



مركز أبحاث وابتكار الطيران
Aerospace Research
and Innovation Center

"A collaborative model to put innovation into practice and create
a competitive edge in the UAE's Aerospace Industry"



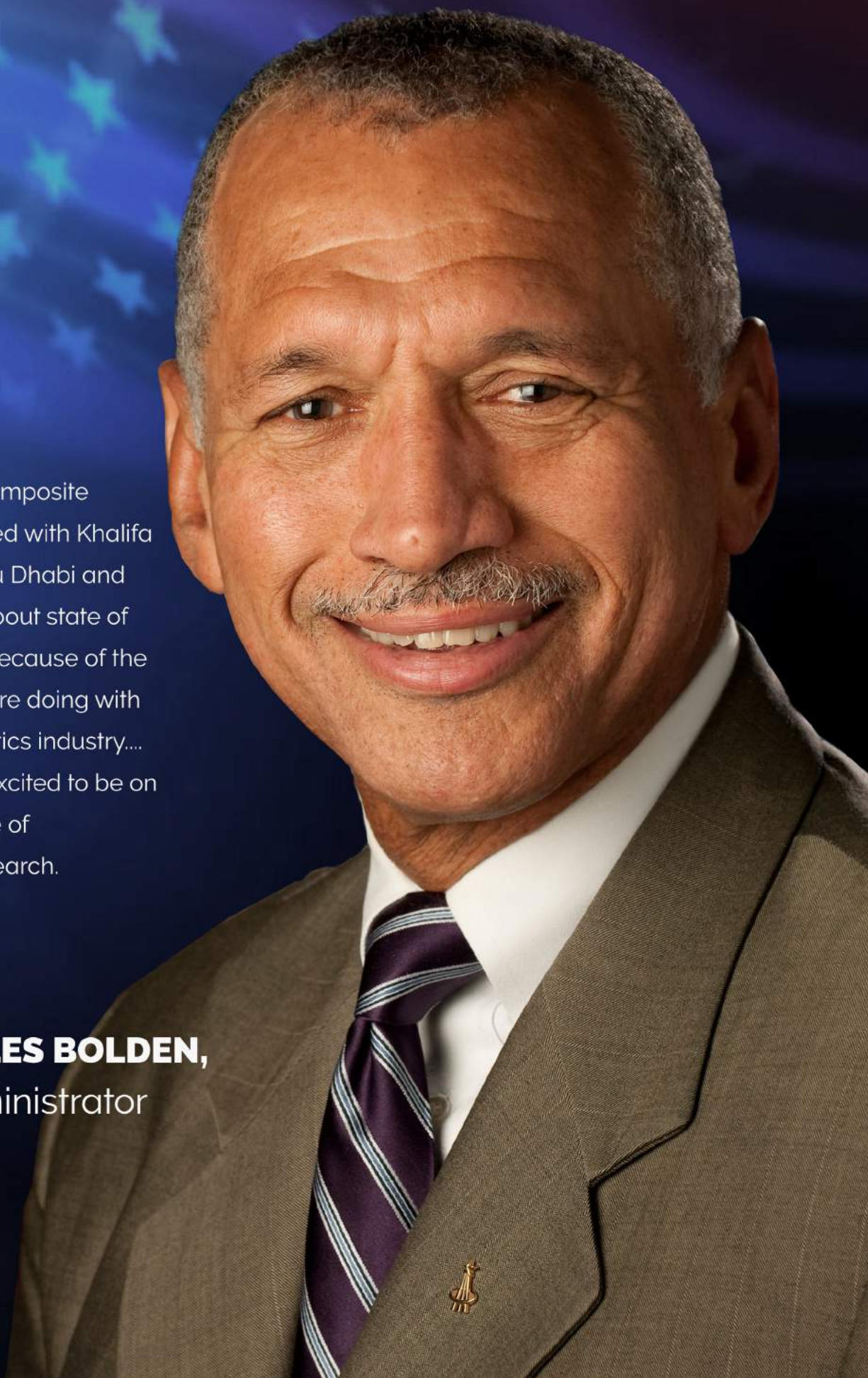
A partnership between
Mubadala and Khalifa University



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We went to a composite facility associated with Khalifa University in Abu Dhabi and man, You talk about state of the art and it's because of the work that they are doing with the US aeronautics industry... they are really excited to be on the cutting edge of aeronautics research.

DR.CHARLES BOLDEN,
NASA Administrator





One of ARIC's goals is to prepare young UAE talent to contribute immediately to the local aerospace industry. As part of this goal, 32 UAE National students have worked on a number of projects which seek to solve real-life engineering challenges within the industry, from the manufacture of an all-composite tactical UAV, to the design of advanced automation equipment for assembling aircraft structures.

EXAMPLES INCLUDE THE FOLLOWING

✓ **Design and build of an Automatic Rivet Feeding System for Aircraft Manufacturing – Saeed H. Almenhali, Abdalla A. Banihammad, Abdul Razzaq A. Al Marzouqi**

This Senior Design Project is developing an automated system that can be used to apply fasteners to composite structures. This could lead to significant reductions in cost and assembly of aircraft wing and tail structures.

✓ **Out-of-Autoclave (OOA) Manufacture of Aerostructures – Aishah Al Antali**

This project is investigating the possibility of manufacturing composite aerostructures using OOA techniques, such as resin transfer molding. The possibility of using this technique in the manufacture of flap track fairings is being studied.

✓ **Spring-back in Advanced Composite Structures – Mariam Al Dhaheer**

This project is investigating the phenomenon of spring-back in composite structures. These phenomenon occur when composites are removed from the mold after manufacture. Although small, these movements can result in difficulties when assembling aircraft components.



ARIC

The Aerospace Research and Innovation Center (ARIC) aims to develop an international reputation for cutting-edge research in aerospace technologies. The initial focus of the research activity will be on developing efficient techniques for manufacturing advanced composites and developing novel procedures for the automated manufacturing and assembly of aerospace components.



OBJECTIVES

- ☑ To support the local aerospace industry in its drive to develop novel solutions for the manufacture of advanced lightweight structures.
- ☑ To educate and train students in the design and manufacture of the next generation of aircraft structures.
- ☑ To identify key technologies that will lead to a paradigm shift in aerospace design.
- ☑ To build long-term collaborations with the leading aircraft manufacturers and research institutes.
- ☑ To develop and maintain an effective IP portfolio.

PEOPLE

SENIOR MANAGEMENT BOARD

Dr. Mohammed Al Mualla (Chairman)

Senior Vice President
Research and Graduate Studies
Khalifa University

Dr. Abdelqader Abusafieh

Head of Research & Development
Aerospace & Engineering Services
Mubadala Development Company

Dr. Tod Laursen

President
Khalifa University

Mansoor Abdulaziz Al Haj

Senior Associate
Aerospace & Engineering Services
Mubadala Development Company



“We believe that technology development is a key enabler for the growth of our aerospace industry. As such establishing ARIC’s capabilities, in partnership with Khalifa University, is part of our strategy to create an R&D ecosystem in Abu Dhabi. The involvement of UAE national students in executing R&D projects at ARIC will create a pipeline of practical innovations that are relevant to industry needs”

Homaïd Al Shemmari,

Mubadala Investment Committee, Chief Executive Officer, Aerospace & Engineering Services

“As the only university in the UAE to offer a BSc in Aerospace Engineering, with programs available at the Masters and PhD level also, KU is dedicated to ensuring that our students have ample opportunities to explore the wide array of options that the aerospace field offers. In collaboration with our colleagues and partners at Mubadala Aerospace, we are creating a cutting edge lab on our campus where research can be nurtured, and collaborations with industry and academia can be actively conducted and fostered. The establishment of ARIC will increase our student’s interactions with world leaders in the industry and provide them with opportunities to work in this exciting field.”



Prof. Tod Laursen,

President of Khalifa University

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“Our partnership with Khalifa University is fundamental to creating a technologically competitive aerospace industry in Abu Dhabi. This R&D partnership will not only strengthen Strata’s global competitiveness but also introduce the next generation of innovative aerospace solutions for the industry.”

Badr S. Al-Olama,

Chief Executive Officer, Strata

“ARIC will play a key role in the education of Emirati youths in the current and next generation of advanced aerospace technologies. The Center will encourage undergraduates to get involved with on-going research through Senior Design Projects, Internships and Independent Study Projects, students will also have the opportunity to spend time in overseas research laboratories and with aircraft manufacturers. We look forward to conducting innovative research and working closely with industry, academia and students.”

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Dr. Mohammed Ismail Al Mualla,

Senior Vice President of Research and Graduate Studies

FACULTY & RESEARCH STAFF

FACULTY

Prof. Wesley Cantwell

Director of ARIC, Associate Dean for Research

Prof. Lakmal Seneviratne

KURI Director and Professor, Mechanical Engineering

Prof. Jorge Dias

Professor, KURI & ECE

Dr. Cesare Stefanini

Associate Professor, Robotics and Biomedical Engineering

Dr. Dongming Gan

Assistant Professor, Robotics Institute

Dr. Rehan Umer

Assistant Professor, Aerospace Engineering

Dr. Kamran Khan

Assistant Professor, Aerospace Engineering

RESEARCH STAFF

Dr. Sanjeev Rao

Post-Doctoral Research Fellow

Dr. Alia Aziz

Post-Doctoral Research Fellow

Dr. Hamza Bendemra

Post-Doctoral Research Fellow

Dr. Toufiq Al Khawli

Post-Doctoral Research Fellow

Mr. Hussam Al Hussein

Research Assistant

Mr. Mahesh Kannath

Research Assistant

Mr. Pradeep George

Lab Engineer

Mr. Dewald Swart

Automation Engineer-Strata Service Provider

Mr. Hendrik Odendaal

Automation Engineer-Strata Service Provider

Mr. George Kerwood

R&D Engineer - Strata

Mr. Dave Mayes

R&D Engineer - Strata



RESEARCH CENTER INFRASTRUCTURE



**THE FOLLOWING
PIECES OF MAJOR
EQUIPMENT ARE
AVAILABLE IN ARIC**



RTM PNEUMATIC HEATING PRESS

The Radius RTM press has a maximum operating temperature of 220 oC and can be used to manufacture panels with dimensions up to 1000 by 650 mm. The available clamping force can be varied up to 70 metric tons, allowing for the optimized compaction of advanced composite parts. The press has a tool loading / unloading station that includes an external 1.25 m rail system, allowing the tool transfer facility to shuttle tools in and out of the clamping zone.



MITSUBISHI RV-6SDL MANIPULATOR

This manipulator is being adapted to offer advanced drilling solutions for high-performance composite structures. The robotic system is

capable of manipulating a 6 kg payload over a reach of 900 mm, whilst ensuring a repeatability of 0.02 mm.



AUTOCLAVE

The Scholz autoclave is capable of manufacturing panels up to 1.5 by 1.0 meters in size. It has a maximum operating pressure of 20 bar and can be used at temperatures up to 400 °C. It allows for the manufacture of a wide range of thermosetting and thermoplastic-matrix composites.

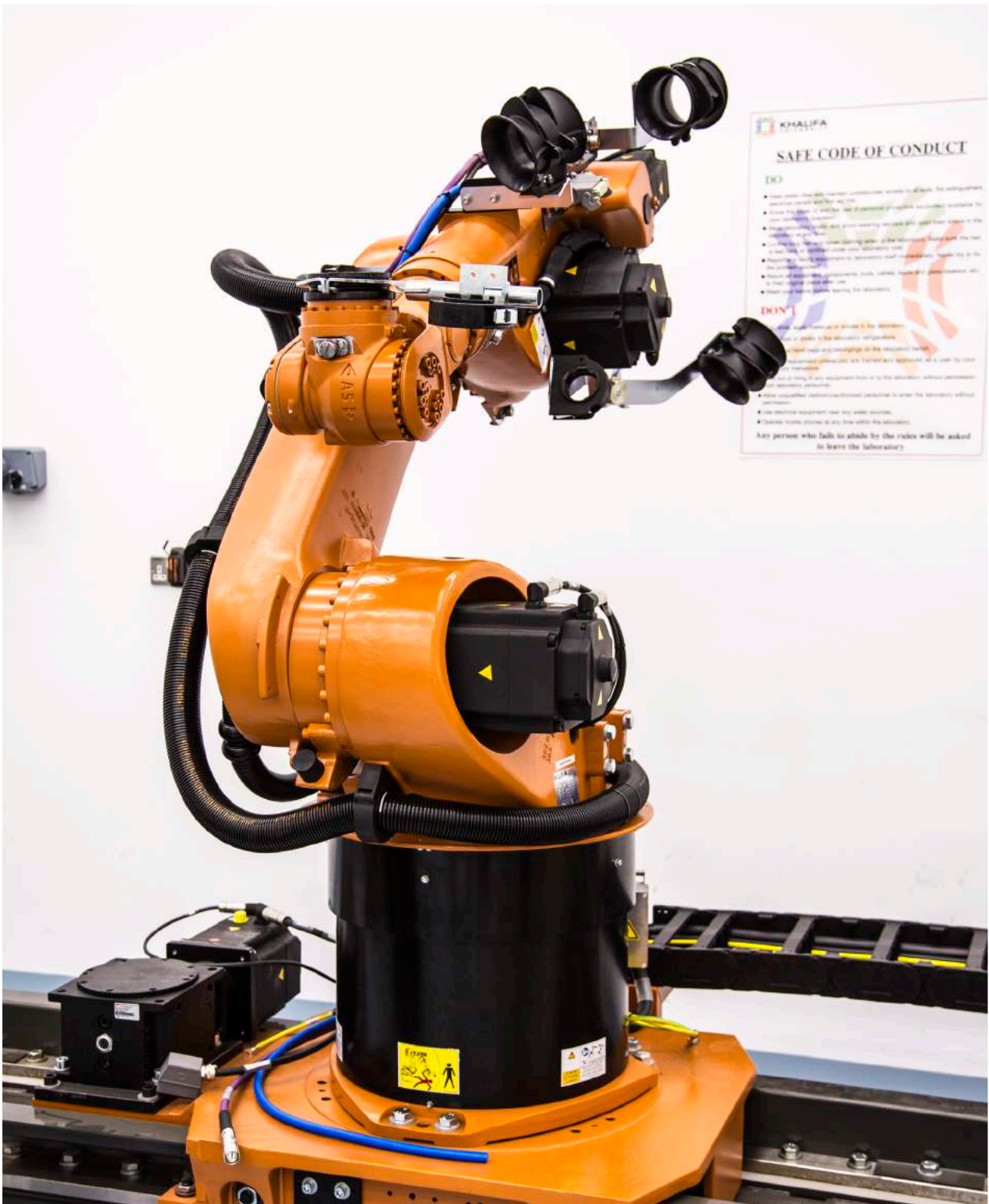
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X-RAY COMPUTED TOMOGRAPHY

The GE Nanotom-m high-end nanofocus x-ray system can be used to identify and characterize a wide range of features and defects in composite materials. The machine has a 180 kV high-power nano-focus X-ray tube with a

maximum target power of 15 Watts. It offers a minimum focal spot size of less than one micron and detailed detectability down to 200 nm. The X-CT can accommodate large samples with edge lengths of up to 250 mm.



KUKA KR60 HA (HIGH ACCURACY) ROBOT

The KUKA robot is being used to develop and demonstrate automated assembly processes for complex aircraft components that go through several steps during assembly. The rail-mounted manipulator offers specific features that allow researchers to develop and demonstrate

processes for real-size aircraft components. The robot offers a 7-axis manipulation capability within 32 m² of working volume. It has a 60 kg payload capacity and a positioning accuracy of 0.05 mm.



EXPERTISE

- ☑ Composites manufacture
- ☑ Robotics and automation
- ☑ Modeling and simulation
- ☑ Mechanical testing
- ☑ Non-destructive testing
- ☑ Rheology and microstructural analysis





CURRENT PROJECTS

- ☑ Understanding the causes of porosity in high performance composites.
- ☑ Automated robotic nut plate installation in aerospace manufacturing.
- ☑ Parallel robotic drilling system for automated aerospace drilling.
- ☑ Out of autoclave processing for aerospace structures.

OUR PARTNER



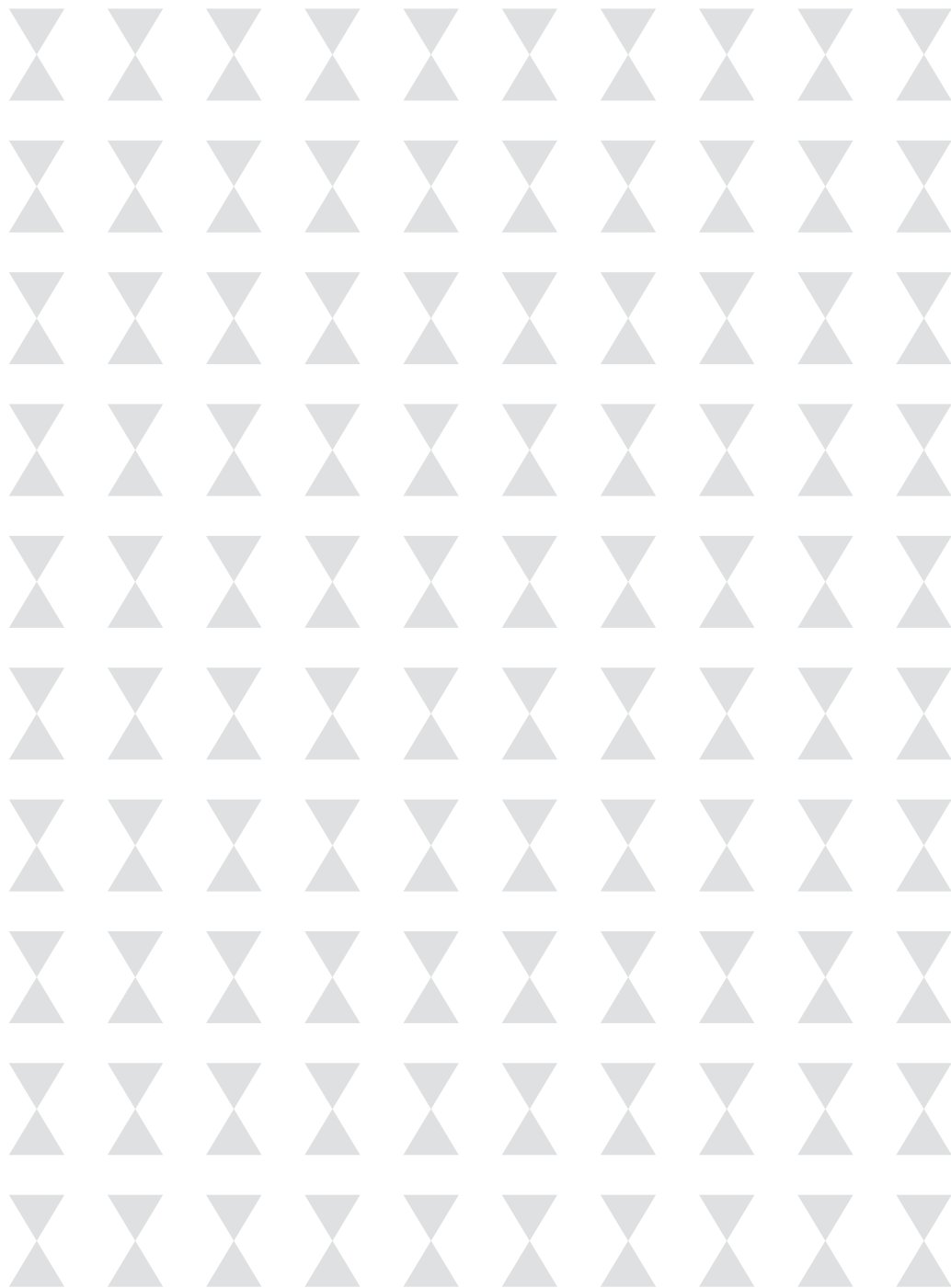


ABOUT **KHALIFA UNIVERSITY**

Based in Abu Dhabi, Khalifa University is a leading science and technology university. The University is dedicated to the advancement of learning through teaching and research, and to the discovery and application of knowledge. It endeavors to be an internationally recognized research university, with a world class reputation for interdisciplinary teaching and research and a tradition of partnering with leading academic institutions from around the world.

Currently, Khalifa University enrolls over 1,900 students studying in several specialized engineering programs, all of which have been accredited by the Ministry of Higher Education in the UAE. The university offers undergraduate degrees across all major fields of engineering, in addition to graduate programs that include masters and PhD programs in specializations that contribute directly to Abu Dhabi's 2030 vision for a knowledge-based economy.

OUR PARTNER



The image shows a large exhibition stand for Mubadala. The stand is white with blue and grey accents. At the top, the word 'مبادلة' is written in Arabic, followed by 'MUBADALA' in English. To the right of the text is a stylized blue logo consisting of two triangles forming an 'X' shape. Below the main text, there are several informational panels. One panel on the left has the Mubadala logo and the word 'MUBADALA' below it. Another panel in the center has the text 'LEADING SECTOR'S YOUR SERVICE' and a list of bullet points. To the right, there is a display of colorful balloons and a banner. The stand is set up outdoors on a paved area under a clear blue sky.

مبادلة
MUBADALA

ABOUT MUBADALA

Mubadala was established to strengthen Abu Dhabi's growth potential, and to help the government meet its socioeconomic targets. While our investments are designed to generate sustainable profits over the long-term, they also deliver strong social returns to Abu Dhabi and the United Arab Emirates.

Focused on investment and development across multiple sectors, Mubadala's portfolio is valued at US 67.1 billion. We are an active investor in sectors and geographies with long-term value propositions, working in partnership with worldclass organizations to establish and manage joint ventures and investment platforms.

OUR PARTNER

STRATA  اسكراطا





ABOUT STRATA

Strata Manufacturing PJSC (STRATA) is a composite aero-structures manufacturing facility based in Al Ain, United Arab Emirates. Established in 2009, with production beginning in 2010, Strata has partnerships with the world's leading aircraft manufacturers, Airbus and Boeing, as well as tier one suppliers like Alenia Aermacchi, FACC AG, SAAB and S.A.B.C.A.

Strata manufactures various parts for Airbus, Boeing and ATR aircraft :

- ☒ *Airbus A380/340/330 Flap Track Fairings*
- ☒ *Airbus A340/330 Ailerons*
- ☒ *Airbus A340/330 Spoilers*
- ☒ *Airbus A900 – 350 Flap Track Fairings*
- ☒ *ATR 72/42 Rudder & Vertical Fin*
- ☒ *Boeing B777 Empennage Ribs*
- ☒ *Boeing B787 Vertical Fin Ribs*

Strata is wholly owned by Mubadala Development Company PJSC (Mubadala), the Abu Dhabi-based investment and development company.



SELECTED PUBLICATIONS

JOURNALS

H. Alhussein, R. Umer, S. Rao, E. Swery, S. Bickerton and W.J. Cantwell, Characterization of 3D woven reinforcements for liquid composite molding processes, Journal of Materials Science, 2016 ,51, pp3288-3277.

H. Z. Jishi, R. Umer and W. J. Cantwell, The fabrication and mechanical properties of novel composite lattice structures, Materials and Design, ,91 2016, pp293-286.

Patents

Lightweight composite single-skin sandwich lattice structures, US Patent Application 704,177/14 Parallel mechanism based automated fiber placement system - US – Provisional Patent Application No. 120,952/62

CONFERENCE PAPERS

S. Rao, M. Al Kuwaiti, V. Barber, A. Abusafieh and W. J. Cantwell, Effect of dwell time on the properties of composite materials, Proc. European Conference on Composite Materials, ECCM2016 ,17.

R. Umer, H. Z. Jishi and W. J. Cantwell, Novel lattice structures based on continuous fibers: Fabrication and mechanical properties, Proc. European Conference on Composite Materials, ECCM2016 ,17.

J. Zhou, Z.W. Guan, R. Umer, and W.J. Cantwell, The Low Velocity Impact Response of Sandwich Structures with Graded Foam Cores, in Proc. 20th Int. Conference on Composite Materials, Copenhagen, July 2015.

H. Alhussein, R. Umer, S. Rao and W.J. Cantwell, Through thickness compaction response of 3D woven fabrics, in Proc. 20th Int. Conference on Composite Materials, Copenhagen, July 2015.

W.J. Cantwell, The impact behaviour of composites and sandwich structures, Proc. 16th European Conference on Composite Materials, ECCM 16, Seville, 2014.

