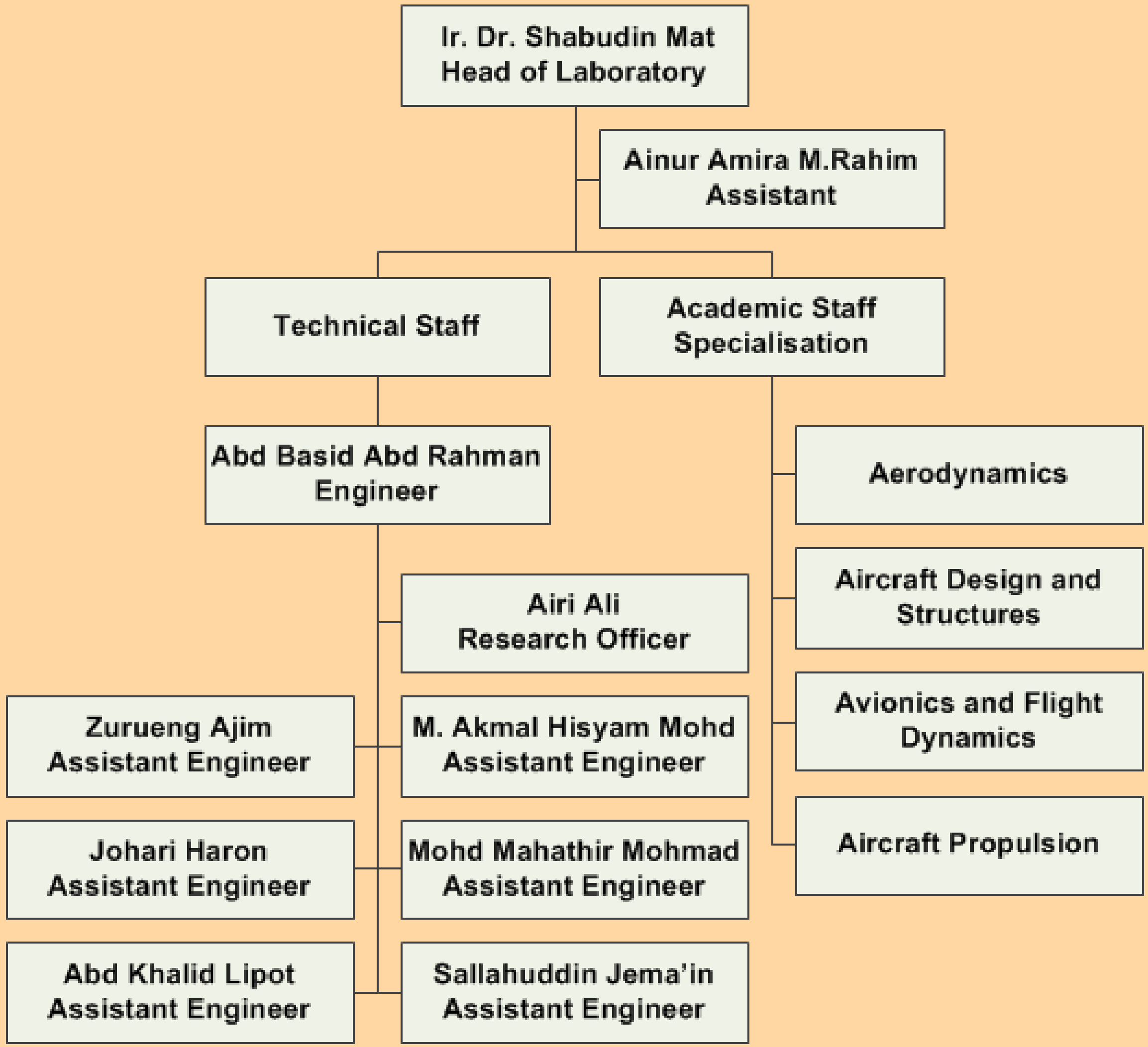
UTM Aerolab

Asia-Pacific Association for International Education 14th Conference & Exhibition (APAIE)

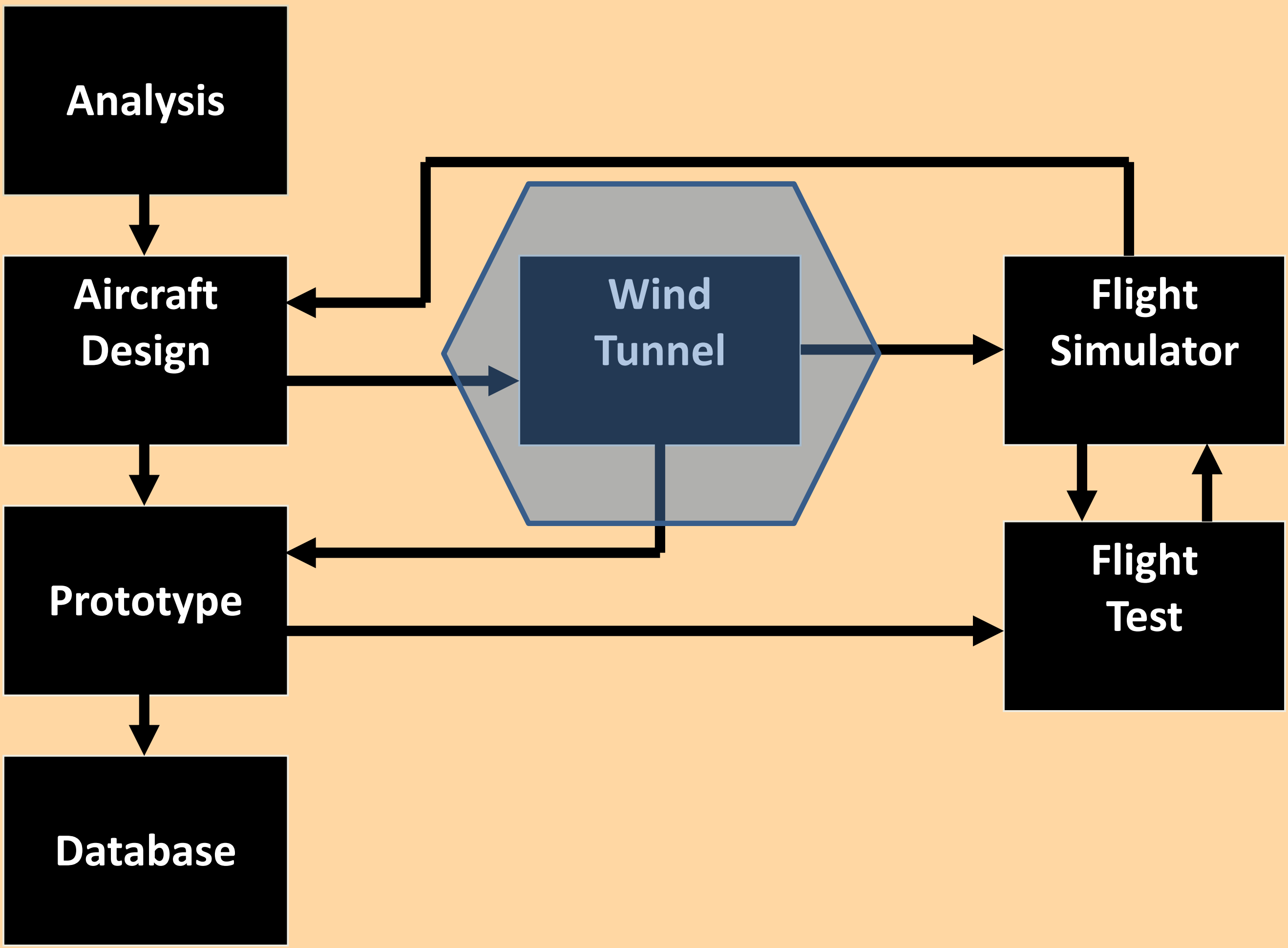
UTM AEROLAB

Department of Aeronautics, Automotive and Ocean Eng.
Transportation Research Alliance
Universiti Teknologi Malaysia

Aeronautics Laboratory Operational Organisation Chart



Facility Development concept



Cooperation and Networking

SUBSONIC AERODYNAMICS TESTING ASSOCIATION

(SATA)*<www.sata.aero>*

- **World-wide organization for operators/users of low speed aerodynamic testing facilities (since 1965)**
- **Membership from all major wind tunnel facilities:**
  DNW, Boeing, NASA, GM, Ford, NRC, Honda etc.
- **UTM accepted as SATA member August, 2002**

Certificate of Membership

This Certifies That

Universiti Teknologi Malaysia

Is Hereby An Active Member In Good Standing Of The

Subsonic Aerodynamic Testing Association

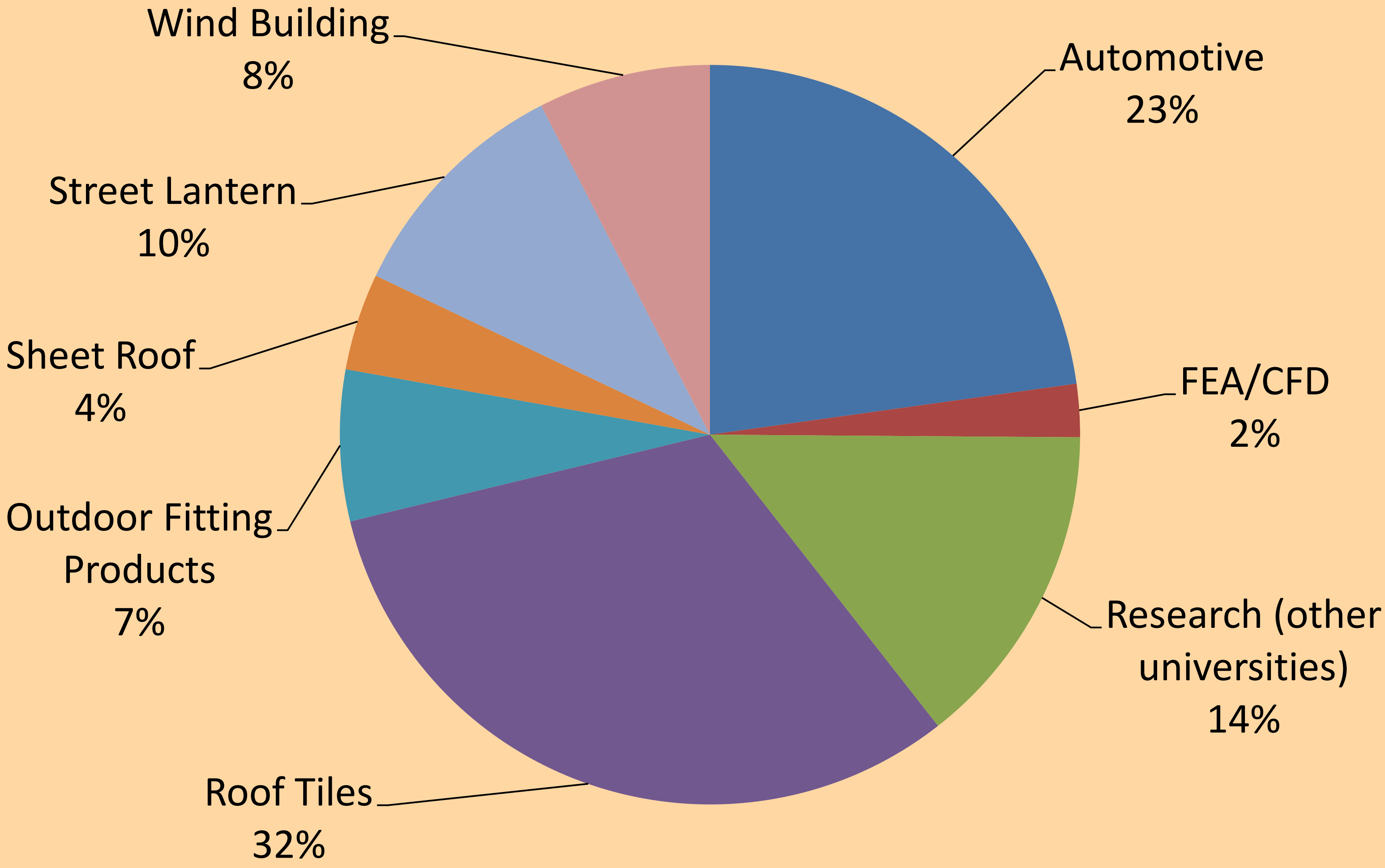
SATA

And Has Met All Requirements Outlined By Its Constitution

2018

Klaus Muthreich	Peter Skinner	John Laffen
Chairman	Vice-Chairman	Secretary

Type of Consultancy Projects



Working with Industry

- Aircraft Design
- Flight Systems & simulation
- Vehicle Aerodynamics
- Expert Service and Training
- Wind Engineering

Pekat Teknologi

Muarlite

Working with Higher Institution

UNIVERSITÉ DE RENNES 1

ANR

cnrs

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

UniMAP

NANYANG TECHNOLOGICAL UNIVERSITY

University of Glasgow

ONLINE BENFACTOR WALL

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UTHM Universiti Tun Hussein Onn Malaysia

SIM UNIVERSITY

Loughborough University

UPM UNIVERSITI PUTRA MALAYSIA

UNIVERSITY OF CAMBRIDGE

USM UNIVERSITI SAINS MALAYSIA

UNIVERSITI PERTAHANAN NASIONAL MALAYSIA

Saint-Malo IUT

LAGG

NRC-CNRC Institute for Aerospace Research

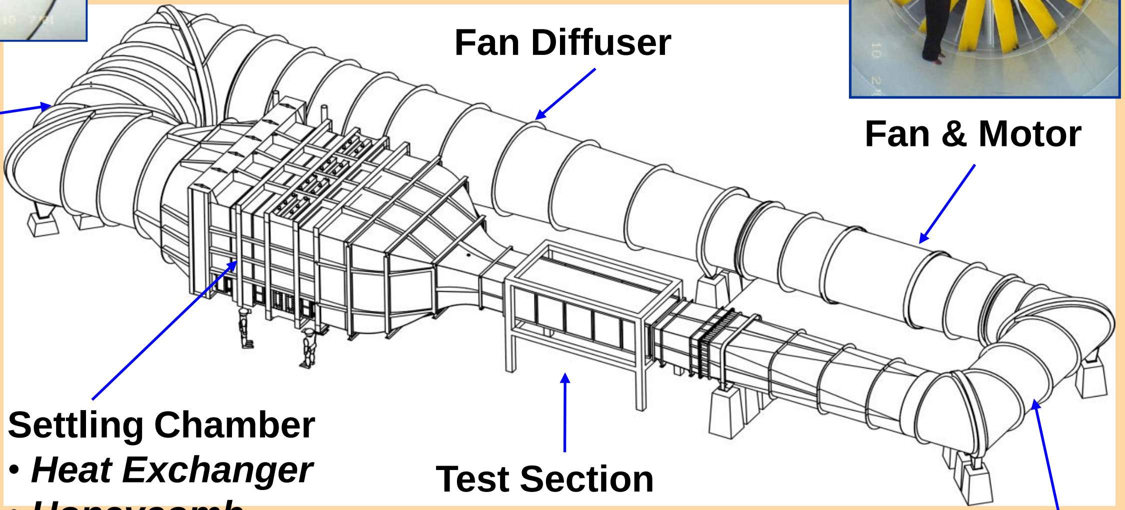
首都大学東京

TOKYO METROPOLITAN UNIVERSITY

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Subsonic Wind Tunnel Facility

- EDUCATION & TRAINING
- RESEARCH
- TESTING SERVICES

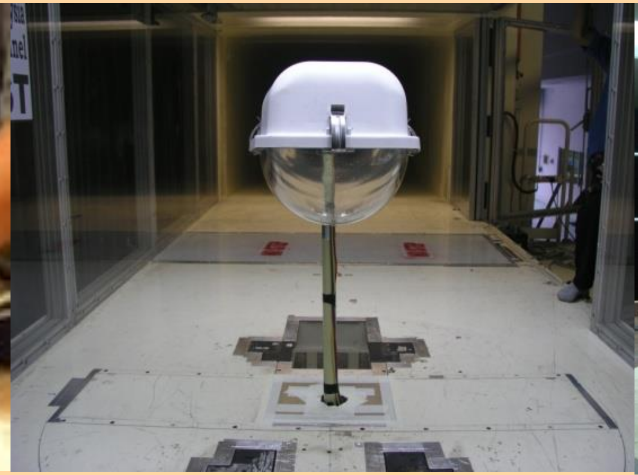
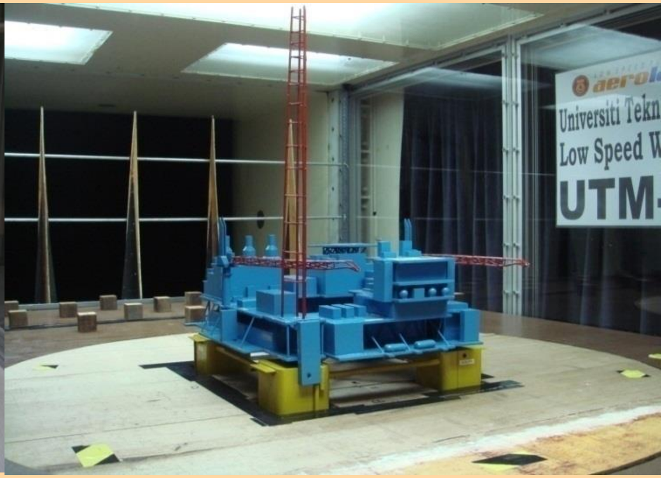
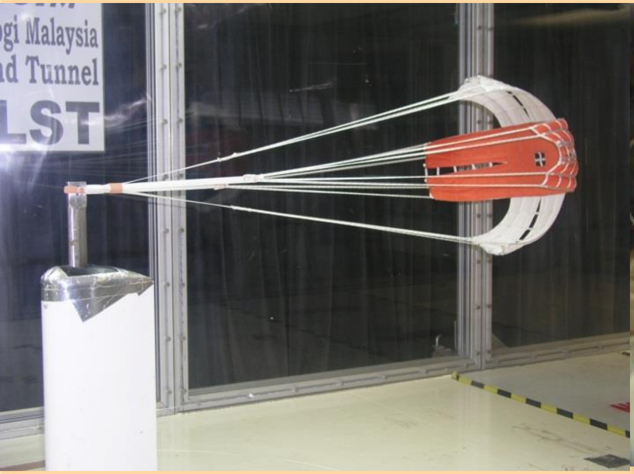
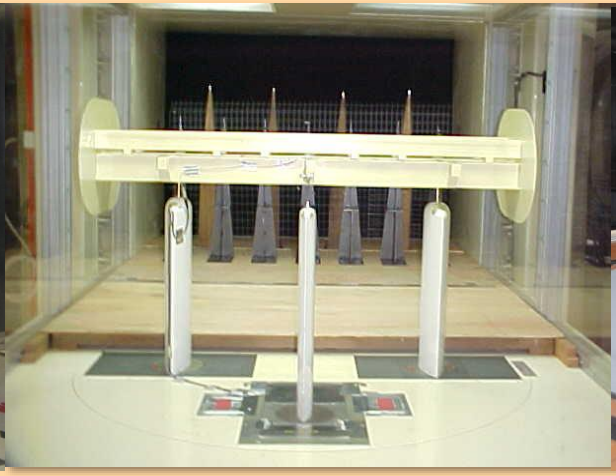
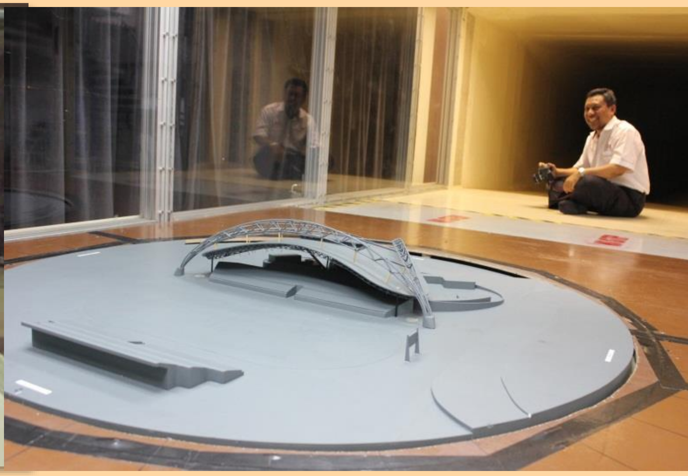


TEST SECTION FLOW QUALITY

Parameters	Measured value
Velocity Spatial Uniformity	0.13 %
Temperature spatial uniformity	0.16 °C
Flow Angularity, pitch	0.13º
Flow Angularity, Yaw	0.13 °
Axial Wind Speed Gradient	0.0003°/m
Flow Angle Gradient, pitch	0.003°/m
Flow Angle Gradient, Yaw	0.070°/m
Velocity Temporal Uniformity	0.046 %
Temperature Temporal Unifermity	0.08 °C
Axial Turbulence Intensity, U_{rms}/U, 5 Hz <f<10kHz	0.037 %

Some of Wind Tunnel Activities

Wind Eng. & Industrial Aero

Research Activities

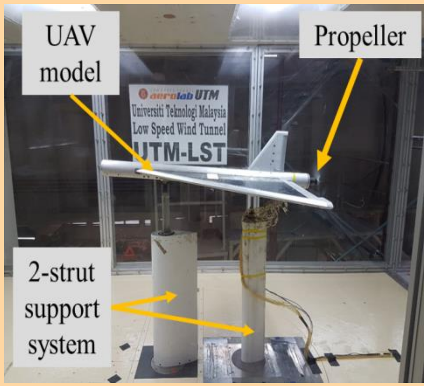
DELTA WING RESEARCH IN UTM

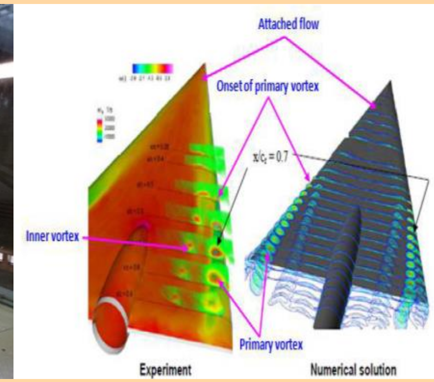
Project Leader :

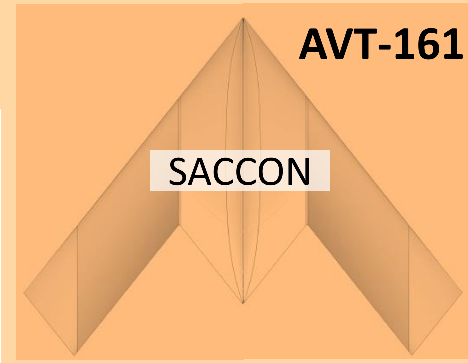
Dr. Ir. Shabudin Bin Mat, CEng & P.Eng

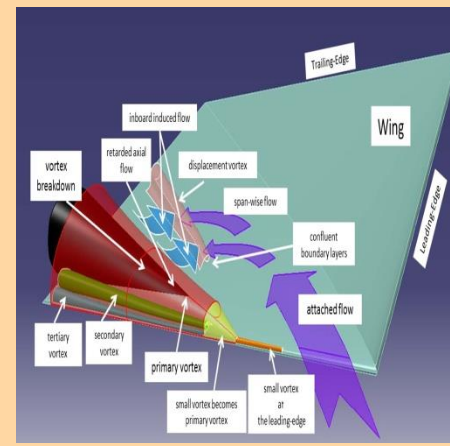
PhD Glasgow University

Current









NATO AVT 113

To investigates the effects of propeller on the aerodynamic characteristics above a 55° sharp-edged delta wing UAV model.

To Investigate the effects of Leading edge bluntness, Reynolds number, angle of attack, flow control techniques above VFE-2 wing

Current Publication:

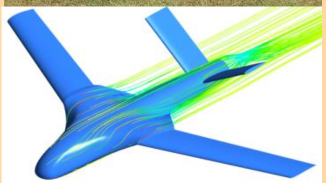
1. *Effects of synthetic jet actuator (SJA) on flow topology of blunt-edged UTM VFE-2 wing model (2017)*
2. *FBG as air pressure sensors on generic UTM-LST half model (2017)*
3. *Wind Tunnel Experiments on a Generic Sharp-Edge Delta Wing UAV Model (2017)*
4. *The effect of edge profile on delta wing flow (2016)*

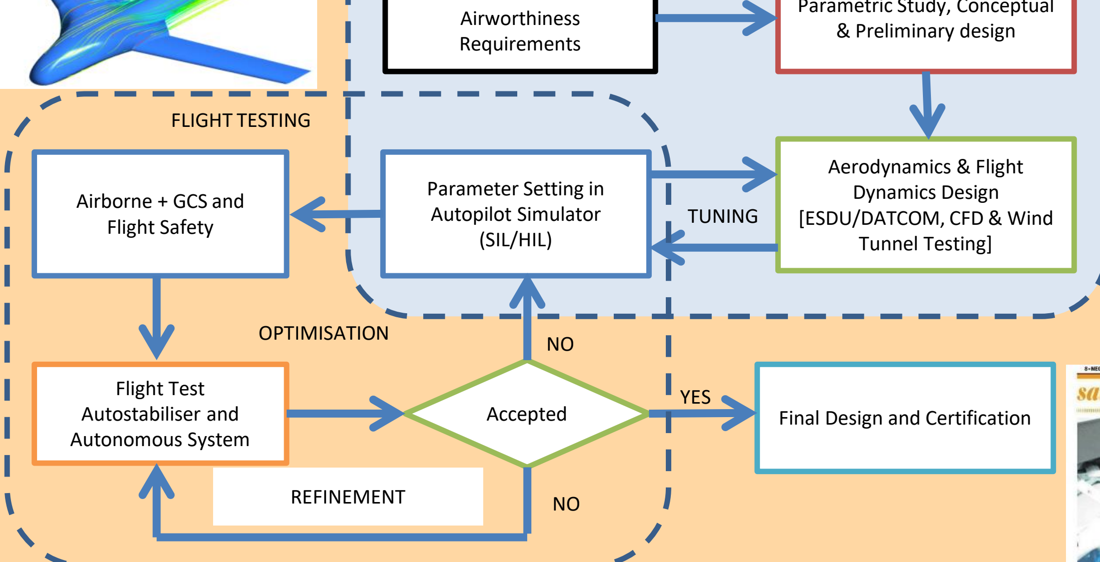
Grant/acknowledgement :

1) ***UTM GUP***
2) ***MOHE***
3) ***Aerolab UTM***

Design, Build and Test of CAMAR-UAV Prototype

Shuhaimi Mansor PhD, PEng, MIEM, MSAE
Dept. of Aeronautics, Automotive & Ocean Engineering, Faculty of Mechanical Engineering
Universiti Teknologi Malaysia





Systematic Design Process: Conceptual and preliminary design phases to freeze configurations using ESDU/DATCOM, CFD-FEM and Wind Tunnel Testing. Followed by detail design and prototyping for system integration (ground and airborne system) and flight testing for optimization design.

Problem Statement:
Systematic design process and human capital development in UAV/UAS technology is required for local indigenous aircraft.

Research Finding:

1. Appreciation the design-build-test knowledge and experience on UAV/UAS.
2. Development of systematic design tools and flight test (airborne lab) facilities.

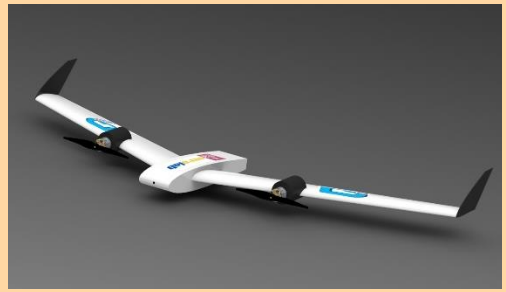
Related Publication:
1 PhD Thesis: 2 Index Articles

PARTNERS: unmanned systems technology, DEFTECH, CTRM, Geo Sense

Acknowledgement :
1) PRGS & KTP Grant
2) UST-DEFTECH, UTM-Aerolab, GeoSense

LOW SPEED TUNNEL aerolab UTM

Unmanned Aerial System, UAS
& Nature Inspired Flight Technologies



UAS flight test & performance analysis, wing tunnel testing, unsteady flight & perturbation, aerodynamics of insect flight & kinematics

Dr.-Ing. M. Nazri M. Nasir, CEng MIMechE

Uni. of Manchester, UK (BSc), TU Delft, NL (Master), TU Darmstadt, DE (PhD)

https://people.utm.my/mnazri/

mnazri@mail.fkm.utm.my

011-10845041

Gas Turbine Combustion Research Group

Prof. Dr. Mohammad Nazri Mohd Jaafar

Gasification of biomass is a renewable energy technology capable of using various bio-resources such as from the forest and agricultural wastes to produce a low to medium energy gas called synthesis gas (or syngas). Syngas can be burned directly, used as a fuel for gas engines and gas turbines, converted to clean diesel fuel through the Fischer-Tropsch process or potentially used in the production of methanol and hydrogen

The research area focuses on the production of **biodiesel and bio kerosene as an alternative fuels and to improve combustion performance in terms of emission reduction**. Biodiesel is produced through esterification transesterification methods while bio kerosene is produced through catalytic cracking method. Various feedstock are used such as waste cooking oil, grease, palm kernel oil and others.

RESEARCH AREAS

Production of Syngas from biomass waste

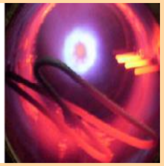
Production of biodiesel and bio kerosene

Development of micro gas turbine

Emissions reduction using retainers and swirlers

Micro gas turbine (MGT) is emerging as a new alternative power generation method for **small scale power output** with potential applications as **emergency standby power and off-grid combined heat and power generation**. MGT presents the advantage of **portability, high thermal efficiency, clean combustion and high power-to-weight ratio**.

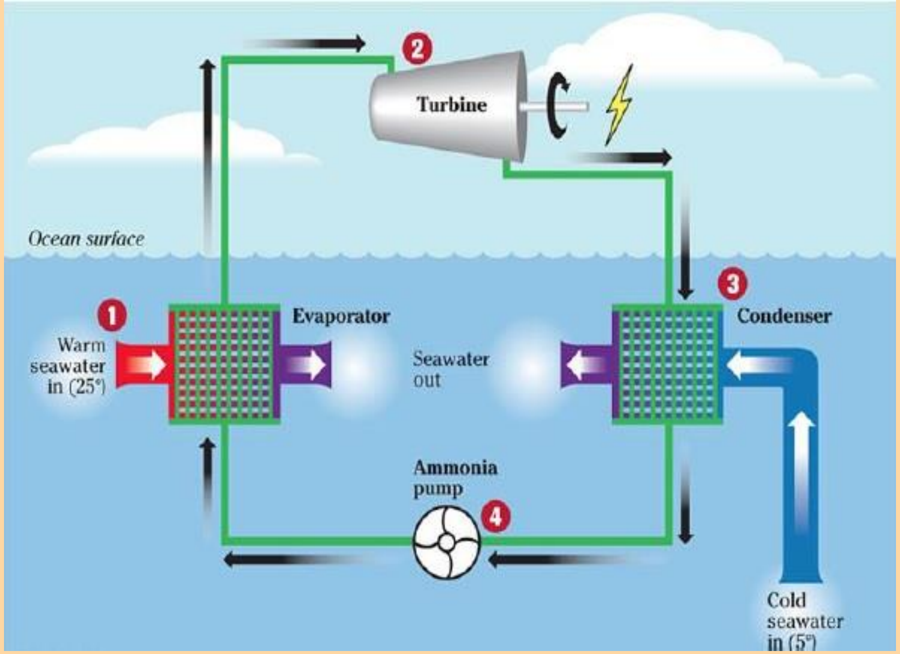
Installation of retainers and swirlers in gas turbine combustor enhances the combustion performance by **maximizing the energy output, increasing the fuel efficiency, and minimizing gas emissions. Retainers and swirlers stabilizes the flame, improves mixing between air and fuel, thus reducing the formation of emissions.**

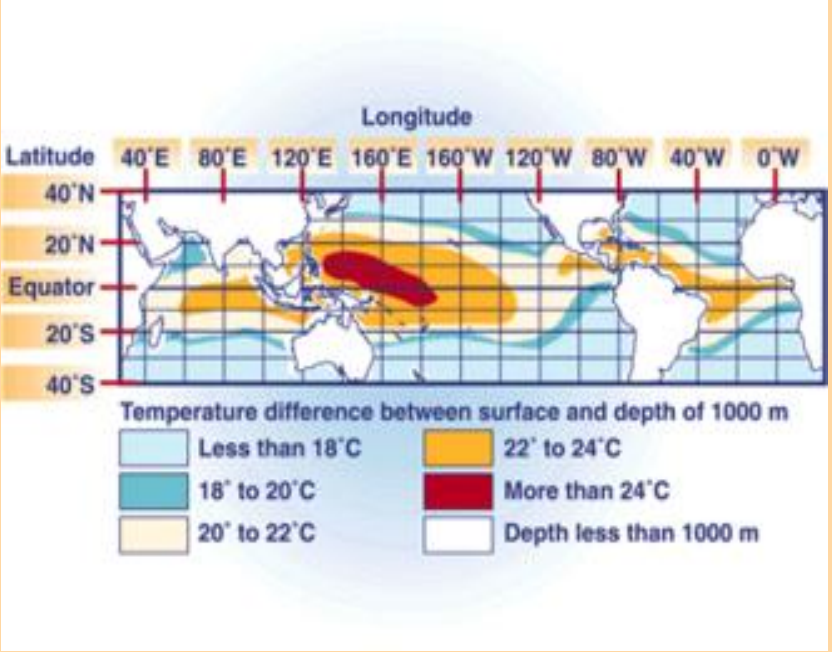


Ocean thermal energy conversion (OTEC)

Project Leader:
Dato' Prof. Dr. Ir. Abu Bakar Jaafar

Development of Advanced Hybrid Ocean Thermal Energy Conversion (OTEC) Technology For Low Carbon Society & Sustainable Energy System : First Experimental OTEC Plant of Malaysia





Computational Solid Mechanics Laboratory, *CSMLab*

Prof. Dr. Mohd. Nasir Bin Tamin

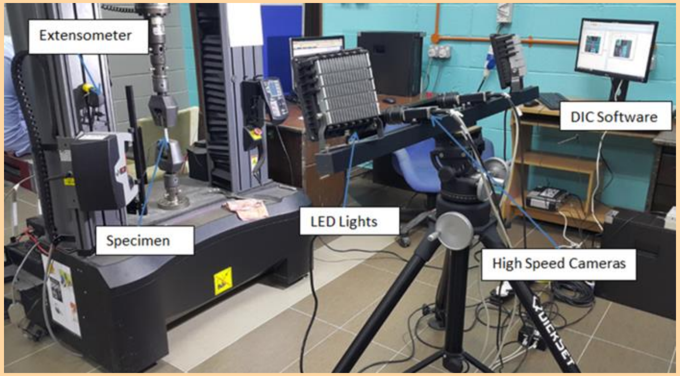
Research Theme

Development of materials constitutive and damage-based models for reliability assessment of the respective advanced structures

On-going research works:

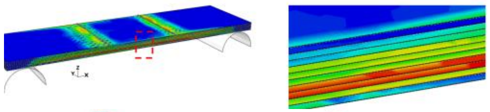
Damage-based models for FRP composite laminates

- Fatigue damage models for laminas
- Cyclic cohesive zone model for interfaces
- Non-Fickian moisture absorption model
- Moisture-induce degradation of adhesive joints
- Damage characterization in CFRP composite laminates by DIC technique

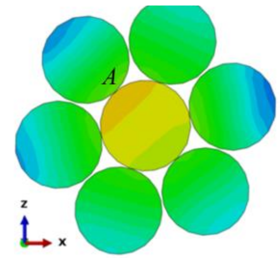


Digital Image Correlation (DIC) set-up with Correli-STC

12-ply CFRP composite laminates



Damage-based fatigue life model for steel wire ropes



Across the section with highest contact pressure

Stresses on 1x7 steel wire rope

Reliability of interconnections in microelectronics components *(Solder joints and TSVs)*

Query: nasirtamin@utm.my

Faculty of Mechanical Engineering
Department of Aeronautical, Automotive & Ocean Engineering

DR. ISKANDAR SHAH BIN HJ ISHAK

Room : C23-325
Tel : 07-5534664 / 012-7225349
Email : shah@utm.my / shah@mail.fkm.utm.my
Research Group: Applied Aerodynamic Research Group (AARG)

EDUCATIONAL BACKGROUND:

- **MCE**, Malay College Kuala Kangsar (MCKK), 1990
- **B.Eng** in Mechanical Engineering (Aeronautics), Universiti Teknologi Malaysia ,1996
- **Mastère Spécialisé** (Techniques Aéronautique et Spatiales), École Nationale Supérieure de l'Aéronautique et de l'Espace (SUPAERO), France, 1998
- **PhD** in Unsteady Aerodynamic Wake of Helicopter Main-Rotor-Hub Assembly, UTM, 2012

CURRENT RESEARCH INTERESTS:

- Unsteady Aerodynamic
- Helicopter Aerodynamic
- Wind Tunnel Testing - involved in various wind tunnel tests for Academic Research and Industry Consultation Services since 2004

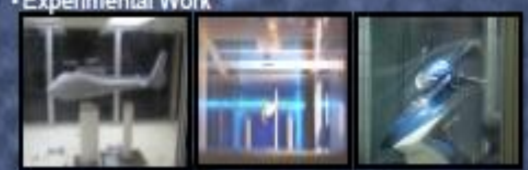
PUBLICATIONS:

Contribute scores of paper for international conferences and articles in Scopus & Web of Science

EXAMPLE OF PROJECTS:

- Design & Fabrication Work

- Experimental Work



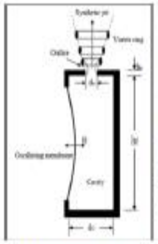
- Numerical Work

SYNTHETIC JET ACTUATOR (SJA) DRIVEN BY PIEZOELECTRIC DIAPHRAGMS TO CONTROL FLOW SEPARATION

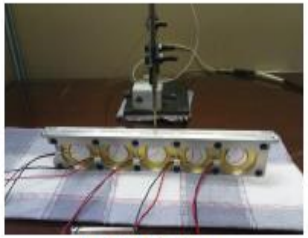
Dr. Md. Nizam Dahalan

Department of Aeronautics, Automotive & Ocean
Faculty of Mechanical Engineering
Universiti Teknologi Malaysia
nizamdahlan@utm.my

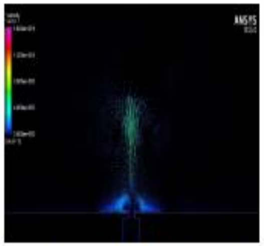
❖ SJA Design



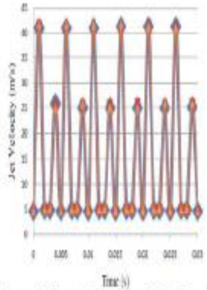
Side View of SJA



Isolated SJA Testing

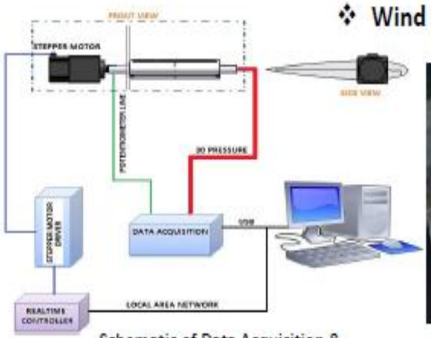


CFD - Vortex Formation in Velocity Vector



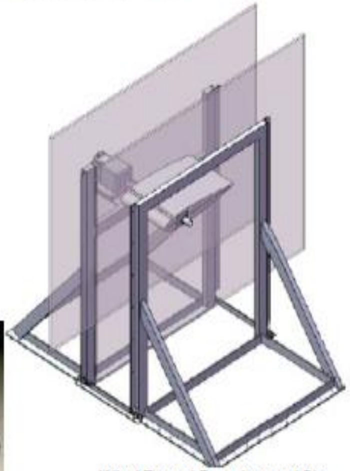
Repetition Results of Pulse Jet Velocity Within 0.03 s at Applied Frequency of 900 Hz

❖ Wind Tunnel Testing



Schematic of Data Acquisition & Control System

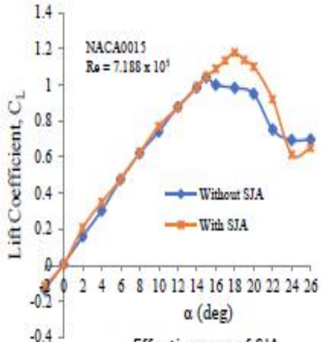
Photograph of NACA0015 Airfoil with SJA



Wind Tunnel Experimental Rig

❖ Potential Applictaions

Synthetic jet actuators (SJA) are multifunctional flow control devices. Their most common application is delaying flow separation. Other applications are jets thrust vectoring, heat transfer augmentation, control the flow at low Mach numbers, wishing to change the effect of airfoil camber and manipulating the vortex flow.



Effectiveness of SJA

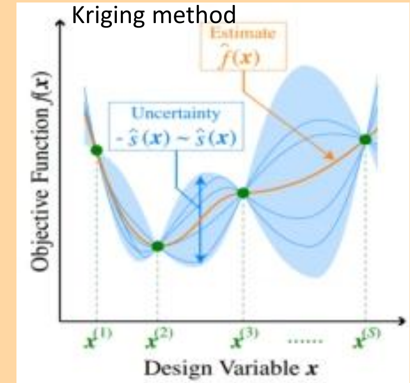
LOW SPEED TUNNEL aerolab UTM

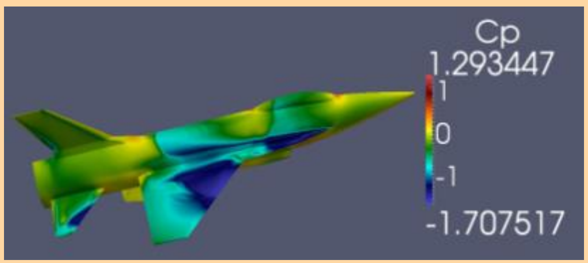
OPTIMIZATION OF AIRCRAFT SYSTEM RESEARCH IN UTM

Project Leader :

Dr. Norazila Othman, PhD

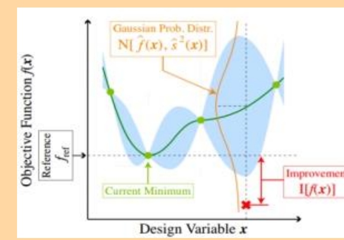
Tokyo Metropolitan University, Japan

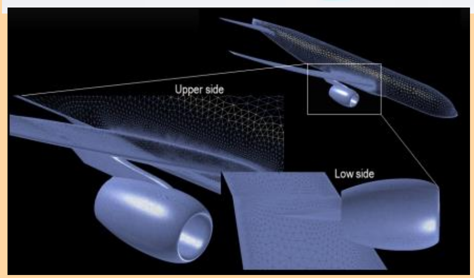


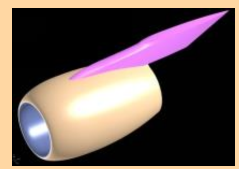


To investigates the transonic speed effects of standard dynamic model (SDM) aircraft.

Efficient gobal optimization







Optimization modelling

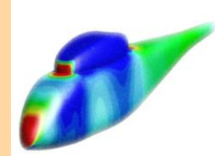
To investigate the effects of engine nacelle and pylon of common research model aircraft (CRM).

Current Publication:

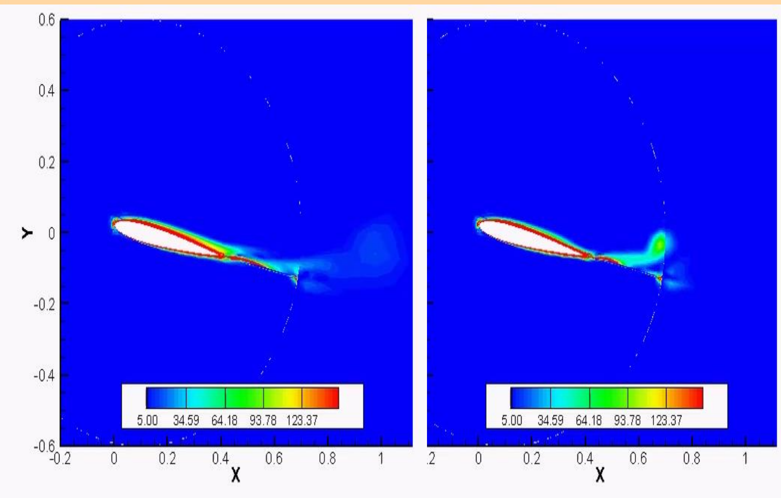
1. *Prediction of aerodynamic derivatives using computational fluid dynamics (CFD) at transonic speed, 2017.*
2. *Development of multiobjective trajectory-optimization method and its application to improve aircraft landing, 2016.*
3. *Trajectory and aerodynamic control optimization of civil aircraft descent under hazard situations based on high-fidelity aerodynamic database, 2016.*
4. *Development of digital flight motion methodology based on aerodynamic derivatives approximation, 2016.*

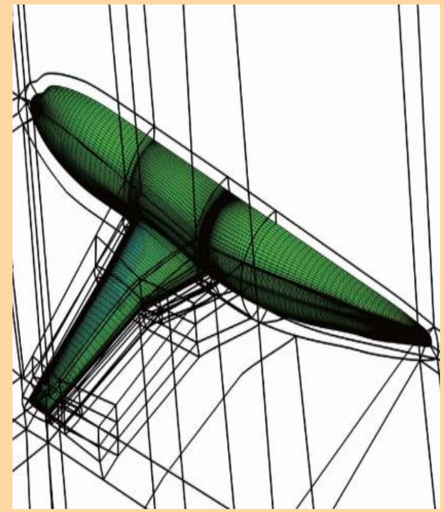
Grant/acknowledgement :

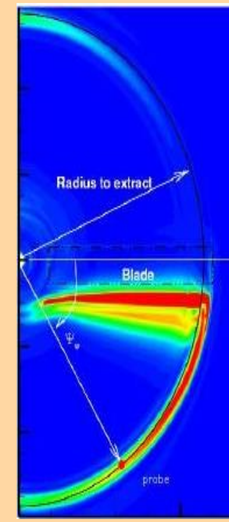
1) ***UTM Potential Academic Grant***
2) ***MOHE***

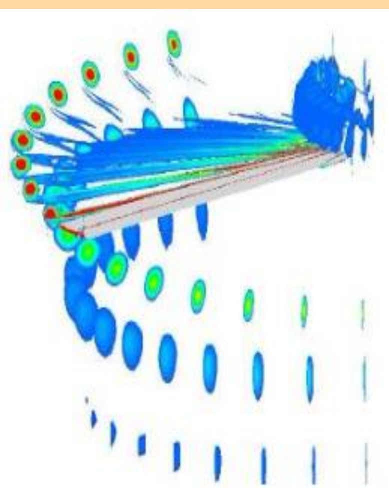


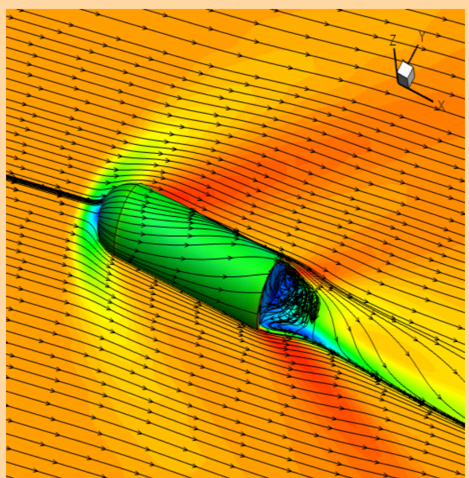
UNSTEADY AERODYNAMICS OF AIRCRAFT & ROAD VEHICLES

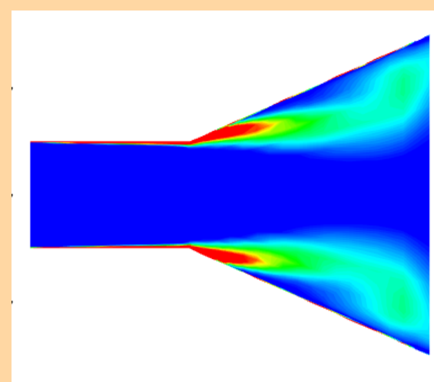












Nik Ahmad Ridhwan Nik Mohd, Ph.D.
Uni of Liverpool, UK
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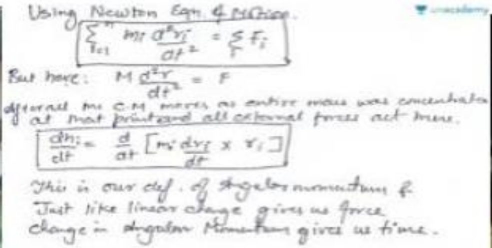
AIRCRAFT DYNAMICS, CONTROL, GUIDANCE AND FLIGHT SIMULATION

IR DR ISTAS F. NUSYIRWAN, istaz@utm.my

The Flight Dynamics Laboratory in Aerolab was established to explore the area of aircraft control and stability. Our work covers from the development of the mathematical model of aircraft equations of motion with aircraft aerodynamic and stability data from wind tunnel test or other sources, to the development of aircraft control system and flight simulation.

WIND TUNNEL TEST



MATHEMATICAL EQUATIONS

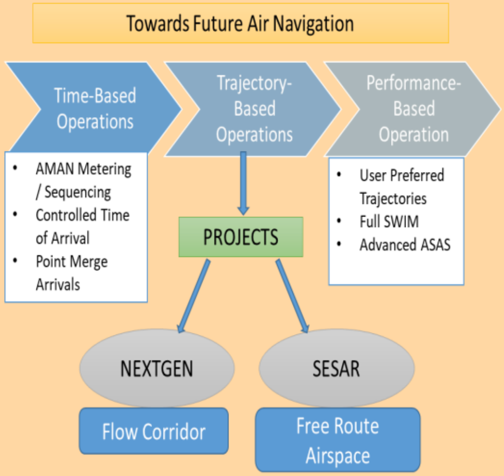
FLIGHT SIMULATION

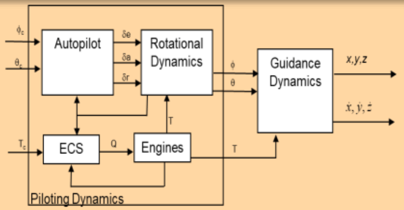
Traffic Management + Flight Guidance, Navigation and Control

Mastura Ab Wahid, PhD
Area: Aircraft Guidance, Navigation and Control.

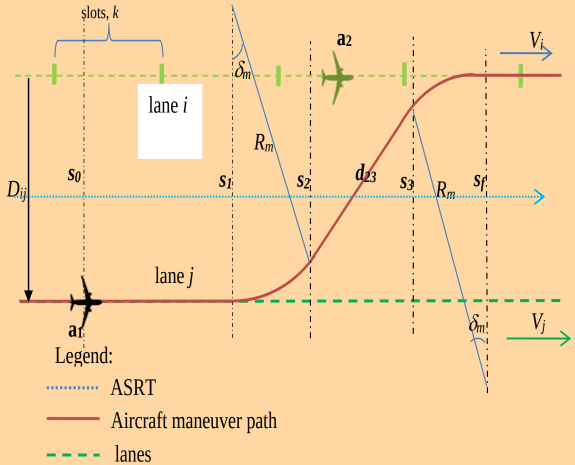
OBJECTIVES

1. to contribute to the synthesis of a space-indexed nonlinear guidance control law for transportation aircraft presenting enhanced 3D+T tracking performances.
2. to explore the performances and feasibility of a flight guidance control law designed to make the aircraft follow a 3D+T trajectory within a high density traffic corridor.





finding the adequate control variables (ϕ_c, θ_c and T_c) for the guidance dynamics so that the aircraft accurately follow its nominal 3D+T trajectory within the airstream



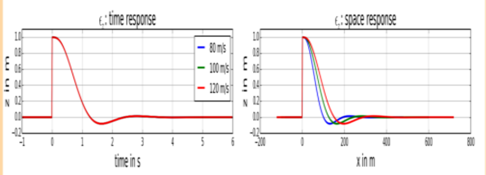
Airstreams Concept

Space-Indexed vs Time-Index Dynamics

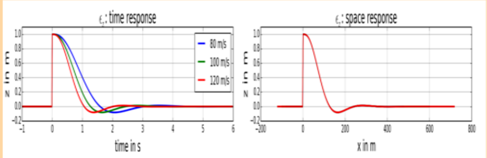
$$\frac{d\,\mathrm{var}}{ds} = \mathrm{var}^{[1]} = \frac{d\,\mathrm{var}}{dt}\cdot\frac{dt}{ds} = \frac{1}{V_{ASRT}(s)}\cdot\frac{d\,\mathrm{var}}{dt}$$

Simulation

Comparison of time and spatial laws



traditional time-indexed NLI guidance law



space-indexed NLI guidance law

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