manufacturing tests were presented to the attention of Nadcap MTL Task Group, the members of which are now searching how they can support Welding Task Group in the additive manufacturing process.

PRI & ANAB Agreement

Executive Vice President & Chief Operating Officer of Performance Review Institute (PRI) announced that a new agreement was officially executed with ANSI-ASQ National Accreditation Board (ANAB-USA). This agreement will enable the companies to achieve Nadcap Material Testing Laboratory (MTL) and ISO/IEC 17025 accreditations with a single joint audit.

The joint Nadcap MTL and ISO/IEC 17025 audit will be carried out by PRI on the same basis as a standard Nadcap audit. Upon conduct and successful completion of the audit by Nadcap MTL Auditors and experts engineers of PRI, Nadcap MTL accreditation will be issued by PRI while ISO/IEC 17025 accreditation will be issued by ANAB. It is estimated that implementation of this process outside the USA will take some time.

Newly - Released Revision of AWS D17.1

Specification American Welding Society (AWS) released the latest version of D17.1 specification in early 2017. The main revisions are procedure qualification, visual acuity and welder qualification for tack welding. It is expected that the specification will be issued either late 2017 or early 2018.

- In case the necessary variables under Welding Procedure Specification (WPS) exceed the pre-determined parameter limits, qualification requirements and qualification testing methods will be redefined, and manual welding qualification requirements will be clarified by procedure qualification revisions.
- Revisions will make the visual acuity requirements for welders and inspectors identical, and allow for alternative testing methods.
- Revisions will limit manual tack welding qualification depending on base metal composition and filling material.

COLLECTIVE INAUGURATION HELD

TEI has assumed a key role in a number of projects to enable accomplishment of the goals set for the national Defense and Aviation Industry in Turkey, including creation of substantial employment opportunities in the industry through the Turkish Utility Helicopter Project launched in 2016 and its investment in Advanced Manufacturing Technologies Building. Executing "Turboshaft Engine Development Project" agreement with Undersecretary for Defense Industries on February 7, 2017 with the aim of developing the first domestic helicopter engine of our country, TEI continues providing contributions to national employment mobilization with its recruitments. As part of the "On-the-Job Training Program", initiated by ISKUR (Turkish Employment Agency) in order to decrease unemployment rate, and the "Project for Training Highly Competent Technical Personnel in Turkish Aviation Industry" which is carried out under the coordination of the Ministry of Labor and Social Security, TEI not only satisfies its own need for qualified workforce but also provides the inexperienced persons with the opportunity to work by providing them the opportunity to put the theoretical information they have learned into practice in line with the needs of the industry. In line with this initiative, TEI delivered personnel ID cards to 57 persons, who have successfully completed these two programs, at the Collective Inauguration held on March 01, 2017, and these people started to work officially at TEI.

We will keep increasing the employment rate

Pursuing a vision for "having globally competitive, original power systems", TEI will increase its workforce by 20%, making 4 times more contributions than expected to national employment mobilization. TEI will be providing additional employment opportunities to 374 people in total, including 207 white-collar employees and 167 technicians to increase qualified workforce in Turkey in 2017.

ACTIVITIES BY FACILITIES & LOGISTICS SERVICES MANAGEMENT

Facilities & Logictics Services Management, established on January 1, 2017 within the organization of Human Resources Directorate, carried out the following activities between January - April:

- Logistic warehouse and office construction,
- Construction of the special building necessary for Pre-spin machine set-up,
- Kardex Storage Area construction,
- Landfill construction,
- Generation of sections within B800 building workshop area basing on the fields of activity of Design Engineering Directorate,
- Establishment of a meeting room for Recruitment Management at the entry of the power plant.

FIRST PRIZE BY UNDERSECRETARIAT FOR DEFENSE INDUSTRIES

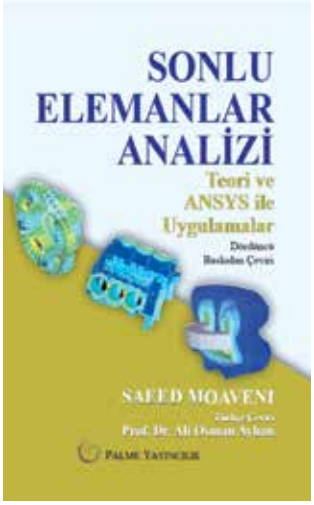
Defense and Aerospace Industry Manufacturers Association (SASAD) organized the awards ceremony during its 28th Ordinary General Assembly Meeting on April 20, 2017, and TEI was granted with the first prize by Undersecretariat for Defense Industries upon assessment of the data of all member countries for 10 different categories in 2015. The award was granted to Prof. Mahmut F. Aksit, President and CEO of TEI, by Fikri Isik, Minister of National Defense.

RUNNER - UP PRIZE BY DEFENSE AND AEROSPACE INDUSTRY EXPORTERS' ASSOCIATION

Defense and Aerospace Industry Exporters' Association granted prizes to the most exporting companies in the field of Defense - Aviation in 2016 during its General Assembly Meeting on April 26. TEI ranked second with its export operations of 237 million dollars in 2016 in the field of Defense and Aviation Industry, following TUSAS. The award was granted to Prof. Mahmut Faruk Aksit, President and CEO of TEI, by Fikri Isik, Minister of National Defense.

ALI OSMAN AYHAN CROWNED WITH **PRIZE** BY TUBA

Turkish Academy of Sciences (TUBA) University Textbooks Award Programme (TECEP) and The Young Scientists Award Programme (GEBIP) awards were presented to the winners during the award ceremony held on February 1, 2017 at the Presidential Complex. The book titled "Finite Element Analysis: Theory and Application with ANSYS", translated by Prof. Ali Osman Ayhan who has served as Design Engineering Director at TEI between 2016-2017, was granted with the Award for Best Books Authored and Translated (TECEP) in 2016 by Turkish Academy of Sciences by Prof. Arif Ergin, president of TUBITAK (The Scientific and Technological Research Council of Turkey).



COUPLED SOLUTION OF FINITE ELEMENTS AND FINITE VOLUME MODELS

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The article is the paper presented during the "National Aeronautics and Astronautics Conference VI" held on September 2016.

ABSTRACT

Finite elements and finite volume analyses are actively involved in the design process of gas turbine engines and are being used extensively. Since exact estimation of the temperature values of the engine parts is of great importance, the simulation models must provide values consistent with the actual situation. Therefore, the primary goal of the analyses is to obtain the exact temperature distribution. The temperature distribution is obtained by three calculation methods. These are conjugate computational fluid dynamics analyses, finite element analyses, and coupled solution of finite elements and finite volume models. The coupled solution method has been often preferred recently as it is superior to the computational fluids dynamics analyses in terms of time and to the finite elements analyses in terms of accuracy.
For the coupled solution method, computational fluid dynamics analysis and finite elements analysis models are created separately, and gas temperature, heat transfer coefficient and metal temperature parameters are exchanged in the common interface. At each exchange, the analyses are re-solved, and the iterations are completed. In this study, the theory of the coupled solution of finite elements and finite volume models is explained, and its equations are described in detail.

INTRODUCTION

In today's aviation, especially in civil aviation, there is a growing need for higher energy efficiency. Gas turbine engine manufacturers, on the other hand, have to manufacture more reliable, more efficient and lighter engines as well as to obtain profit from the manufacturing. There are two methods that can be applied to overcome this problem. These are either testing engines with differently designed configurations or creating realistic simulations by using verified methods. Since engine testing for each new version results in higher costs, it is preferable to create realistic analysis models. Temperature distribution is desired to be modeled in a more realistic manner in these analysis models. Because overestimation of the temperature values causes higher stress values, and such values also cause geometric shapes for which many more materials are used (thick blades, higher values of wall thickness). In such case, engine components that are designed on extremely safe basis will be heavier and more costly. On the other hand, since underestimation of temperature values will result in selection of non-durable materials, thus, in destruction during the run, the need for a new engine, i.e. a higher cost, will occur accordingly. As a result, it is important to calculate more exact metal temperatures during the course of engine design and to conclude the design accordingly; thus, it is required to improve the methods used or to create new analysis methods.

By the increased computational fluid dynamics (CFD) analysis capacity and computer power, CFD analyses have started to be used as well as finite elements analysis (FEA) software frequently used in metal temperature calculations. In respect of heat transfer problems between solids/fluids, in general, three methods, including the CFD analyses, are used. These are conjugate heat transfer analysis, non-coupled FEA/CFD process and coupled FEA/CFD approach, respectively.

Solid/fluid heat transfer calculations with respect to conjugate analyses are performed by expanding the CFD capacity to include the heat transfer in the solid elements adjacent to the fluid. However, CFD calculations require longer period of calculation and

higher capacity technical equipment due to the fact that such calculations are also expanded to include the solid elements in addition to the fluid elements. Therefore, steady state models or transient simple problems can be solved in general. The correlations obtained as a result of CFD analyses are used during the process of non-coupled FEA/CFD, which were boundary conditions of the finite elements software. Such correlations are obtained as a result of limited CFD problems solved for steady state. Therefore, the high cost in the analyses has been reduced. Although this method has been used frequently in recent years, the success of the non-coupled process depends on the experience of the analyst. Because it is the analyst's preference to determine the dimensions at which the parts of the elements are to be divided, and to determine which correlations are to be applied to such elements. The coupled FEA/CFD approach is a method, which has been frequently applied in recent times, and the example of which is available in the literature. Using this method, more exact results can be obtained compared to the solutions performed through a single tool (computational fluid dynamics, heat transfer analyses and mechanical analyses). The result can be obtained by coupling two different tools or more than two tools. For example; aero-thermal analyses are performed by coupling aerodynamic and heat transfer models, and thermo-mechanical analyses are performed by coupling the heat transfer and mechanical analyses (structural analyses), and aero-mechanical analyses are performed by coupling the aerodynamic calculations and mechanical analyses, or aero-thermo-mechanical analyses are performed by coupling such three models (aerodynamic, heat transfer, mechanical analyses). Since all these processes are based on the iterations between the models constituting the coupled solution, the coupled solution is also an optimization method. The iterations are based on data exchange between the models, and any data obtained from a model solution is used as input to the other model. Data transfer is performed manually due to the limited number of iterations (often one or two) between methods that do not directly affect each other. These methods may be considered as thermo-mechanical and aero-mechanical solutions. However, since metal temperature in aero-thermal solutions will vary based on the gas temperature applied each time, it is desirable to minimize the difference between the two iterations. Therefore, the number of iterations is very high (hundreds), and the convergence will take a considerable period of time. Consequently, automation tools are used. The main task of these tools is to run analysis models, created previously, and to feed the output of the model, run firstly, into the other model and to run such model.

METHOD

In the literature, the coupled solution has been performed for the purpose of exact estimation of the temperature distribution of the bifurcation pipe in a nuclear power plant heat exchanger [Dixon et al., 2010]. During this solution, SC03 as the finite elements software (the software, which has been created internally by Rolls-Royce, and which is provided to the other users on commercial basis, and which obtains thermal, mechanical and vibration solutions), and Fluent as the CFD software have been used. In order to perform data exchange between the two software, the communication code has been created and automatic iteration has been ensured. In this study, iterations have been maintained until the difference of 0.1 K between the two temperature analyses has been obtained. It has been reported that the model has produced results very quickly, and that a distribution that is very close to the actual temperature distribution has been obtained. In another study, the movement of the cooling air in the compressor disk space of a gas turbine engine and the variation of the temperature distribution of the disk have been investigated [Dixon et al., 2004]. Also, the temperature values calculated as a result of the analyses have been validated by thermocouple measurements. Similarly, the analysis of the space between rotating and stationary turbine components has been calculated by means of the coupled solution method [Mirzamoghadam et al., 2000]. In addition, structural analysis has been performed by using temperature values calculated by means of the iteration method, and it has been coupled with thermo-mechanical analysis. As a result, the most realistic metal temperatures have been obtained by using the geometry of the engine in operating condition (hot state). In another study, temperature distribution of the free-rotating disks has been calculated by means of both conjugated and coupled method, and it has been compared with analytical solution [Verdicchio et al., 2001]. Accordingly, although there is a great difference between the coupled method and the conjugated method with respect to time of solution, the results are dissociated with negligible differences. Furthermore, in different studies, a coupled solution has been performed in order to obtain the exact temperature distribution for the compartments of the gas turbine engine which contain complex air streams. [Sun et al., 2010-2012]. During such studies, wall temperature and wall heat flow have been exchanged between the finite volume and finite elements models constituting the coupled solution.

The wall temperature has been obtained from the finite elements model, and the wall heat flow has been obtained from the finite volume model. In respect of software, finite volume solutions have been performed through HYDRA (a computational fluid dynamics software created internally by Rolls-Royce), and finite elements solutions have been performed through SC03. In the coupled solution approach, used for all studies, conduction and convection heat transfer have been calculated by means of FEA and CFD models. The solution of the problem will be explained through the conduction and convection equations under the section of applications.

APPLICATIONS

Attention should be paid to two subheadings when the solution process through the coupled method is theoretically examined. These are the location of the heat transfer coefficient during the process and the equations for an element available in the solid/fluid interface.

Location of the Heat Transfer Coefficient during the Process

For the purpose of understanding better the relationship between the solid and fluid regions, it is of great importance to evaluate the heat transfer coefficient that is often used in engineering. The energy equation for the fluid is specified in equation (1).

$$\frac{\partial}{\partial x_i}\left[u_i \rho \left(H + \frac{u_i^2}{2}\right)\right] = \frac{\partial}{\partial x_i}\left[q_i + u_j(\tau_{ij})_{eff}\right] \quad (1)$$

In equation (1), "H" represents the enthalpy, "x" represents the coordinate, and also u, q and τ represent the velocity, heat flow and shear stress, respectively. Enthalpy and heat flow is shown in equation (2) and equation (3), respectively.

In equation (2), Cp represents the specific heat at constant pressure; and in equation (3), keff represents the effective thermal conductivity coefficient.

$$H = \int_{t_{ref}}^{t} C_p dt \quad (2)$$

$$q_i = k_{eff} \frac{\partial T}{\partial x_i} \quad (3)$$

When the specific heat, effective conductivity, effective shear stress and density in the model are independent from time, velocity components are also independent from time, and equation (1) is linear at time "t". This is true when the temperature change and the lifting force are lower in the solution domain.

In a flow problem; let's assign Tg notation to the gas inlet temperature, which is determined as the boundary condition, and T notation to the constant temperature of solid surfaces when all of these surfaces are adiabatic. In addition to these, let's define Tad for the surface temperature obtained by adiabatic solution. In another solution, let's calculate the q1 heat flow distribution for the temperature T1. Based on all of such definitions, the distribution of the heat transfer coefficient can be expressed as in equation (4).

$$h = q_1/(T_1 - T_{ad}) \quad (4)$$

In Equation (1), Tad and Tg (gas temperature) are equal to each other since the terms of heating and kinetic energy derived from friction can be neglected. Due to both such matter and the fact that equation (1) provides linear results for temperature, the heat flow (q2) that changes the surface temperature from T1 to T2 is obtained by adding solutions (equation (5)).

$$q_2 = h(T_2 - T_{ad}) \quad (5)$$

Equation (6) can be created for the heat transfer coefficient by using equations (4) and (5).

$$h = \frac{q_1 - q_2}{T_1 - T_2} \quad (6)$$

As a result, "h" can be obtained by using two CFD solutions obtained from two different surface temperatures [Verdicchio et al., 2001].

Thermal Equilibrium of an Element in the Solid/Fluid Interface

Figure 1 shows a 1-dimensional (1D) fluid/solid conduction problem. Accordingly, in the length "l", there is a metal rod with a constant coefficient of thermal conductivity "k", one end of which is at a temperature T0. The unknown metal temperature in the fluid/solid interface is in Ts. Heat transfer to the metal from the fluid is obtained by multiplying the temperature difference by the heat transfer coefficient (equation (7)).

$$q = h(T_s - T_g) \quad (7)$$

Assuming that h and Tg are fixed throughout the coupling process, the fact that such two parameters (heat transfer coefficient and gas temperature) are sent to the solid model provides rapid convergence.

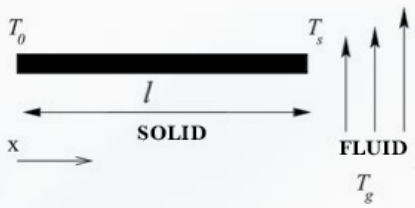

Figure 1.1-Dimensional Solid/Fluid Thermal Equilibrium

The exact temperature value of the 1-dimensional conduction problem is expressed by equation (8). Tt represents the exact solution for Ts.

$$T_t = \frac{kT_0 + hlT_g}{k + hl} \quad (8)$$

On the other hand, if the heat flow boundary condition is used to solve the conduction problem, the equation of conduction at x = 0 with T = T0 and at x=1 with "q" heat flow is as follows (equation (9)).

$$T(x) = T_0 - \frac{qx}{k} \quad (9)$$

When the heat flow value is placed in equation (9), a new Ts value is obtained at x=l. This value is shown in equation (11).

$$q = h\left(T_t + \Delta T - T_g\right) \quad (10)$$

When the heat flow value is placed in equation (9), a new Ts value is obtained at x=l. This value is shown in equation (11).

$$T_s' = T_t - \frac{hl}{k}\Delta T \quad (11)$$

Equation (12) can be created when "n" number of iterations is performed between solid and fluid.

$$T_t'^n = T_t + \left(-\frac{hl}{k}\right)^n \Delta T \quad (12)$$

The diagram of the solution and iteration process shown in equations is shown in Figure 2.

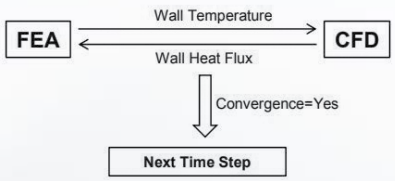

Figure 2. Diagram of solution and iteration

Accordingly, the steps can be listed as follows:

- In the CFD model, the temperature in the boundary of the fluid/solid is fixed to a certain value. During the first analysis run, the temperature value is homogeneously distributed. In respect of the subsequent iterations, the temperature value is obtained by interpolating the FEA results.
- The CFD model is run until it converges within itself.
- The boundary condition required for FEA analysis is calculated.
- The FEA model is run until it converges.
- Surface metal temperatures are transferred to the CFD model.
- Iterations are continued until the value on one side (heat transfer coefficient, metal temperature) converges.

CONCLUSION

In conclusion, it is important to simulate both metal and fluid sections in engine analysis models, since metal temperature distribution and exact determination of temperature values in gas turbine engines directly determine the development of the design. However, since the process has to progress rapidly at the same time, the methods that obtain rapid solutions from conjugate models should be developed. Since the coupled solution method is both rapid and realistic (close to test results), it meets the need for analysis. The basic method here is realization of the heat transfer, performed by convection from the fluid at the solid/fluid interface, in the solid element by means of conduction. When these two phenomena are equalized, the exact temperature distribution will be obtained by iterative solutions.

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TURNING OPERATION OF NICKEL BASED SUPERALLOY RENE 41

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SUMMARY

In the present work, the turning operation of superalloy Rene 41 was investigated in terms of surface quality of workpiece and wear behavior of cutting tool. In the experimental stage of this study, cutting speed and feed rate were used as the variable parameters and their influences were investigated using main effects plots in a full factorial experimental design. The results showed that surface roughness is mainly dependent on feed rate which results in a poor surface finish at high values. Although cutting speed is not a determining factor for surface roughness, surface quality is more prone to reduce as cutting speed increases. On the other side, the wear mechanism of cutting tool accelerates using elevated cutting speeds and feed rates.

Keywords - Turning; nickel based superalloy; surface roughness; wear.

INTRODUCTION

Aerospace applications provide an increase in flight range due to improvements in materials science for jet engines (Figure 1). In general, nickel, titanium, cobalt and iron based alloys are employed for the components of aero-engine systems depending on mechanical and thermal requirements. Nickel based alloys are the most preferred materials for aerospace applications. Rene 41 is a kind of precipitation hardening nickel based superalloy developed by General Electric and widely utilized for severely stressed high temperature applications such as hot section components in jet engines (Figure 1). Rene 41 is a highly corrosion and oxidation resistant material and therefore, it provides very good resistance to jet engine combustion gases up to 980°C. In aeroengines, this alloy is employed for afterburner parts, turbine casings (Figure 2), wheels, buckets, bolts and fasteners. Although this advanced alloy contributes to improvement in aerospace applications, it exhibits poor manufacturing properties due to their superior mechanical and chemical properties especially at elevated temperatures. The alloys with fully treated or partially aged condition are recommended for better surface finish in machining operations. Although Rene 41 has processing characteristics similar to Inconel 718, the machining behavior of this alloy is more difficult in comparison to alloy 718. In general, the studies in literature investigate the machining characteristics of Inconel 718 which is more popular due to the average utilization of 75wt% in aerospace applications and 50wt% in modern jet engines [1]. However, utilization of Rene 41 has been greatly increased in recent years which means that the machining behavior of this alloy is required to be properly understood for high efficient manufacturing operations. This work investigates the turning operation of Rene 41 in terms of surface quality of workpiece and wear behavior of cutting tool. In the study, cutting speed and feed rate were used as the variable parameters and their influences were investigated using main effects plots in a full factorial experimental design.

Figure 1. J85 Turbojet Engine with Afterburner [8]

EXPERIMENTAL DETAILS

In the present study, a cylindrical bar made of Rene 41 was used as the workpiece. The machining operation was performed using a vertical CNC machine (You Ji, YV-1000ATC)(Figure 3). Two input parameters such as cutting speed and feed rate were varied to investigate their effects on the surface roughness of workpiece and wear behavior of cutting tools. Table 1 shows the full factorial experimental design in this study. The cutting depth of 0.2 mm was fixed in the experiments. After completing the experiments, surface roughness of the workpiece for each run was measured ten times from different regions on the surface using a Taylor-Hobson Surtronic 3P surface profilometer. The wear tracks on the inserts were visualized using a Mitutoyo Quick Scope microscope and wear measurements were performed in accordance with ISO-3685 standard.

Figure 2. A typical gas turbine casing [9]

Figure 3. CNC machine YV 1000 ATC [10]

Table 1. Full factorial design of experiments

Run	Cutting Speed (m/min)	Feed Rate (mm/rev)
1	180	0,15
2	180	0,20
3	180	0,25
4	240	0,15
5	240	0,20
6	240	0,25

RESULTS AND DISCUSSION

In the evaluation of the experimental results, main effects plots were used to observe the influence of the input parameters on each output. Figure 4 shows the main effects plot for surface roughness of workpiece. It is seen that surface roughness of workpiece is not heavily dependent on cutting speed since the mean of data is quite close each other for each level of cutting speed. However, there is a very slight increase in surface roughness when cutting speed is enhanced in the operation. On the other hand, feed rate has a significant impact on surface roughness that the surface profile of workpiece becomes rougher as feed rate is increased in the turning operation [2]. This phenomenon stems from the geometrical characteristics of machining. The amplitude of surface profile gets larger using higher feed rates which means that surface roughness increases due to higher difference in the location of peak and valley points of each cycle [3]. Figure 5 shows the main effects plot considering the wear behavior of cutting tools for each input parameter. It is obvious that cutting speed negatively influences the wear rate of cutting tool in the operation. This is directly related to the interaction of workpiece and cutting tool surface where crucial conditions are seen in this zone [4], [5]. The increase in cutting speed causes elevated cutting temperature in the cutting zone and therefore, wear resistance of cutting zone deteriorates due to degradation of cutting tool. In particular, Rene 41 has very low thermal conductivity which stops the generated heat dissipating from the cutting zone [6], [7]. In addition to thermal effect which accelerates the adhesive wear, cutting speed enhances the chip flow rate on the surface of cutting tool and therefore, abrasive wear prevails the failure mode of cutting tool. Considering the influence of feed rate on the wear rate on cutting tool, it can be mentioned that wear rate continuously rises by increasing feed rate in the operation. This can be attributed to enhanced cutting forces act on cutting tool which grow the friction at the contact surface of cutting tool and chip [8], [9]. Figure 6

shows the wear tracks on the cutting tools for different feed rates in the turning operations. It is seen that high feed rates result in a quick wear deformation on cutting tools and consequently, the service life of tool drastically reduces which enhances the expenses in manufacturing. The tool life criterion is a maximum notch wear of 600 µm in according to in according to the ISO-3685 standard and the mean of notch wear values are 683 and 1376 µm for the cutting tools at the feed rate of 0.15 and 0.25 mm/rev when the cutting speed is 240 m/min. In this light, it is possible to state that the cutting tools completed their service life for both feed rates however, lower feed rates extends the utilization period of cutting tools. Beside the wear mechanism, tool breakage is common type of failure at the excessive feed rates due to drastic jump in cutting forces.

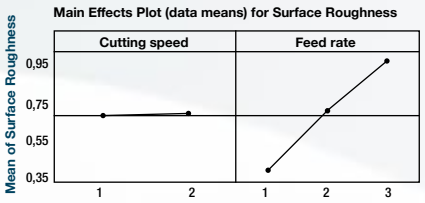

Figure 4. Main effects plot for surface roughness of workpiece

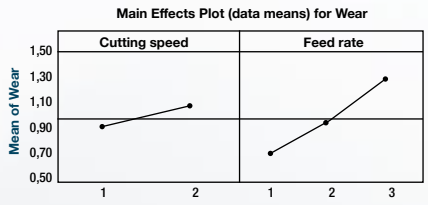

Figure 5. Main effects plot for wear on cutting tool

CONCLUSIONS

In the present work, the turning operation of superalloy Rene 41 was investigated in terms of surface quality of workpiece and wear behavior of cutting tool. In the experimental stage of this study, cutting speed and feed rate were used as the variable parameters and their influences were investigate using main effects plots in a full factorial experimental design. The results showed that surface roughness is mainly dependent on feed rate which results in a poor surface finish at high values. Although cutting speed is not a determining factor for surface roughness, surface quality is more prone to reduce as cutting speed increases. On the other side, the wear mechanism of cutting tool accelerates using elevated cutting speeds and feed rates.

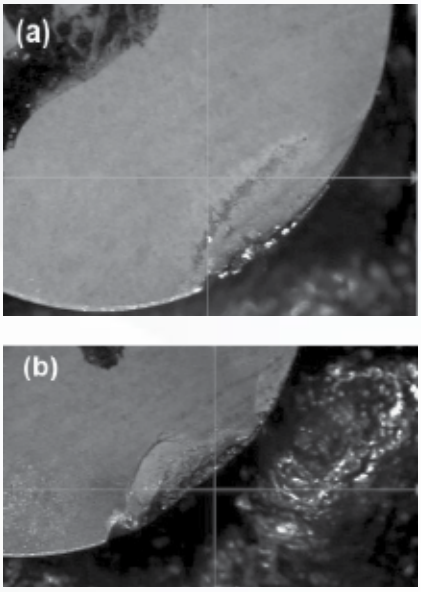

Figure 6. Wear tracks on the cutting tools at the feed rate of (a) 0.15 and (b) 0.25 mm/rev

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Designs That Changed The Way
AIRCRAFT ARE BUILT

Nov 21, 2016 Graham Warwick I Aviation Week & Space Technology

While aircraft design over the decades has narrowed in on a set of configurations that worked better than others, how aircraft are manufactured continues to evolve in a bid to lower cost as well as improve performance. Here are some of the landmark aircraft over those decades.

1912 – Deperdussin Monocoque

This racing aircraft built by France's Aeroplanes Deperdussion, later to become famous as SPAD, pioneered the light, strong and streamlined monocoque fuselage, formed of thin plywood layers over a circular frame. The Monocoque won the Gordon Bennett Trophy for air racing in 1912 and 1913, raising the aircraft speed record to 130 mph.

Photo: Wikipedia

(1) monocoque fuselage: Fuselage is composed of molded frames (circular beam - ring) and individually-attached covering sheet, which bears all main loads. Fuselage robustness is depending on quality of covering materials. Structural components running in the longitudinal direction like longeron are not used, instead the fuselage plate is directly attached on the frames in monocoque structures.

1916 – Albatros D.III

The Albatros series of biplane fighters flown by Germany in World War I featured semi - monocoque fuselages, in which load - bearing plywood skin panels were glued to longitudinal longerons and internal bulkheads. As metal replaced wood, the term semi - monocoque gave way to stressed skin, and remains the prevalent aircraft structural configuration.

Photo: Wikipedia

(2) semi-monocoque fuselage: It refers to the most commonly-used method used currently in aircraft. In addition to rib elements such as bulkhead and frame, longitudinal structural components such as longeron and keel beam are also used in this kind of structures. These elements bear not only structural loads but also vertical loads. (3) bulkhead: It is a structural component which serves as a vertical wall or panel within the hull of an aircraft, and bears major loads on fuselage.

1919 – Junkers F13

Germany's Hugo Junkers flew the revolutionary J1 - an experimental all - metal, cantilever - wing, stressed-skin monoplane - in 1915. The steel J1 was followed in 1919 by the Duralumin F13 (pictured), the first all - metal transport aircraft. More than 300 were built. Also flown in 1919 was the sole example of the Zeppelin - Stakken E-4/20, the first four - engine, all - metal passenger aircraft.

Photo: San Diego Aerospace Museum - Wikipedia

1929 – Hall XFH

Built in the U.S. by Hall Aluminum and flown in 1929, the XFH naval fighter prototype (pictured) was the first aircraft with a riveted metal fuselage - a watertight aluminum skin over steel tubing. Hall also pioneered flush rivets and butt joints between skin panels in the PH flying boat, which first flew in 1929.

Photo: Wikipedia

1931 – Budd BB-1 Pioneer

U.S. railcar maker Budd built the BB-1 Pioneer experimental flying boat - based on the Italian Savoia - Marchetti S56 - from corrosion - resistant stainless steel using newly developed spot welding. Budd tried again in 1943 with the RB - 1 Conestoga cargo aircraft (pictured), but steel is heavy, and it did not catch on.

Photo: San Diego Aerospace Museum - Wikipedia

1940 – de Havilland Mosquito

With the wartime scarcity of aluminum, de Havilland built its Mosquito fighter-bomber (pictured) from wood - plywood facings bonded to a balsawood core and formed using molds to produce monocoque structures. This led to the development of metal - to - metal bonding, used in the de Havilland Comet jet airliner and by Fokker in the F27 and F28 airliners.

Photo: UK Ministry of Defense - Wikipedia

1952 – Douglas X-3 Stiletto

The first titanium aircraft was the Douglas X - 3 Stiletto (pictured) flown in 1952. Designed to cruise at Mach 2, where skin friction required the heat resistance of titanium, the X - 3 was underpowered and barely supersonic. Capable of Mach 3.2, Lockheed's A - 12 and SR - 71 were also mainly titanium, and the material was to be used for Boeing's canceled 2707 supersonic transport, designed to cruise at Mach 2.7.

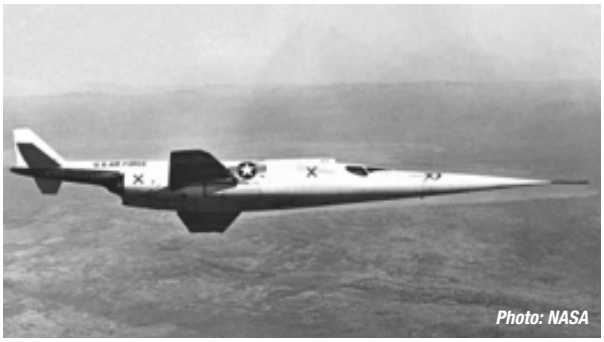


Photo: NASA

1964 – Mikoyan-Gurevich MiG-25

Russian design bureau Mikoyan - Gurevich used welded nickel steel for the airframe of the Mach 2.8 MiG-25 fighter (pictured), first flown in 1964, because heat - resistant titanium was difficult to work with and hard to weld. The North American XB - 70, designed to reach Mach 3.1, but canceled by the time it flew in 1964, used brazed stainless-steel honeycomb panels and titanium.

Photo: Wikipedia

1976 – McDonnell Douglas F-15 Eagle

McDonnell Aircraft began using computers to help lay out designs in 1969, and developed the computer-aided design system used in development of the F - 15 fighter (pictured). The F - 15A and Grumman F - 14A, both flown first in 1974, used boron-fiber composites in the tails. But boron fiber was expensive, and the U.S. moved to carbon-fiber composite for wing skins on the Boeing AV - 8B, F/A - 18 and Northrop B - 2.

Photo: U.S. Air Force

1985 - Airbus A310

The first carbon-fiber primary structure in a production commercial aircraft was the vertical stabilizer of the Airbus A310 - 300, first flown in 1985. It marked the beginning of a progression of increasing composites use in the European manufacturer's airliners that added the horizontal stabilizer with the A320 in 1987 and A330/A340 in 1994 and the center wing-box and aft fuselage of the A380 in 2005.

Photo: Adrian Pingstone - Wikipedia

2011 – Boeing 787

Use of carbon-fiber composites in commercial aircraft reached a landmark 50% of structure weight with the Boeing 787, first flown in 2009, where the material allowed a more slender, lower - drag wing and higher cabin pressurization and humidity. Aluminum was reduced to 20%, but titanium boosted to 15%. The competing Airbus A350, flown in 2013, is 53% carbon-fiber by structure weight.

Photo: Boeing - Wikipedia

2013 – Bombardier C Series

Looking ahead, Bombardier's all - new C Series narrowbody suggests one balance of materials and manufacturing in aircraft, at least for future single - aisle airliners. The aircraft has a carbon - fiber composite wing, produced using dry - fiber composites and resin transfer infusion, and a metallic fuselage using lightweight aluminum-lithium alloy for damage resistance and repairability.

Photo: Bombardier

FUTURE AEROSPACE CENTER OF ISTANBUL OPENED

Future Aerospace Center of Istanbul (HUGEM), established within the organization of Air Forces Command, was put into operation at the Aviation Museum in Yesilkoy. Drawn up jointly by the Provincial Directorate of National Education and Directorate of Education of Istanbul Metropolitan Municipality, HUGEM Project was supported by the Administrative Board of Istanbul Development Agency (ISTKA) under the scope of 2015 Innovative Istanbul Financial Support Program initiated by ISTKA.

In addition to presenting aviation history, professions and sports to visitors through knowledge - based innovative applications, HUGEM intends to increase interest, curiosity and motivation of students for aerospace-related matters with thematic workshops and organizations, and guide them to STE(A)M (Science, Technology, Engineering, Arts and Mathematics) fields which will be needed more in future.

Comprising of four sections, HUGEM was established to endear especially teenagers to science by providing contributions for raising teenagers who are interested in science, technology, engineering, arts and mathematics, increasing public awareness in aerospace-related matters, and providing information on aerospace technologies to people of all ages.

All milestones of our aviation history ranging from Hezârfen Ahmed Celebi, one of the most important incidents of Aerospace history, to modern aviation are displayed at the central section. All recent news can be followed through NASA, and the digital archive in the lounge can be updated chronologically. Moreover; 270 - degree digital presentation room regarding aerospace professions, digital timeline about the aerospace history, and interactive display rooms regarding aviation sports are waiting for visitors.

It is aimed that the workshop activities, to be carried out in especially the field of aerospace by HUGEM, will encourage 3.000 students from primary, secondary and high schools to science, technology - engineering, arts and mathematics. The Center also holds meetings with NASA and US Air Forces to assess the future cooperation opportunities. In addition to the foregoing; high - quality cooperation activities are maintained among the military - civil, public - private organizations such as industrial enterprises and universities in the field of aerospace.

NEW ASSIGNMENTS IN OUR COMPANY BETWEEN JANUARY 01, 2017 - APRIL 30, 2017:

Erhan Kacmaz
was assigned to serve as Programs Manager at Programs Directorate on April 10, 2017;

Suleyman Aydin
was assigned to serve as Facilities and Logistics Services Manager at Human Resources Directorate on April 10, 2017;

Suleyman Tasci
was assigned to serve as Procurement Manager at Finance Directorate on April 10, 2017;

Burcu Yavuz
was assigned to serve as Quality Technical Leader at Quality Management on January 01, 2017;

Dilek Akay
was assigned to serve as Manufacturing Technical Leader at Manufacturing Engineering Management on January 01, 2017;

Onur Ersay Us
was assigned to serve as Quality Technical Leader at Quality Management on January 01, 2017;

Yusuf Kemal Demiray
was assigned to serve as Quality Technical Leader at Quality Management on January 01, 2017;

Birgul Ay
was assigned to serve as Human Resources Administrative Leader, at Career Development and Training Management on April 24, 2017;

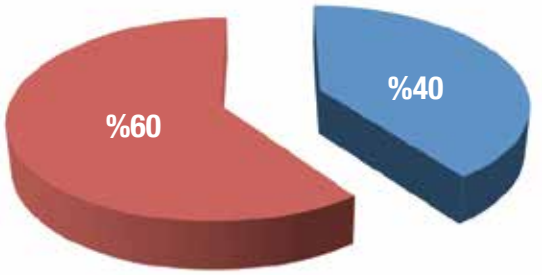
Battal Can Gul
was assigned to serve as Plant Maintenance Technical Leader at Plant Maintenance Management on April 26, 2017.

We wish them success in their new positions.

Facilities and Logistics Services Management was established at Human Resources Directorate across TEI in January 2017.

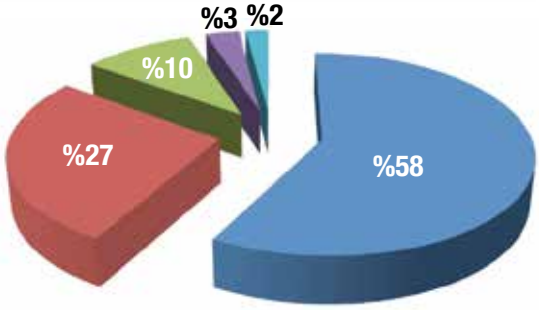
STATISTICS ON TEI'S EMPLOYEES

Breakdown of our staff consisting of more than 1800 members as of April 30, 2017:



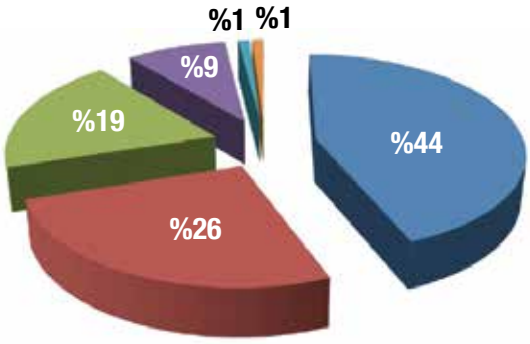
Breakdown of White - Collar and Blue - Collar Employees

White – Collar
Blue – Collar



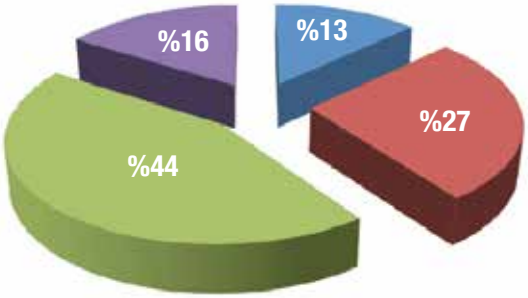
By Title Groups

Executive
Engineer
Specialist
Technician
Other



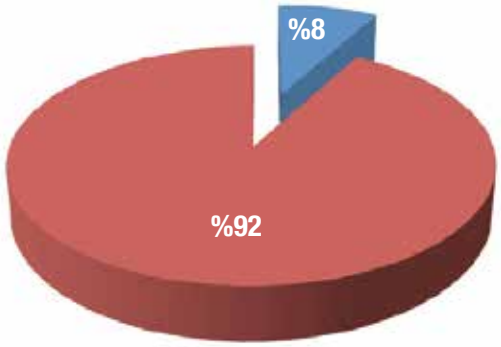
By Educational Status

Doctorate
Master's Degree
Bachelor's Degree
Two - year Degree
Technical High School / High School
Primary School



By Age Group

Age 18 - 25
Age 26 - 30
Age 31 - 40
Over 41



By Gender

Female
Male

VISITORS

Visits to our company by various institutions and organizations continued at full steam in the first 4 months of 2017. We hosted a great number of visitors between January - April 2017.

JANUARY 05, 2017

Visit by Mr. Mohammed Rasheed Al - Shubaili, CEO of Saudi Arabian Industrial Investments Company (SAIIC), and His Delegation

MARCH 06, 2017

Visit by Mr. Sahin Demirci, Head of Tax Office of Eskisehir

FEBRUARY 10, 2017

Visit by Ataturk Vocational and Technical Anatolian High School Teachers

MARCH 23, 2017

Visit by Mechanical Engineering Department of Sakarya University

APRIL 05, 2017

Visit by Machine Technology, Robotics and Automation Community & Aviation, Aerospace and Defense Community of Bursa Technical University

APRIL 13, 2017

Visit by Explorer Engineers Club of Firat University

APRIL 17, 2017

Visit by Goksel Kahya, Commander between 2016 and 2017 at 1st Air Supply Maintenance Center (ASMC)

APRIL 25, 2017

Visit by Mr. Clemens Linden, CEO of Eurojet

APRIL 19, 2017

Visit by Aerospace Society & IEEE Student Club of METU

APRIL 26, 2017

Visit by European Union Business Development Center (ABIGEM - Eskisehir)

ORGANIZATIONS ATTENDED BY TEI

NATIONAL POWER WORKSHOP

TEI attended the National Power Workshop organized in Kayseri on April 20 - 21 in cooperation with Undersecretariat for Defense Industries, Erciyes Teknopark and Teknopark Istanbul in order to make most of the available means and capabilities of our country. Mr. Erhan Kacmaz, Programs Manager at TEI, and Mr. Talha Hizli, Supplier Development Manager at TEI, attended the organization as participants. At this organization, Mr. Erhan Bilgic, Piston Engines Design Manager at TEI, delivered an introductory presentation on our company.

SARES SUSTAINABLE AVIATION WORKSHOP

Prof. Ali Osman Ayhan, serving as Design Engineering Director at TEI between 2016 - 2017, made a presentation regarding TEI's Design Engineering Activities and Projects at Sustainable Aviation Workshop organized at Gebze Technical University under the sponsorship of TEI on April 6 - 7.

SOUTHERN ANATOLIA DEFENSE AND AVIATION NATIONALIZATION SUMMIT

Southern Anatolia Defense and Aviation Nationalization Summit was organized on March 21 - 22 in Gaziantep under the coordination of Chamber of Industry of Gaziantep, Defence and Aerospace Industry Manufacturers Association, and Association of Support of Technical Production and Exportation with the support extended by Undersecretary for Defense Industries. Mr. Serkan Caliskan, Senior Technical Leader - Suppliers Development, and Mr. Emre Dalak, Technical Leader - Procurement, attended the Summit for and on behalf of TEI. At the organization, Mr. Serkan Caliskan delivered a presentation about TEI's processes for suppliers.

WORKSHOP FOR DETERMINATION OF AVIATION INDUSTRY CERTIFICATION - TESTING INFRASTRUCTURE NEEDS

Workshop for Determination of Aviation Industry Certification - Testing Infrastructure Needs (Center of Test and Excellence for Aviation Technologies) was held on April 26 at Gebze Facilities of TUBITAK (The Scientific and Technological Research Council of Turkey) - Turkish Management Sciences Institute, and Mr. Kahraman Coban, Senior Technical Leader at Engine Prototype and Testing Management at TEI, made a presentation regarding TEI's activities.

ASSESSMENT OF **RISKS**

Risk is a concept, which we encounter in all fields of life from medicine to finance and from politics to occupational safety, and with which we try to deal. In general, it is defined as any uncertain fact, factor or progress/course for occurrence of any damage, loss, hazard or injury.

We define in advance, and assess the risks, which our assets may be exposed, and we take any measures to minimize or eliminate such risks. This process, known as risk management, is one of the primary issues that must be carried out in the enterprises. In the enterprises, the production inputs, classified as 5M, constitutes the resource for the risk management process

Business inputs (5M):
Man
Money
Machine
Material
Management

In any enterprise, the inputs called 5M are generally in question, and it is known that the input of man is more different and valuable than the others. Accordingly, management of any risks, to which any person may be exposed, is also among the most critical issues. Enterprises should aim at improving the quality of life of the employees while at the same time improving their working performance. This may be performed through a man-focused risk management.

The most important issue with respect to management of the risks for the factor "man" is occupational health and safety. Any practices available within the organization of TEI are also performed from the perspective of "Human Being First". Researches have shown that there is a strong interaction between the occupational safety and workforce productivity, and that productivity increases in healthy and safe workplaces. Ensuring the occupational safety by preventing any occupational accidents and occupational diseases also leads to increase of productivity and production at the workplace. As a result of occupational accidents and occupational diseases occurred at the workplaces, significant financial losses occur. However, both occupational accidents and occupational diseases can be avoided by predetermining the reasons thereof and by taking any precautionary measures accordingly. During the risk assessment process, the risks, arising from the work environment, the conditions, or the hazards present in the environment, are revealed in a systematic manner; and the actions required to be taken in order to eliminate such risks or reduce them in an acceptable manner are determined and put into practice. The process is continuously reviewed, and compliance with the plans is checked, and the system is improved based on the changing conditions. Organizational development is accompanied by the aim of protecting the man, which is the most important factor of production, through the risk assessment on the basis of a proactive approach. Based on such approach;

- The productivity increases at a safe work environment,
- The quality of production increases,
- The enterprise gains trust and prestige,
- Market share increases,
- Economic recovery is ensured.

In the society, development of the risk perception and the occupational health and safety culture will be ensured by adaptation of the risk management to all fields of life.

PAINTING CONTEST ORGANIZED FOR APRIL 23

The painting contest, we have been organizing on annual basis since 2009 as part of Events for April 23 dedicated to the children of our employees, was held under the theme "TEI Attaches Importance to Occupational Health and Safety". 42 paintings, participating in the contest, were displayed at TEI Guesthouse in Children's Event for April 23. Nearly 100 participating children had an enjoyable time with the animation team. The event ended with presentation of gifts to the children who participated in the painting contest and the event.

TEI TABLE TENNIS TOURNAMENT CHAMPION ANNOUNCED

Held by Mr. Turgut Alptekin, Quality Assurance Senior Technical Support Specialist, for the third time this year, the traditional table tennis tournament was organized in February with attendance of 16 teams and 39 sportsmen. Following 72 closely - contested matches, the team of Mr. Murat Kasap, Mr. Adnan Bulut and Mr. Huseyin Tenbel won the first prize.

For the first time this year, a jury was formed among the table tennis lovers, and Mr. Kagan Dortkasli and Mr. Alpaslan Demir was selected as the "Best Fair Play Team" and Mr. Murat Kasap was selected as the "Most Valuable Player". All Starts match was held by Quality and Manufacturing Engineering Director Mr. Turgut Cicek, Manufacturing Director Mr. Murat Karamahmutoglu and Head of Internal Auditing and Evaluation Commitee Mr. Murat Colaker before the final match.

FEMALE STUDENTS TAKE THEIR FIRST STEP TO AVIATION WITH TEI

TEI celebrated the Women of Aviation Worldwide Week with two organizations in a gorgeous way once again. The week covering the date March 8th has been celebrated as "Women of Aviation Worldwide Week" since 2010 with a different and meaningful theme in the memory of March 8th, 1910 when the first woman pilot was licensed across the world. Accordingly, TEI held two different organizations on March 8th with the support of the Provincial Directorate of National Education in Eskisehir, like the previous years.

During the first organization, held in the morning, 40 female students from 20 different schools attended the Contest of Making and Flying a Model Aircraft at Sabiha Gokcen Vocational and Technical Anatolian High School. Prof. Orhan Oguz Anatolian High School won the first place in the category of making the best aircraft while Ahi Evran Vocational and Technical Anatolian High School ranked first in the category of flying the model aircraft made for a maximum period of time.

Prof. Orhan Oguz Anatolian High School won the first place in the category of making the best aircraft

Ahi Evran Vocational and Technical Anatolian High School ranked first in the category of flying the model aircraft made for a maximum period of time

‘Women of Aviation" get together at a panel to inspire female students

The second organization, held in the afternoon, was "Meeting of TEI Women of Aviation". The panel was held in the meeting hall of Haci Suleyman Cakir Anatolian High School for Girls, during which the industry was introduced to female students that are interested in aviation. Dr. Aybike Molbay, General Manager of General Electric Aviation - Turkey Technology Center and Member of the Board of Directors at TEI, Prof. Melike Nikbay, Faculty Member, Faculty of Aeronautics and Astronautics at Istanbul Technical University, Gokce Kubra Tugran Yildirim, A320 First Officer at Turkish Airlines, Pinar Gunaydin, MRO Manager at TEI and Ayse Akalin, Chief Editor of Defence Turkey Magazine, took floor to deliver speeches and gave the common message to the female student that they should find their favorite profession and improve themselves in the respective field. Sharing the industry - specific experiences they gained, the speakers emphasized that the number of women serving in the aviation industry was too low, and encouraged the female students to build their careers in the field of aviation. The organization ended following the Q&A session and presentation of plaques.

TEI VISITS MOTHERS ON ANNIVERSARY OF ITS INCORPORATION

TEI Social Responsibility Group members visited the mothers at the Obstetrics Clinic in Eskisehir State - Run Hospital on January 25, the anniversary of its incorporation, making this organization a tradition since 2016. TEI's volunteer female employees and TEI Social Responsibility Group members visited the women, who gave birth to their children, and shared their happiness with the newborn sets they presented to these mothers on January 25.

APRIL 2, WORLD AUTISM AWARENESS DAY ORGANIZATION

TEI's volunteer employees hosted 15 students, receiving training at Eskisehir Tepebasi Municipality Center for the Disabled, and 3 teachers, serving at this center, in TEI Guest House on April 2 World Autism Awareness Day. Starting with breakfast, the organization ended upon presentation of gifts to the guests.

VOCATIONAL HIGH SCHOOL COACHING PROGRAM
VISIT TO ROKETSAN

Maintaining the scheduled meetings in the 2nd year under Vocational High School Coaching Program, our teams visited Roketsan, which is one of the defense industry companies providing its support to Vocational High School Coaching Program, on April 17. At the end of visit, covering company introduction and facility tour, all students and coaches expressed their appreciation.

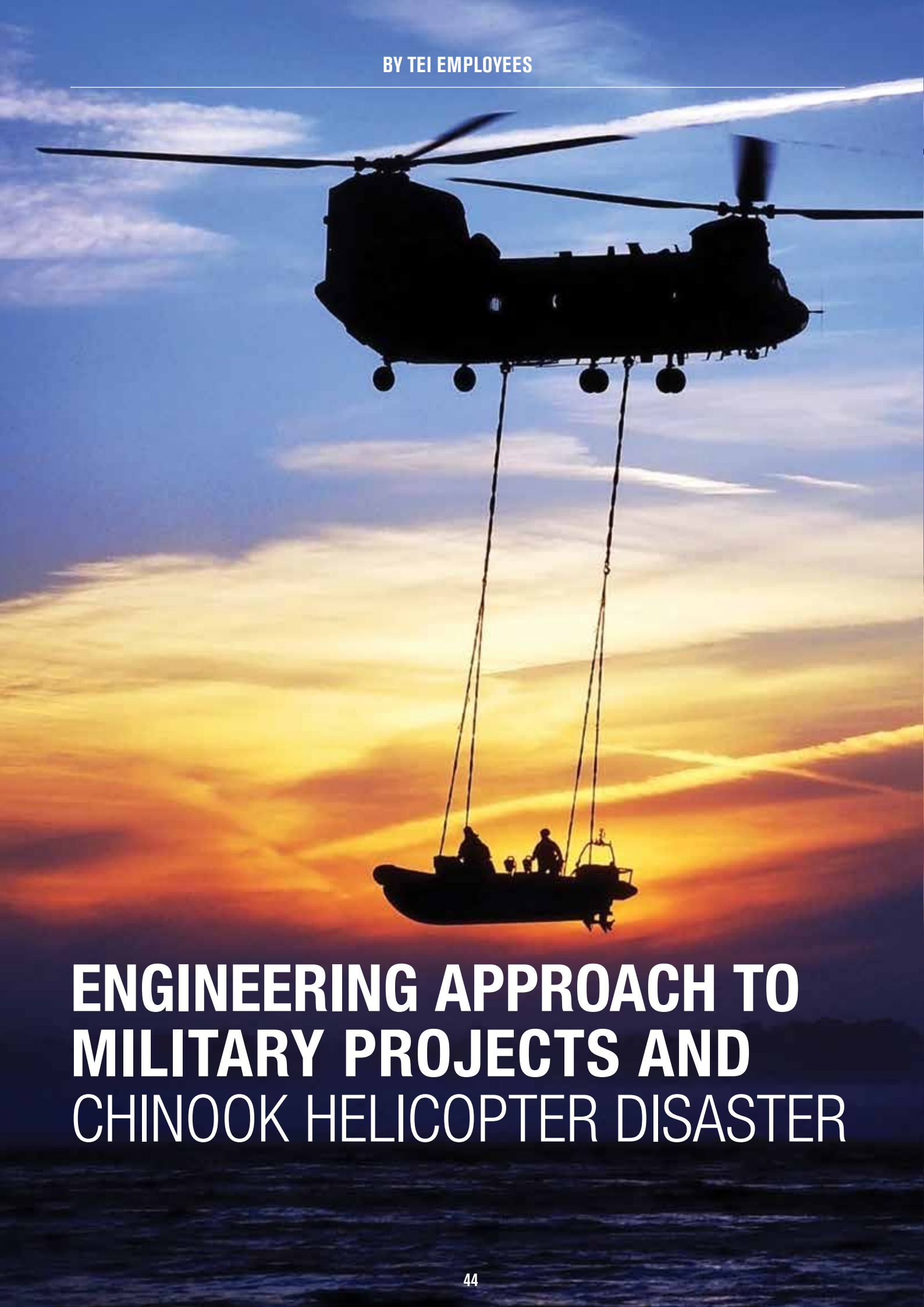
REMARKABLE SUCCESS
ACHIEVED BY BEYZA MERCAN

Beyza Mercan, the athlete from Eskisehir who has been sponsored by TEI since 2014, ranked second at 4x400 m branch with the provincial mixed team at Turkish Youth Indoor Championship held on February 5, 2017 in Istanbul. We congratulate and wish her continued success in her efforts.

ANATOLIA AERO DESIGN TEAM RETURNS FROM
USA WITH GOLD MEDAL

The unmanned aerial vehicle, originally designed, manufactured and tested by Anatolia Aero Design Team of Anadolu University under the sponsorship of TEI won the first prize and got entitled to receive the gold medal at International SAE Aero Design East 2017 hosted on April 23 by SAE in Florida, USA and attended by 75 teams from 10 different countries.

BY TEI EMPLOYEES



ENGINEERING APPROACH TO MILITARY PROJECTS AND CHINOOK HELICOPTER DISASTER

One of the most important factors in the development of the aviation industry is undoubtedly the military design works carried out in order to achieve superiority during World War I and World War II. The human beings, dreaming of flying throughout its existence, have achieved this dream even if it is intended to improve its abilities to fight.

The aviation industry, which has been developed following such works carried out, has also started to operate civilian flights, and the technological development of the last century has been reached in a short time. Just as every technological development comes at a price, the aviation industry has had to pay a heavy price during such development stages. Only the accidents that occurred in 2014, when we can call the mourning year of aviation history, are the examples that can clearly reveal these prices alone.

The 227 passengers and 12 crew members of the Boeing 777 passenger aircraft, operating from Kuala Lumpur to Beijing, disappeared off the radar, and despite the most expensive and extensive search activities performed in the history, no trace for the accident was found as a result of 9 months of searches. Four months later, another aircraft, belonging to Malaysian Airlines, crashed with 295 passengers in a region near Russia's border. On July 23, an ATR72 Type aircraft, belonging to TransAsia Airlines, crashed during the emergency landing, and 48 people lost their life and 11 were injured. Two houses burned at the location where the aircraft crashed! In the relevant week, 116 people available in the aircraft, belonging to Algeria Airlines, lost their life.

"Aviation rules are written in blood"
Many accidents happen although we have autonomous systems and advanced fault detection technology. The use of aircraft in every field has expanded the risk mass.


Chinook Crash Memorial

The fact that this risk level is higher and results in heavy prices reveal the necessity to inspect the accidents in detail. Thanks to this necessity, aviation requirements have achieved its present clarity and detail. The phrase "Aviation rules are written in blood" has been derived therefrom. There are separate focuses specific to the military systems and civilian systems with respect to the accident destruction investigations. While loss of life and cost are highly focused with respect to the civilian/ commercial systems, the strategical loss and loss of competent personnel are focused with respect to the military systems. Critical missions in military aviation lead to the needs of the system, which has an expectation of a performance and maneuvering. For this reason, the cost is of secondary importance.

From this point of view, although serious investments have been made in military systems, serious losses have been experienced and continue to be experienced in military aviation as it has been in civil aviation. Many more aircraft or helicopters than the aircraft, crashed by the enemy forces during the operation, have an accident destruction during the routine test flights and arrival at/ departure from the location of the operation. The Chinook Crash, which is one of the most painful accidents in the history of military aviation accidents, and which resulted in the death of 25 antiterrorism specialists and 4 military personnel, is the best example of such accidents.

Chinook Crash

This report also focused on the investigations carried out with respect to the propeller actuators found at the accident site. When the hydraulic levers were inspected, the fact that such levers were in different positions was indicator of different airspeeds. This meant either that there was a technical failure or that maneuvering was performed at that time. In such case; either the pilots entered the clouds due to sudden elevation arising from the speed difference, caused by a technical failure, in the propellers while flying under the clouds, or they maneuvered in a manner that they should not have performed while flying at high speed.

The fact that the pilots are competent personnel, and that they have flight experiences with many critical systems

before reduce the possibility of performance of a wrong move. Therefore, technical failure code records have been inspected. Even though one of the DECUs, which were the parts of the FADEC system, burned, the records available on the other one could have been obtained. Based on such records, it was observed that the E5 fault, which was found in 1989, and which led to an accident, also appeared in this system. However, failure in knowing the date of such record caused the question for whether the E5 fault was experienced during any flight performed prior to such accident or it was experienced during such flight remained unanswered. The E5 fault arose from a fault that led to propeller overspeed due to excessive delivery of fuel. Since the observations carried out with respect to the hydraulic levers overlaid such fault, the possibility of technical failure increased. Despite this, the fact that the pilots was able to make a choice for passage point until the moment of the crash indicated that they could have controlled the helicopter, and this refuted the DECU fault scenario. In addition, the maintenance records of the aircraft have been inspected for such purposes. Three weeks before the accident, the brackets available in the control cabinet were found to be loose and the brackets were tightened. It was found out that the pilot used the rudder bar at the rate of 75% at the moment of crash. Such information and the loosening scenario in the records supported each other. No competent pilot would use the rudder bar, which would only rotate the aircraft in its own axis, in case of a risk of crash and while flying at high speed. This situation was considered as a possibility for occurrence of a control jam and use of the rudder bar by the pilot reflexively in the last resort since s/he could not maneuver. Boeing, the manufacturer, stated that the risk of a control jam arising from loosening of the brackets and falling of them into the control cabinet "was a very slight possibility". However, three years after this accident, another helicopter crashed due to a control jam. This situation supported the final scenario.

As a result of all these works, the military commission maintained its decision exactly, and the accident report was closed as the "pilot error". The questions starting with "I wonder..." stuck in the minds, and their beloved ones are left in wake of 29 lives lost. The loss of competent antiterrorism specialist, and the loss of the 4 competent personnel, and the condemnation of the pilots fully committed to the army exacerbated the pain. The example of Chinook Crash clearly shows how the accidents that may be experienced in military aviation can cause speculations, and how any acquisitions can be lost accordingly. Military platforms are critical systems both in operational terms and in terms of their missions. Such special situation should be discussed separately with respect to design activities, to be carried out in these systems, and with respect to System Safety Assessment activities and a safety- and reliability-effective approach should be showed during the development stages of such systems that do not have a cost priority. While the lives dedicated to the critical missions and the systems developed through the resources provided by the competent senior persons and each individual of the country are discussed, it is of great importance that the engineers, involved in the military projects, are not far from this awareness. We all know doubtlessly that our military personnel in Turkey are bounded on their mission at heart and devotedly. For the purpose of defensing this country and nation, the fact that the families sacrifice their children, and that the spouses sacrifice each other, and also that the children sacrifice their parent show that we, as the defense industry engineers, should act consciously with respect to our design activities. The possibilities for breaking the motivation of our Armed Forces, and for any damage to/loss of the systems developed by the contributions of each individual of our nation, or for causing a favorable situation for the enemy forces are and should be unacceptable. Be safe.

ABOUT MUJDAT ASLAN

Born in 1990 in Ayancik, Sinop, Mujdat graduated from Department of Aeronautical Engineering, Aeronautics and Astronautics Faculty, Istanbul Technical University in 2013. He has been serving as an Engineer at the Piston Motors Design Management since 2014.

4X4 FREEDOM: OFF - ROAD

Gokhan Benli is a nature - lover member of TEI. Starting to explore the nature with his bicycle, Mr. Benli now continues his adventure with his off - road vehicle, and shares the excitement he feels on deserted roads on "TEI POST".

Nature has always attracted my attention since my childhood. Thanks to my father's substantial influence, nature has always attracted my attention since my childhood. I can say that I have taken every opportunity to commune with nature up until now. I set off on my journey with my bicycle, and now I organize mini nature tours and some events with my off - road vehicle, together with my friends.

Dreams come true...

When I was a child, I always watched the adventurous competitions at Camel Trophy dreaming "I will be like them one day," and I stepped into the world of Offroad when I bought my off - road vehicle. Since I didn't have much experience with off - road vehicles and there was nobody around to guide me, I searched through the internet and obtained information on driving techniques, and I developed myself with my own experiences. What I like most in Off - road is that I make efforts to see the places on which nobody set foot before. You are rewarded for your efforts when you seat at a lovely camping area or on an unknown lakeside, or when you enjoy the moment from an observation terrace. But of course; when a breakdown arises at a wild and remote place, it becomes too hard to enjoy"! You cannot say "I will call the mechanic and ask for his help to run my vehicle," or "Let's call the breakdown truck, and wait for it to save us from this mud,". You need to roll up your sleeves. We sometimes get stuck in snow or mud. Sometimes, drive shaft is broken inappropriately, and we try to fix our vehicle under hard conditions. That's why you need to be knowledgeable with vehicles and be able to fix such failures. Luckily, I have a satisfactory level of experience in all kinds of mechanical parts, and don't get into any trouble with fixing.

ABOUT GOKHAN BENLI

Born in 1981 in Eskisehir, Gokhan Benli has been serving as Mechanical Maintenance Assistant Technician at Plant Maintenance Management since 2014.

FISHING LOVE

Sportive fish hunting is a passion of Ozgur Alpan from TEI which has gone deep inside his genes. Mr. Alpan shared his information and experiences on fishing sports which was inherited from grandfather to grandson, and gave tips for amateur fishermen.

My grandfather was a fisherman for long years, infusing fishing love and sports into all members of our family. I can say that my passion for hunting is derived from the genes of ancient and nomadic Turkish culture based on hunting. Due to my fishing love arisen by combination of these two factors, I have difficulty in remembering how many nights I have spent without sleeping to make researches on this matter. I think fishing is a quite pleasurable and scientific hobby which nearly everybody wants to take up but doesn't know what to do at the first time they take the fishing rod in their hands. The fishing rods, used to cope with especially such strong fish as carp, are made of composite and highly robust materials.

We can talk over the fishing hobby from a wide range of perspectives. Hunting techniques are available for many places such as sea, stream, standing freshwater, underwater (speargun). Now, I want to tell you about the sportive fishing method applied only in standing freshwater - lakes or ponds - I have gained experience for many years (around 20 years). The first fish species that comes to mind when someone says lake or pond fish is carp (Cyprinus Carpio in Latin), of course.

In fact, this famous fish, which has a public reputation with the saying "gut like a carp", doesn't get caught in the fishing rod easily. Because, carp is an intelligent fish species which acts with caution towards feed and fishing rods. If you fail to utilize the appropriate techniques and fishing rods, you will have to content yourself with only fresh air in the first 2 - 3 days of your fishing activity. The first rule to catch a carp is to be patient. Another rule is to try to not to catch any fish which is smaller than the allowed size (40 cm and over) and more than the allowed quantity (maximum 5 fish per person). In sportive fishing, each and every fish caught is released to nature again. Techniques for catching carps have been continuously developed and determined for long years in such countries as England, France, Germany, Italy, Poland and USA. There are many rumors that the "carp rig" fishing gear, developed to catch carp in England, date back to 100 years ago. Discovered in the recent 10 years, this fishing gear is characterized as modern carp hunting in our country. The main principle of this fishing gear is that the boilies are not attached to the hook. Seeming like balls, boilies hang out a little way of the fishing line hook. Carps, which search for feed, try to open their mouths hungrily and swallow the feed with vacuum method. When they taste the hook, they try to spit the feed out since they don't like the taste of steel; but they have already got caught by the hook fastened on their palatine. The key points to achieve success in this process are as follows: the distance between the hook and the boilie should not exceed the size of a hook.

Odor and taste of feeds should be as attracting as possible (like vanilla) for the fish, and the distance between the hook and the weight should be 20 - 30 cm. Since the fish will be on the move when it takes the feed in its mouth, it can spit the feed out if it feels the weight, and in such case, it cannot get caught. For this reason, the weight used (bullet) should be able to move on the fishing line called as "body". Bullet should have the same color as the floor of the freshwater (khaki for moss - covered water), and upon throwing the fishing rod into the water, the area around the rod should be fed with especially dried corn. Feeding draws carps to the area around the rod, and your chance to catch them arises. Although some fishermen use boiled corn, it has been established in scientific terms that dried corn is better than boiled corn which loses its aroma and fat after boiling. I recommend you to use the German brand D.A.M, which I currently use, for fishing rod and machine. Moreover; the brands such as FOX, Century, Korda, Shimano offer high - quality products, as well.

After all these tips, it's your turn to catch fish. Following obtaining the Certificate of Amateur Fishing from the Ministry of Food, Agriculture and Livestock, you can set off on your first fishing journey in Porsuk Dam, Keskin Pond, Catoren Dam, Zemzemiye Pond or Cukurhisar Pond around Eskisehir.

When you go for fishing, don't forget to keep sufficient amount of foods, drinks, emergency packages and equipment to protect you from sun. Likewise, you should get appropriately prepared for cold weathers and rain. I hope you lose track of time thinking "I will catch a bigger one now," and enjoy a pleasant day with unique natural beauties independently from time. Good luck. Hope everything goes well.

ABOUT OZGUR ALPAN

Born in 1982 in Sakarya, Ozgur Alpan graduated as Mechanical Engineer MSC from Sakarya University in 2007. He has been serving as Expert Engineer at Piston Engines Design Management since 2014.

TEI SOCIAL ACTIVITY GROUP
PRINCES' ISLANDS TOUR

TEI Social Activity Group organized 4 tours to Princes' Islands on different dates. The first stop of nearly 300 TEI employees and their families was Burgazada. The tour ended with visits to Heybeliada and Buyukada.

TEI SPORTS CLUB
BUSINESS LEAGUE BASKETBALL TOURNAMENT ENDED

TEI ranked in group A in Business League Basketball Tournament. Defeating Ford Otosan, Koza Altin and Pinar Sut teams in group matches, TEI was beaten by the Ref (Referees) team, and ranked second in its own group, qualifying for the quarterfinal. TEI Basketball Team was defeated by Eskisehir Metropolitan Municipality team, and eliminated from the tournament at the quarterfinal.

INTERINSTITUTIONAL TABLE TENNIS TOURNAMENT IN ESKISEHIR

TEI took part in Interinstitutional Table Tennis Tournament in Eskisehir for the eighth time this year with 3 teams and 18 sportsmen. At the tournament with 15 participating teams; TEI A Team ranked third, TEI C Team ranked sixth, and TEI B Team ranked eighth, achieving the best rankings so far.

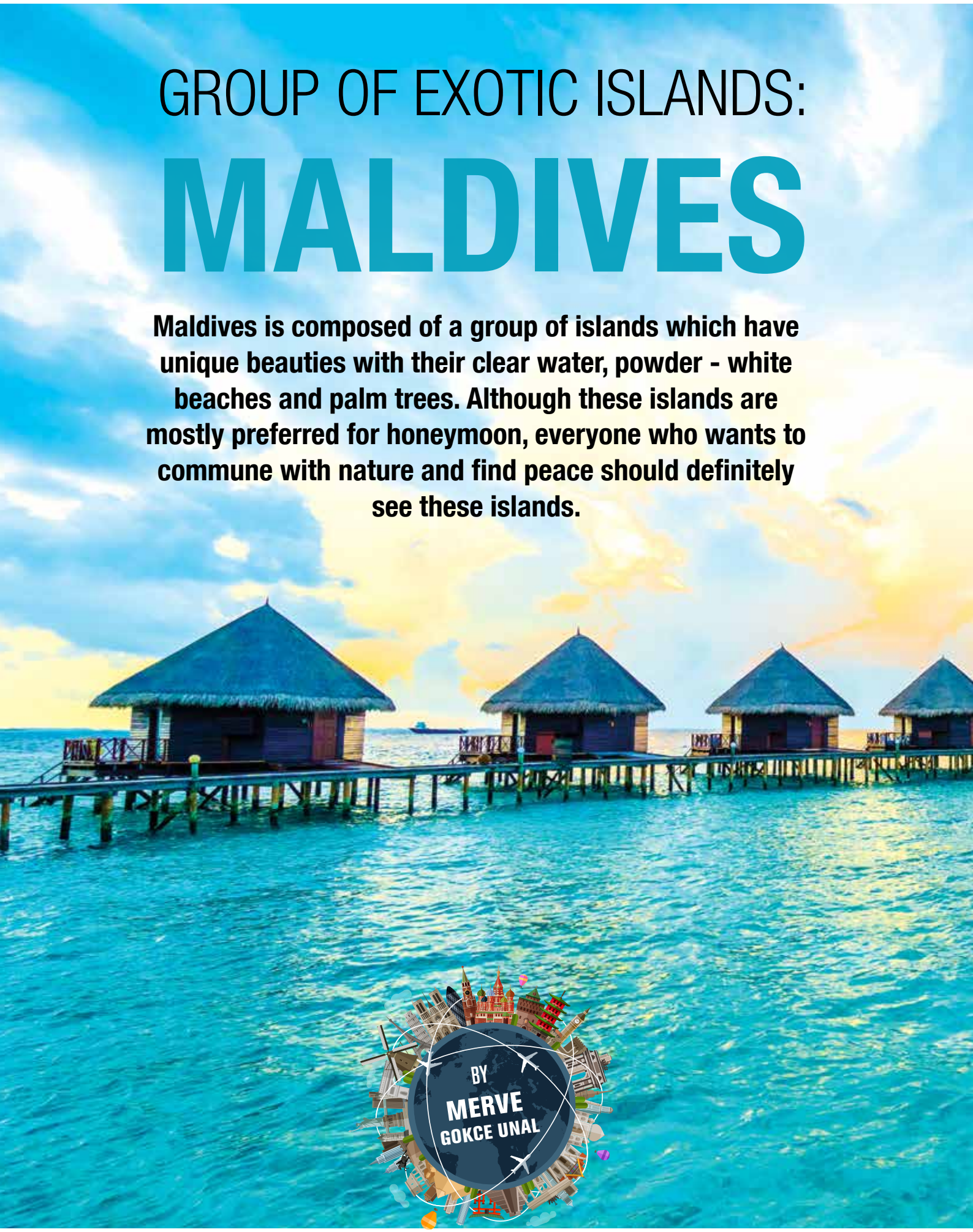
“blisket” KEEPS PEDALLING IN NEW SEASON

TEI's Bicycle Club “blisket” kept adding new members to its club with preliminary tours organized on the days under favorable weather conditions. Moreover, "blisket" members started to wear the new jerseys designed in harmony with our corporate logo. Team members intend to wear these jerseys in the future tours, and carry the friendship and team spirit, marking the goals of the club, further. Attaching a high level of importance to safety, "blisket" will be pleased to welcome you in the weekend tours.

GROUP OF EXOTIC ISLANDS:

MALDIVES

Maldives is composed of a group of islands which have unique beauties with their clear water, powder - white beaches and palm trees. Although these islands are mostly preferred for honeymoon, everyone who wants to commune with nature and find peace should definitely see these islands.



If you don't like crowded atmospheres, there are many empty beaches where you can swim alone. The water is so clean that when you go just a few meters from the shore, you can see the orange and yellow fish.

Republic of Maldives, composed of around 1200 islands, is located on Indian Ocean, and managed with the presidential republic system. Around 200 islands are populated, and most of the islands are used as hotel - island. The airport is even located on a separate island. Allowing the Turkish citizens to visit without any visa requirement, the group of these lovely islands can be visited throughout the year thanks to its tropical climate. Although the temperature values do not change substantially, the best time to visit Maldives is September - May due to lack of rains. Main means of living of Maldives, expected to submerge in a few years due to global warming, are tourism and fishery. Since there is not any river or natural water source, each island has its own water treatment facility which enables to treat ocean water in order to be used for drinking and mains water. Many hotels of Maldives do not admit children aged under 12; so, there is an overall silent atmosphere across the islands.

When you wake up, the only thing you can hear is the sounds of waves and palm tree leaves swinging slowly with each breeze. Since the islands are located close to the equator, stars appear closer and more lively; so, there is not much need for lightning. You watch star shows every night.

You can find yourself just in the middle of all these fascinating beauties following a flight of around 8 hours. You will first land in Malé, the capital of Maldives. Then, you will be transferred to the island, where your hotel is situated, by either speed boat or seaplane in line with your agreement with the hotel.
This transfer will take around 45 minutes depending on your island. We preferred seaplane, and the view was breathtaking while the seaplane took us to our hotel over the endless waters.

Never - Ending Peace
When you step on the island, you will be welcomed warmly. Hotel personnel are generally the persons who come from the neighboring countries such as

Bangladesh and Thailand. You will not have any difficulty in communicating in English; but, since their salaries are around 100 - 150 dollars, they will wait for you to tip them after each service they provide. You can make them burst with happiness with tips of 1 - 2 dollars. Our hotel preference was Medhufushi Island Resort, which made us feel highly satisfied. Since hotels are generally designed in line with island concept, the activities you can do are limited. Here are some details of the weekly activity schedules of hotels: fishing on Tuesdays, diving on Wednesdays, and boat trip on Thursdays. You can enjoy local dance performances after dinner. Therefore; if you spend more than 1 week here, you might get bored. However; if you just want to rest your head and find peace, probably you will not want to leave here.

If you don't like crowded atmospheres, there are many empty beaches where you can swim alone. The water is so clean that when you go just a few meters from the shore, you can see the orange and yellow fish. If you choose to stay in bungalows built on the ocean, you can sunbath and dive into the sea at your own terrace. Since there are not many people, you will feel as if you were alone in the ocean.

As for meals; I can say that spicy Indian meals and seafood are common; but if you are not open to new things, you can also find meals from world cuisine such as pizza and pasta. Well, we could find a pastry which looked and tasted like pancake. However; soils of the islands can grow just tropical fruits, and even staple food products such as potato and water are imported. So, I recommend you to make your hotel preference on all-inclusive basis. People generally feel uneasy about crabs and insects leaking inside the rooms, but we didn't experience this problem. Beware that beaches are full of crabs at night, but don't feel worried; since doctors are available on 7/24 basis on each island, they immediately intervene in case of insect sting.

No Security Problem

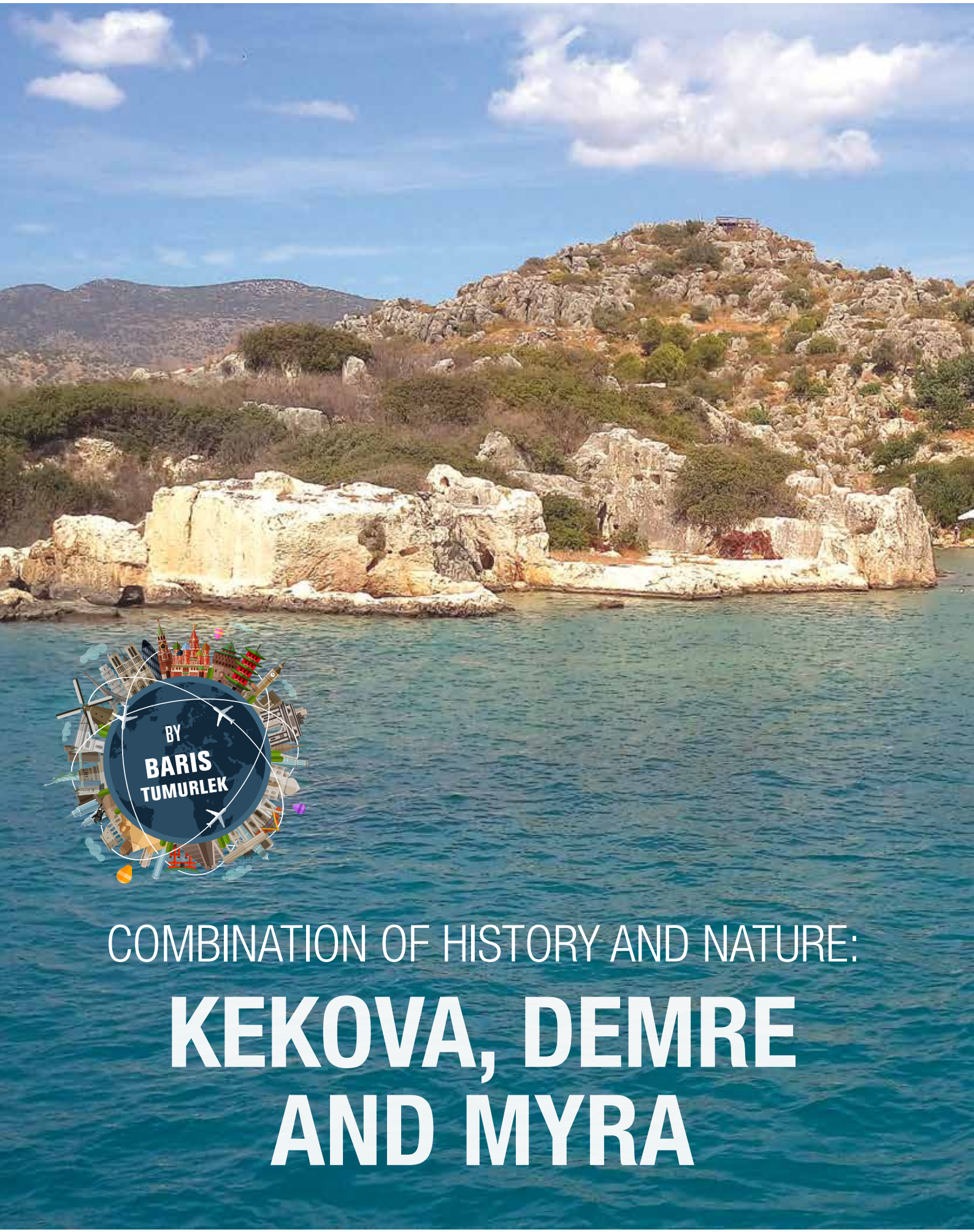
We were directly transferred to the hotel when we landed in Maldives; so, we couldn't find the opportunity to see the living style of the local people. That's why we spent our last day in Malé, and got shocked to see lives of the local people. Lives of the local people of Malé have nothing to do with luxury. Everybody knows each other on the island where the crime rate is very low. Don't feel worried about "How can I wander here?"; because, when you get in the ferries to get to the capital, tourist guides will follow hard behind you and show you around the island in just half a day for a few dollars. If you don't have much time but want to see the local living style, you can tour around the island in just half an hour for 5 dollars before embarking the aircraft. You can find extremely different tropical fruits at outdoor markets at highly affordable prices. Our favorite was the orange and purple passion fruit tasting like mixed fruit juice which was translated into our language as "carkifelek meyvesi". Another food you should try is hand - made chocolate. These chocolates are sold by the local people who hold them in their hands rolled in detail papers like Cuban cigar. Don't forget to add Maldives, offering unique experiences, to your future holiday alternatives.

ABOUT MERVE GOKCE UNAL

Born in 1990, Merve Gokce Unal graduated from Manufacturing Engineering, Istanbul Technical University. She has been serving as Engineer at TEI Manufacturing Directorate since 2014.

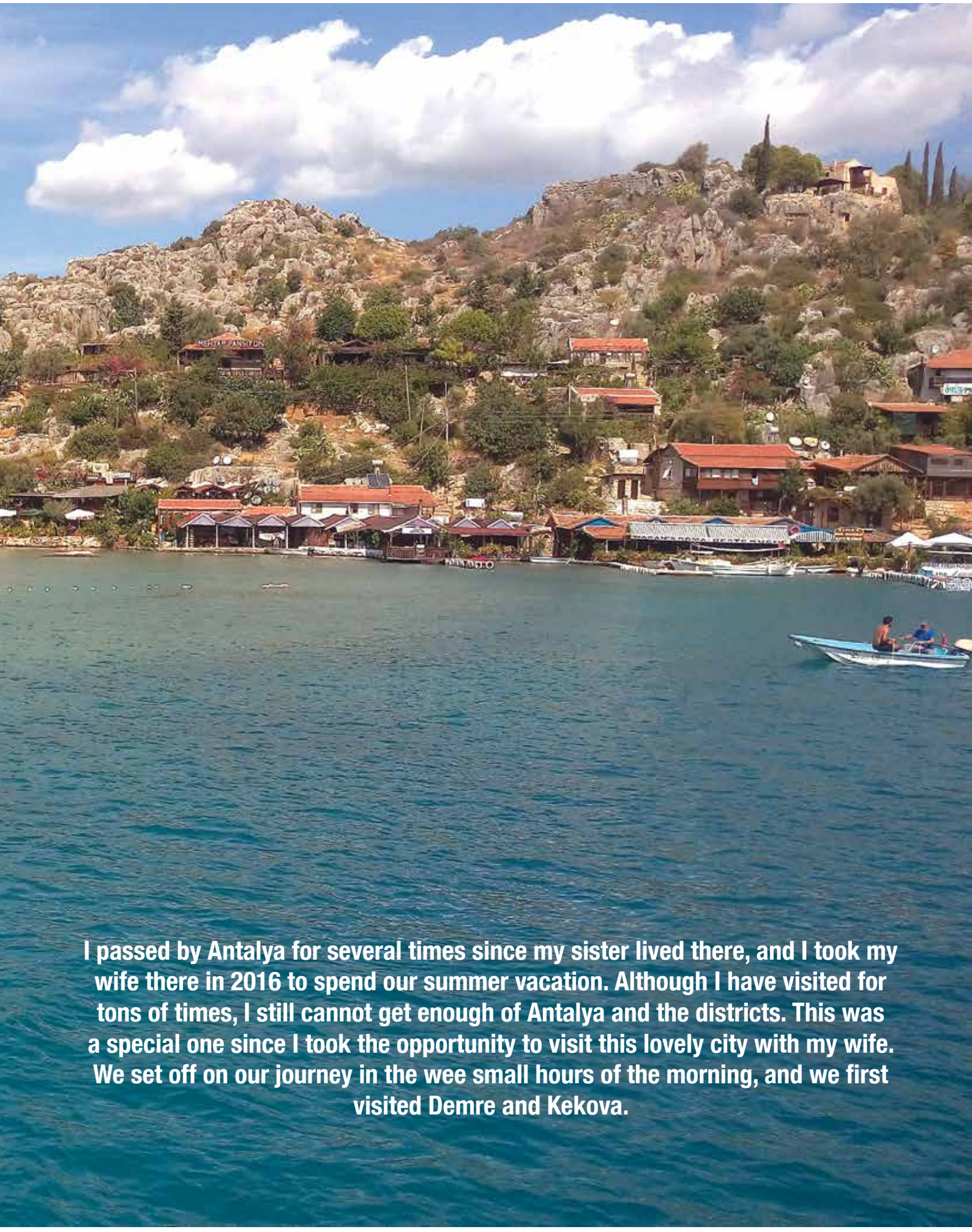
A marketplace in Malé

Fishermen from Malé

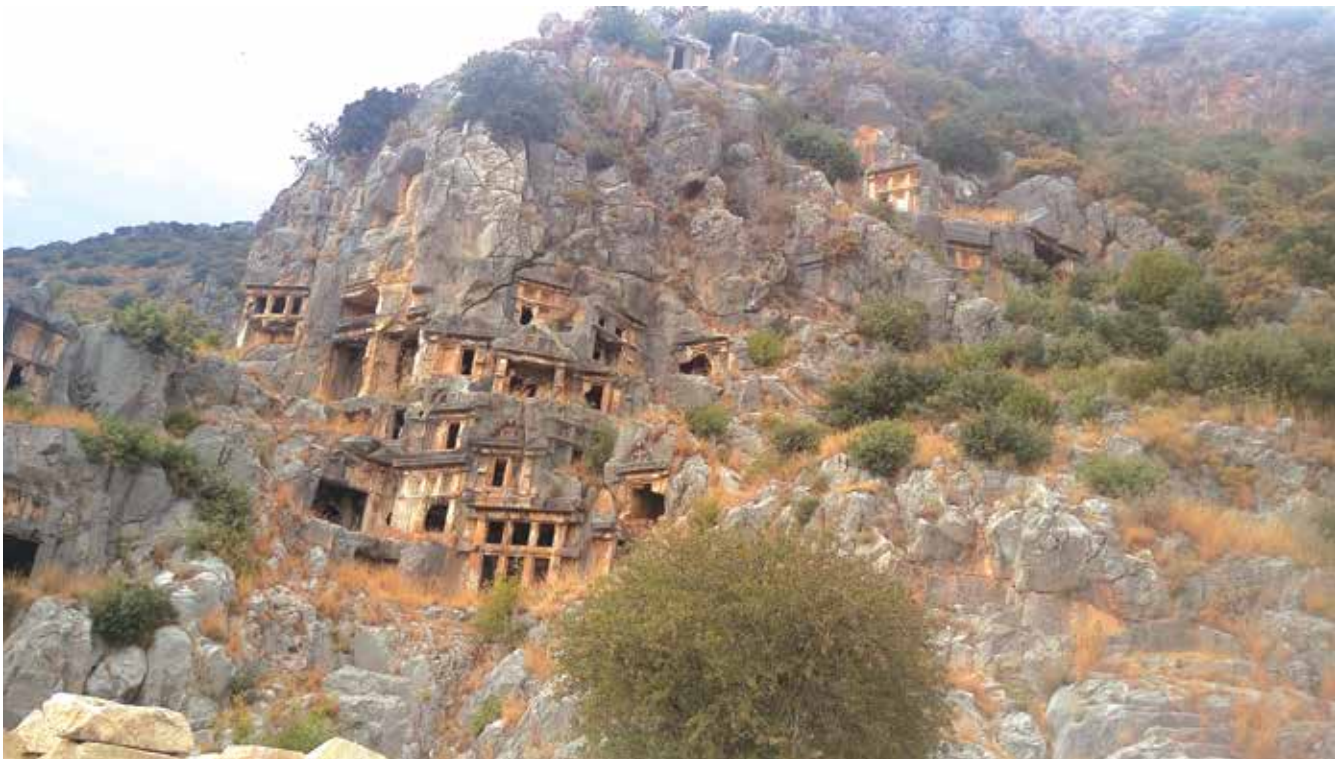


COMBINATION OF HISTORY AND NATURE:

KEKOVA, DEMRE AND MYRA

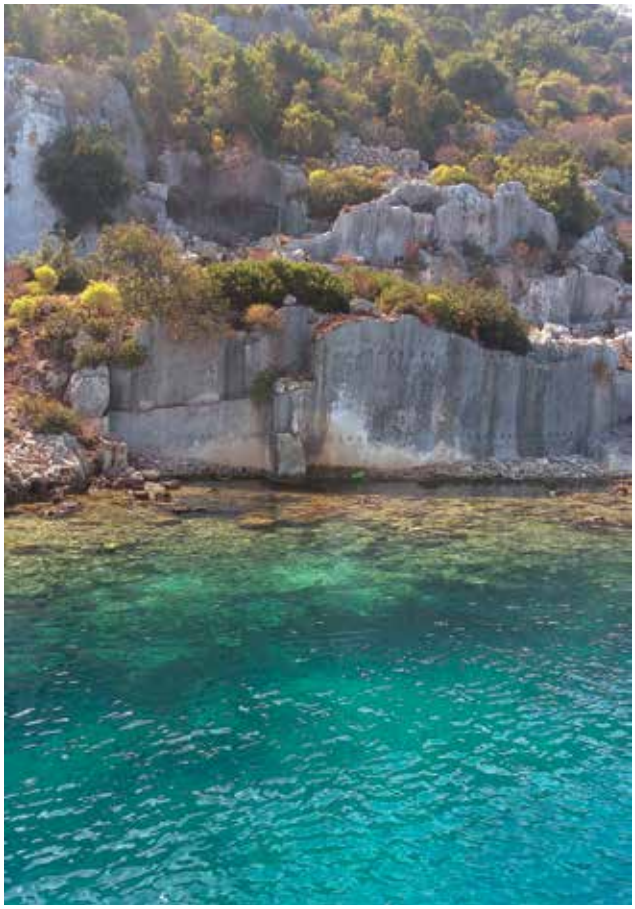


I passed by Antalya for several times since my sister lived there, and I took my wife there in 2016 to spend our summer vacation. Although I have visited for tons of times, I still cannot get enough of Antalya and the districts. This was a special one since I took the opportunity to visit this lovely city with my wife. We set off on our journey in the wee small hours of the morning, and we first visited Demre and Kekova.



Stairs, patterns carved on stone, and kings tombs carved in the rocks in layers drew our attention most. You can climb the stairs and reach the rock - carved tombs.

It is estimated that Demre, one of the most important cities of the Lycia, was established in 5th century BC. Kekova is a sunken city located 20 km far away from Demre, and this region is named after this sunken city. Yet more, the tours organized across this region are called as "Kekova Tour". Nearly entire of the region is an archaeological site. Following Kekova, we visited Myria which is located a few kilometers far away Demre and established inside the rocks facing the sea. We learned from the ruins, tombs and Lycian inscriptions, which are among the best examples of their kinds in Anatolia and extending to a wide area, that the history of the city dates back to 5th century BC. In Myra, you can see one of the preserved ancient theatres which is leaning back to the peak and has a capacity to hold 9 - 10 thousand people. This theatre is still used from time to time to organize some festivals.



Stairs, patterns carved on stone, and kings tombs carved in the rocks in layers drew our attention most. You can climb the stairs and reach the rock-carved tombs. We stepped into the theatre from a small space, and got fascinated to see such a gorgeous venue. It was really worth to see this breath-taking venue and relieves of the theatre that were made with great efforts and care. St. Nicholas Church was another remarkable structure that aroused my attention. This church was rebuilt after being destructed due to the earthquake and Arab invasions in 8th century.

I was deeply affected by the Legend of Myra I read while leaving the church. It seemed to say "I'm the silent screams of these lands". I highly recommend you to visit this splendid site.

ABOUT BARIS TUMURLEK

Born in 1986, Mr. Tumurlek joined TEI as a team member of Quality and Manufacturing Engineering Directorate in 2012 and currently works as Quality Assistant Technician.

MODERN LEADERSHIP

In briefest and simplest term, leadership means influencing which is realized only by establishing a relationship. Although leadership and management are different from each other, they have an extensive common ground. This common ground is to get a result through the agency of other persons.

We all know that we are living in a world which is changing in an unusual rapid manner, which affects everybody. Not only parents, who raise their children, but also housewives, who maintain their social relationships, are affected from these changes. Managerial attitude and style of a person holding a managerial position are rooted in previous instances s/he has had with her / his managers, and her / his information and experiences gained through the years. However; all these information and instances belong to the world of the past that is generally not valid any more. Therefore; it is neither meaningful nor realistic to manage today's young people, who will found the world of future, with this outdated perspective. Private sector, especially executives of corporate companies, strive to keep up with this change. However; since I have been working increasingly with public senior executives in the recent years, I cannot say that this perspective is also adopted there. Across the public sector; executives holding highly critical positions and needing the contributions of young people most, believe that "a manager should be rough, scaring and frightening".

Prof. Acar Baltas
Psychologist

What changes?
Based on my observations in international meetings I have attended recently, as well as the meetings I have managed and my observations in Turkey, I can list the major shifts (changes) arising in the fields of management and leadership as follows:

• Previously - recognized managerial attitude was based on keeping distance from direct reports. Since the current leadership perspective bases the power to influence upon establishing a relationship, leaders should be approachable and accessible.

• The previous perspective expected leaders to make a good talk and have a strong oratory ability. Under the current conditions; leaders are still expected to express themselves well; however, asking the right questions and listening are arising as more important features.

• Teaching, expressing, instructing and developing her/ his direct reports accordingly were considered important for a manager or leader in previous years. Asking, making someone to find and express replace these features nowadays.

• Previous leadership perspective focused on "what to do and how to do" regardless of the field. That is why direct reports needed to act under pressure, get scared and frightened a bit to achieve something. Therefore, leaders were expected to "show her / his power" and manage "with power". Today's leaders, on the other hand, should manage with the meaning s/he will attribute to the question "why" instead of power.

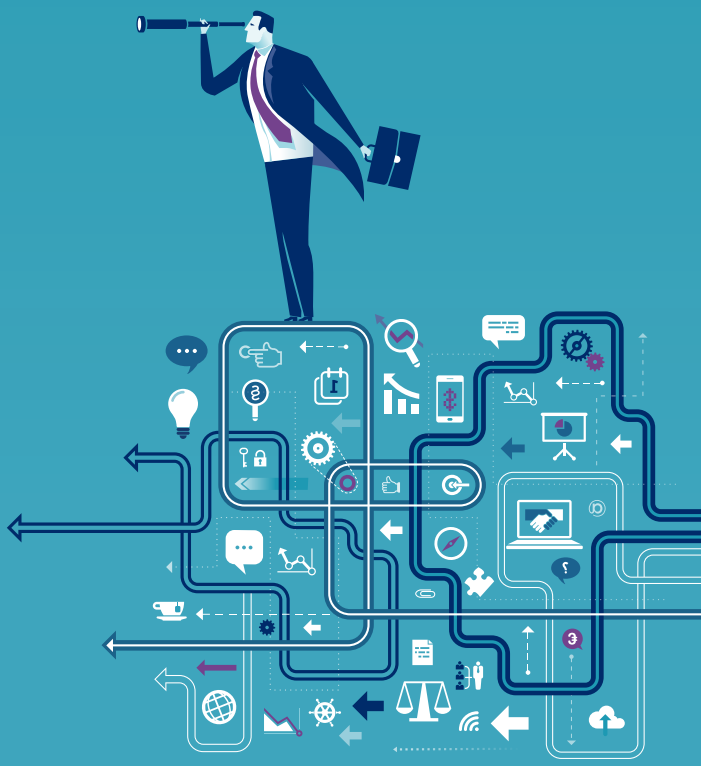
• In the past, leaders expressed their own characteristics and managerial perspective, and expected her / his direct reports to observe these. In today's world, however, leaders are expected to know their colleagues with their strong characteristics, values and life styles, and to manage them on individual basis, not in general terms.

• The last new qualification, expected from today's leaders, is to have a uniting power. Uniting power means managing people with a perspective to eliminate all differences of age, education, past, gender, belief, origin inside a company or a society, take advantage of their knowledge, and focus their contributions around a common purpose.

A leader should be able to reflect potentials of her/ his persons to their performance, and these persons should follow her / him voluntarily since s/he gives them inspiration, not mandatorily since s/he represents power. Confidence is the most basic need. Considering the above - given qualifications, women are intrinsically luckier for modern leadership perspective.

Conclusion
As seen, modern leadership goes well beyond the mentality of command and control high -ranking and common soldiers, who experienced the first and second world wars, applied in civil lives after they stepped into the business life.

Modern leaders and managers, who have left behind the agricultural and industrial revolutions, witness the information age and will manage the world just before the robotic age, will be representatives of a leadership perspective that goes well beyond the previous outdated instances.



APPLY AT LEAST 30

FACTOR CREAM FOR SUN PROTECTION

Due to the increase in air temperatures and the arrival of summer, the sun, which especially plays a significant role in photo - aging, is one of the leading enemies of our skin. The harmful solar rays come out as a result of many skin diseases.

Surveys carried out show that skin diseases are the most common health problems in Turkey in summer. Sunburns, sun spots, stains of different colors, stiffness and thickness in the skin might occur in the areas of the body where the skin is frequently exposed to the sun. Another long - standing effect of the sun is early skin aging. Acibadem Eskisehir Hospital Dermatologists, Eda Kibar Atasoy and Hulya Saglam, answered the questions about skin diseases observed commonly in summer months.

What is sunburn and how should be the treated?
Today, since it is a sign of being healthy and it is "fashion", everyone's desire and longing is to "get a bronze skin". However, while intending to have a bronze skin, very serious problems can be experienced for a long or short period. Sunburns can occur within 2 - 4 hours in a very short time when the solar rays fall steeply. The burns, reaching the highest severity within a period of 12 hours, are beginning to lose their effect gradually within a period of 72 hours. In respect of sunburn, the skin first blushes as a whole, and then small bumps like acne / pimple filled with liquid occur. During this process, the skin is hot and sensitive. As the burn progresses, the endings of the nerves available in the deeper layers of the skin start to be affected, and severe pains occur accordingly. For sunburn treatment, the first step required to be taken is to cool the skin. It is also an important treatment to compress with cold water, to take painkillers and antipyretics, and to ensure that the skin protect its moisture by applying the moisturizing cream to the body after the

In respect of sunburn, the skin first blushes as a whole, and then small bumps like acne/pimple filled with liquid occur. During this process, the skin is hot and sensitive. As the burn progresses, the endings of the nerves available in the deeper layers of the skin start to be affected, and severe pains occur accordingly.

body has cooled completely. If itching occurs in burned areas, then any alcohol free and non - allergic creams that will reduce the itching may be applied. You should leave any blistered area of the body as they are, and if such blisters are popped, then you should take any necessary measures to prevent the body from being infected.

What are the reasons for photo - aging due to the sun?
It can be listed as the increase of the solar rays falling to our country in the summer, the fact that our skin color is white, our cultural characteristics, the poor basic education and the lack of knowledge of protection from the sun.

How does the sun affect the existing skin diseases?
The solar rays affect positively some skin diseases while having negative impacts on some of them. For example; in respect of "vitiligo" disease that occurs when the skin pigment is not generated adequately or is not available in the skin in adequate level, and also in respect of the diseases called "xeroderma pigmentosum, the you should protect from the solar rays more carefully. “Psoriasis”, also called as "cutaneous disease" among the people, and teenage acne (pimples) observed in young people may become better by losing its severity through the effect of the solar rays. However, it is also possible that the severity of the disease will increase if you are over - exposed to the sun.

What is the importance of the sun protectors in summer diseases?
Since many people do not have adequate knowledge, they try to protect themselves from the harmful rays of the sun by using the products with low protection factors; however, this can increase the problems rather than reduce the problems. Since the people intend to get bronze within a short period of time for aesthetic reasons, they apply various oils, which have no protective properties, on their skin, and this results in some unwanted spots due to the sun. For all these reasons, it is very important to use the proper sun protector.

How many sun protector are there, what are their features?
Sun protectors, which are produced in various forms such as gel, foam, cream, lotion, spray, etc., can be examined in two groups as chemical protectors and physical protectors.

Dr. Hulya Saglam

Chemical sun protectors are the products containing one or more chemicals. They absorb more than 95 percent of UV, and make the light energy harmless. Physical sun protectors are the products that minimize the damages, arising from the sun, by distributing and reflecting the UV rays. Physical protectors are preferably used in children and pregnant women. In respect of the sun protectors, the SPF (Sun Protect Factor) number, which is the number that is constantly mentioned and is used to evaluate the effectiveness of the product on numerical basis, is important to ensure the protection. The SPF statement is a safety factor that, in general, shows how the solar rays are burning the body and how much they block the effect of the protector used. There are creams with a protective factor of 2 to 60. We, as dermatologists, recommend you to use products with a SPF of at least 30.

Dr. Eda Kibar Atasoy

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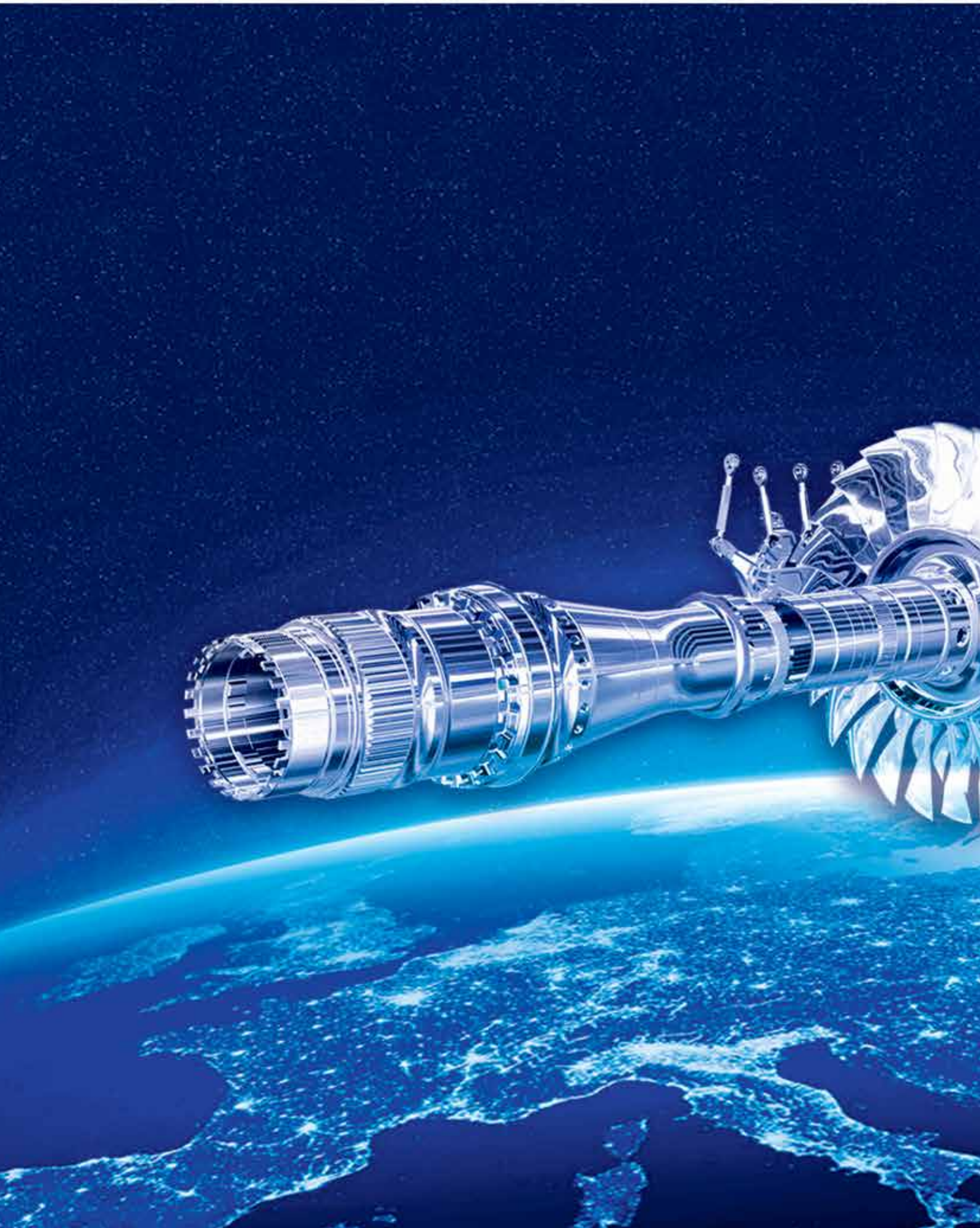

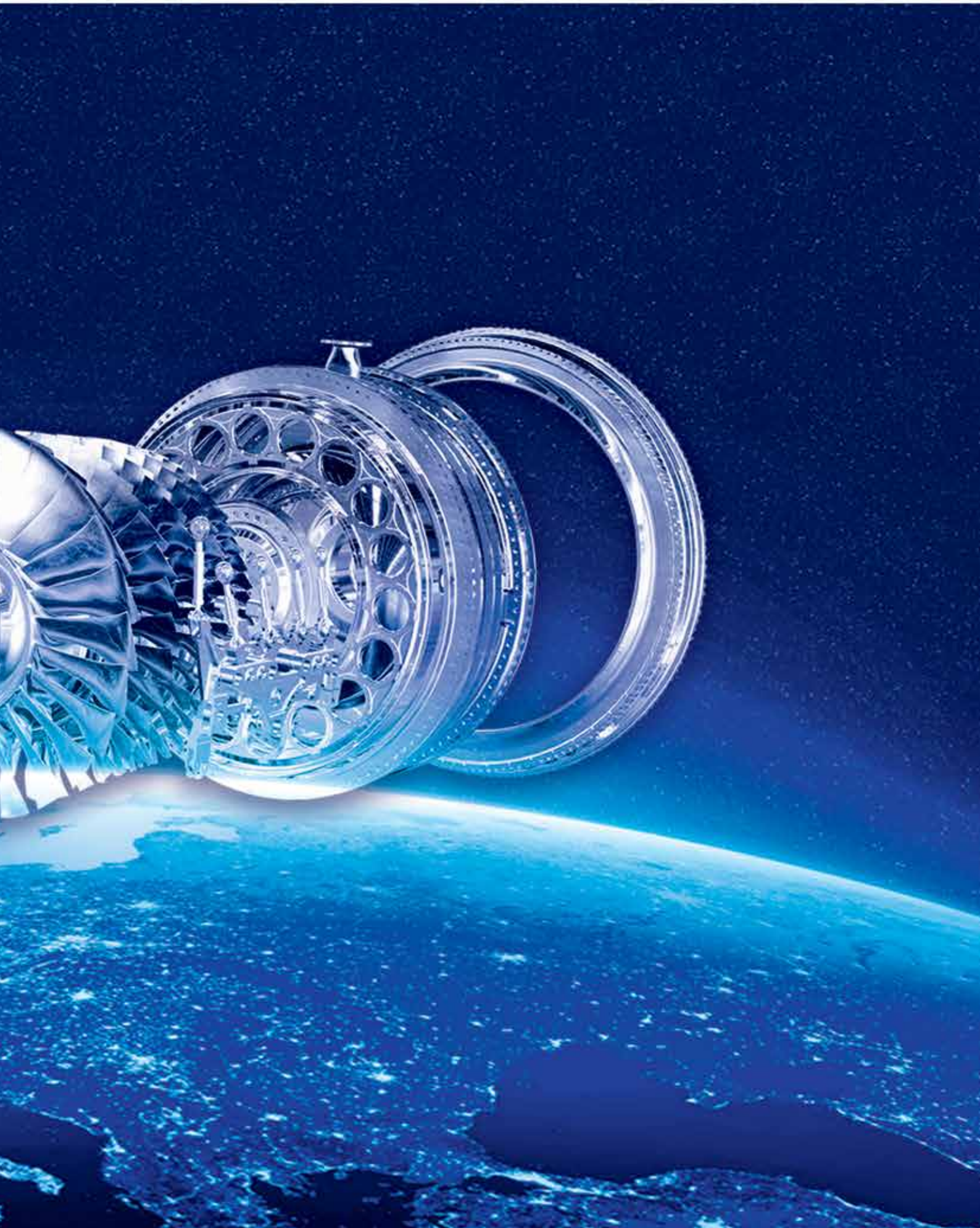

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