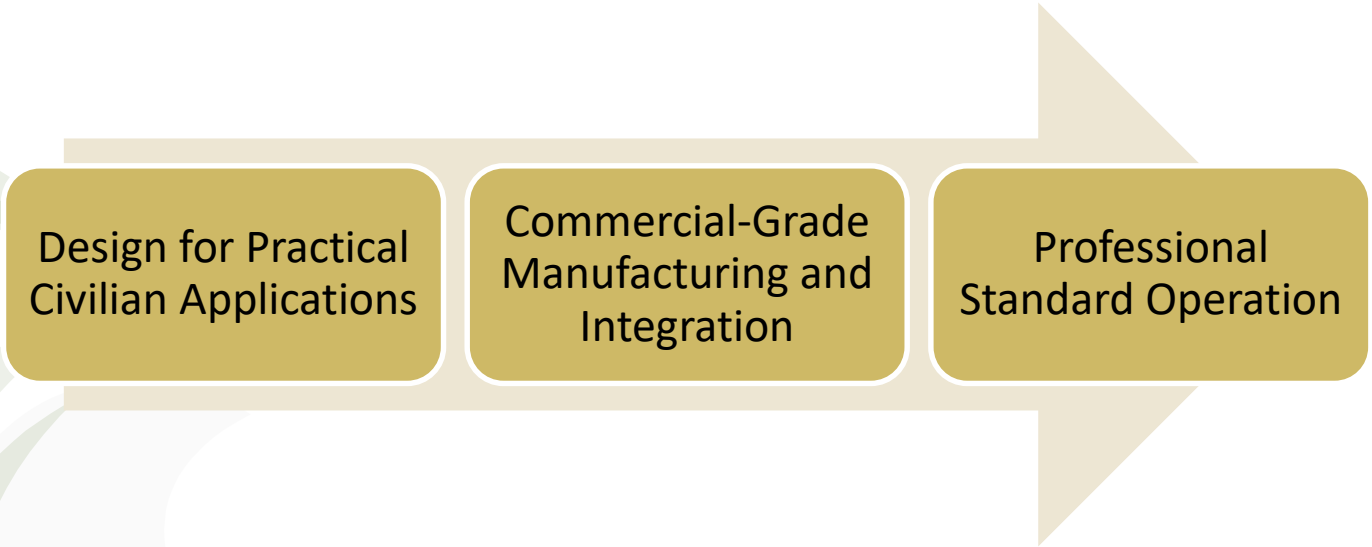
UAV-Based Weather Sounding Platform
For Precision Weather Modification Planning and Operation

Intelligent Structures and Automatic Control Laboratory and
Center for Unmanned Aerial Vehicles of Kasetsart University
(ISAAC LAB and KU UAV)
www.facebook.com/isaaclab.aeroku
chaiwat.kl@ku.th

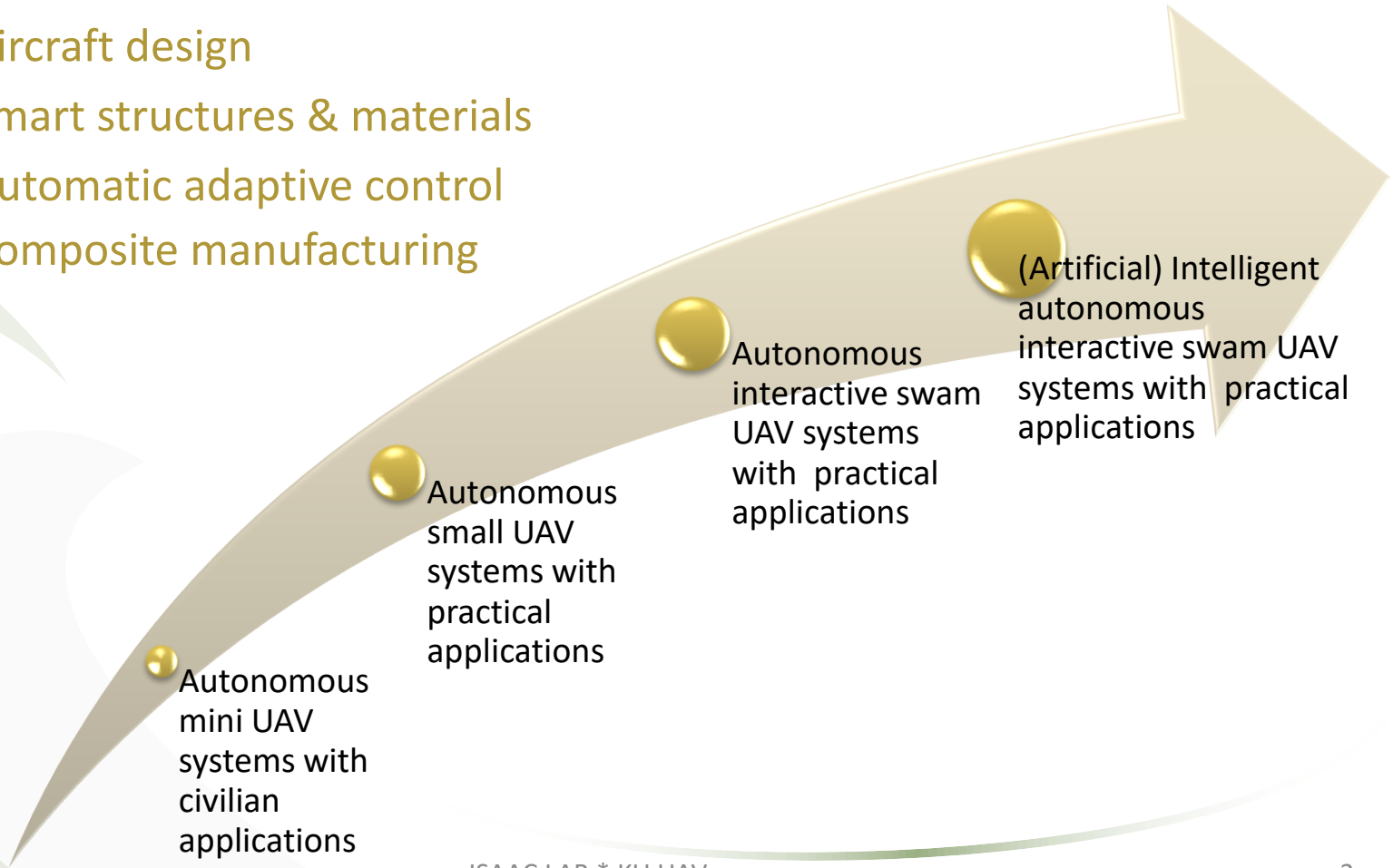
Aerospace Engineering Technolgy@ ISAAC LAB – KU UAV

- Advanced Technology for Our Country Development



ISAAC LAB – KU UAV
UAS Development Roadmap

- Key advanced research areas
  - Aircraft design
  - Smart structures & materials
  - Automatic adaptive control
  - Composite manufacturing

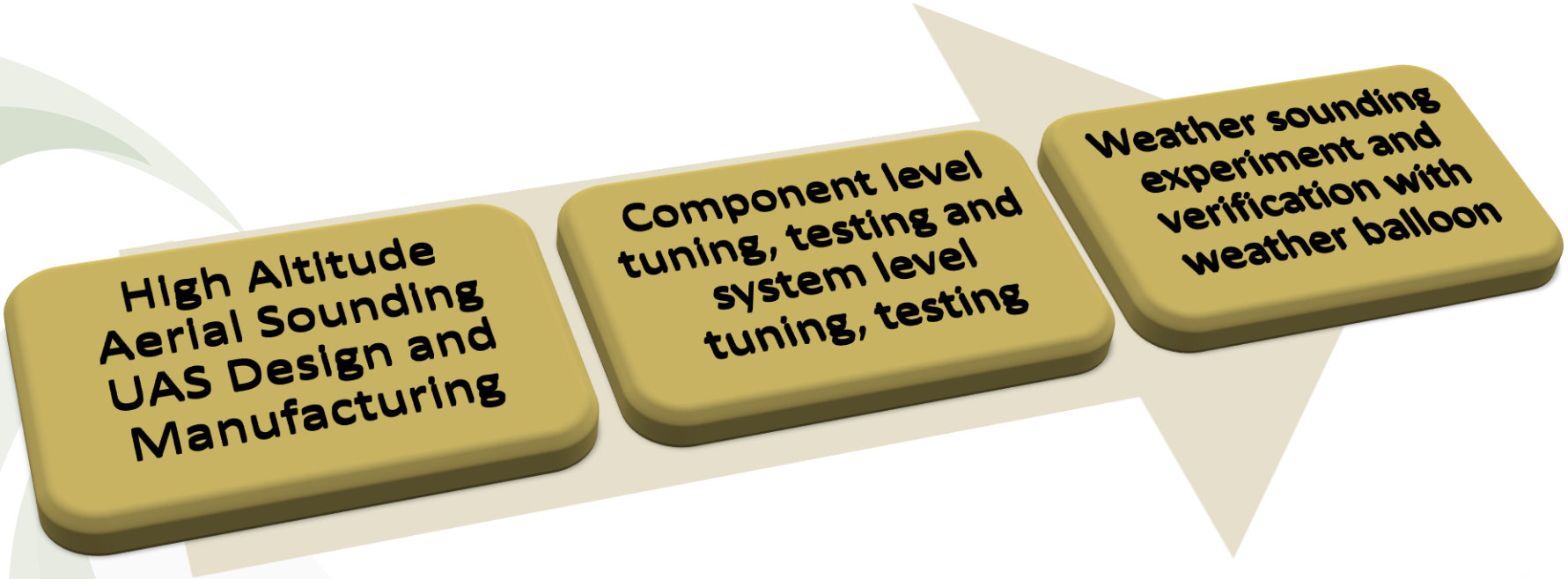


Project objectives

- Unmanned Aerial Vehicle(UAV) technology is becoming more significance in many aspects of science. Weather modification operation of the department of Royal Rain Making could also benefit from the such technology. This is the pilot project to demonstrate the possibility of using unmanned aircraft system (UAS) in weather sounding and in-situ atmospheric measurement.
- In this project, the systems is tasked to fly up to 20000 ft. Equipped high precision weather sounding equipment, the aircraft will provide the scientists with real-time data feed operation planning.

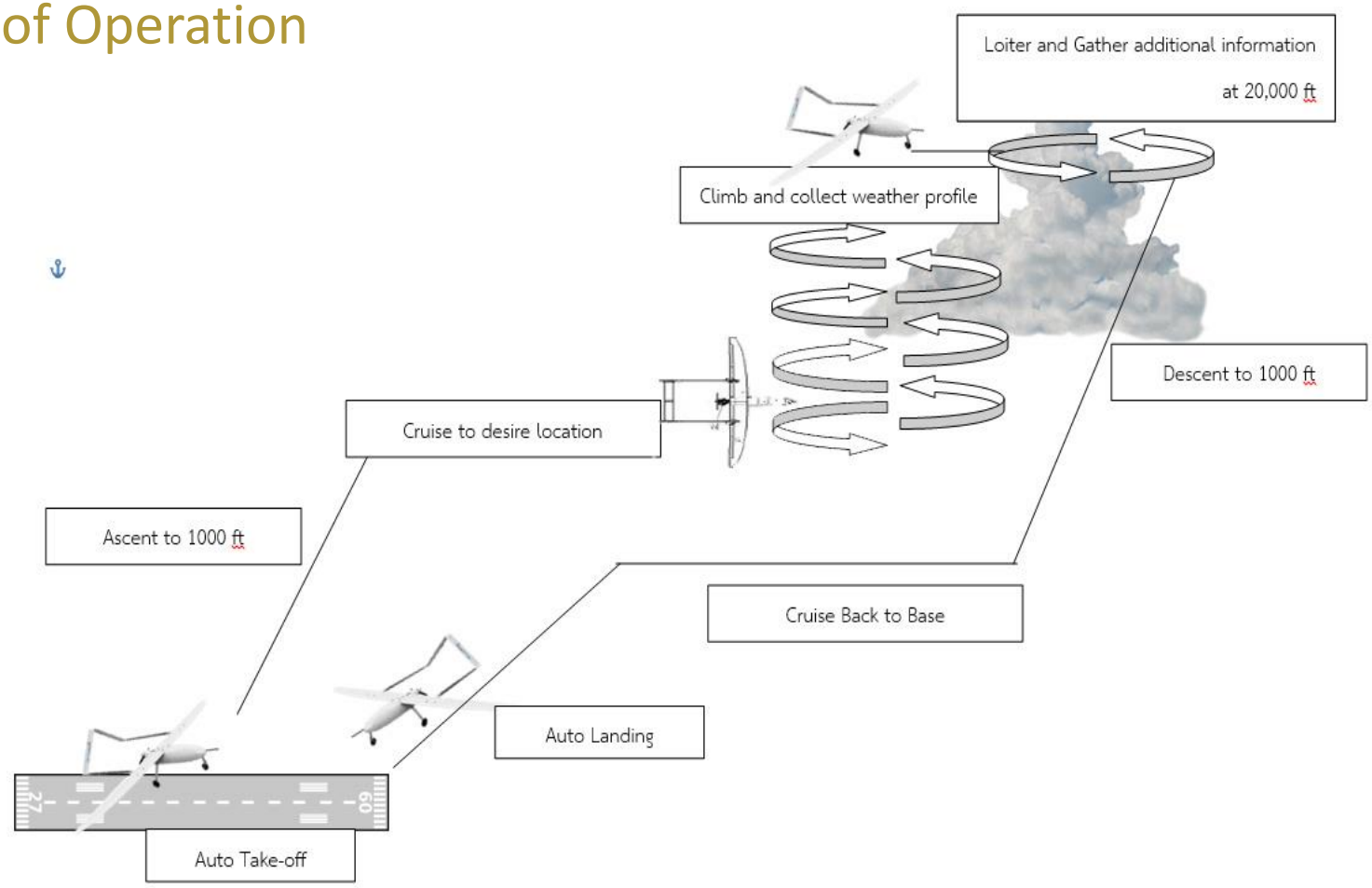
UAS for Aerial Sounding

- Development Framework

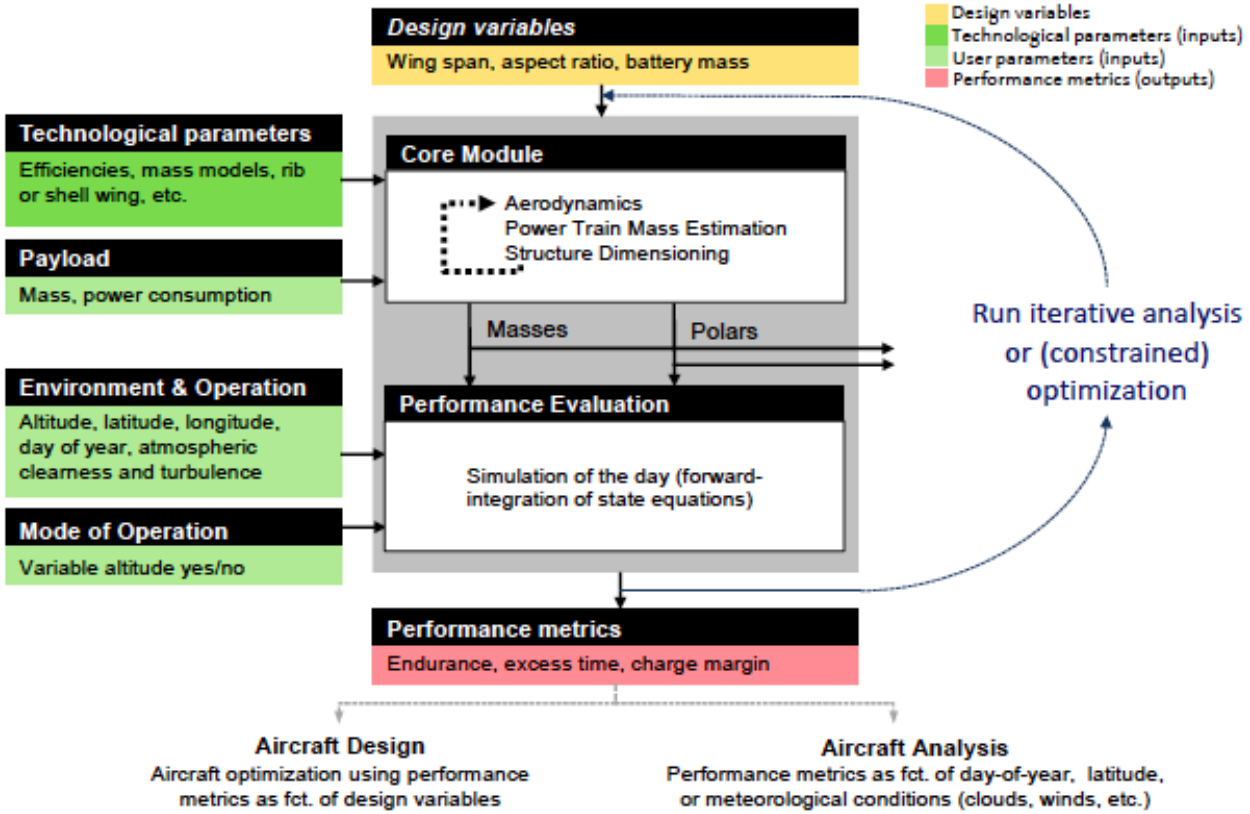


Aerial Sounding UAS

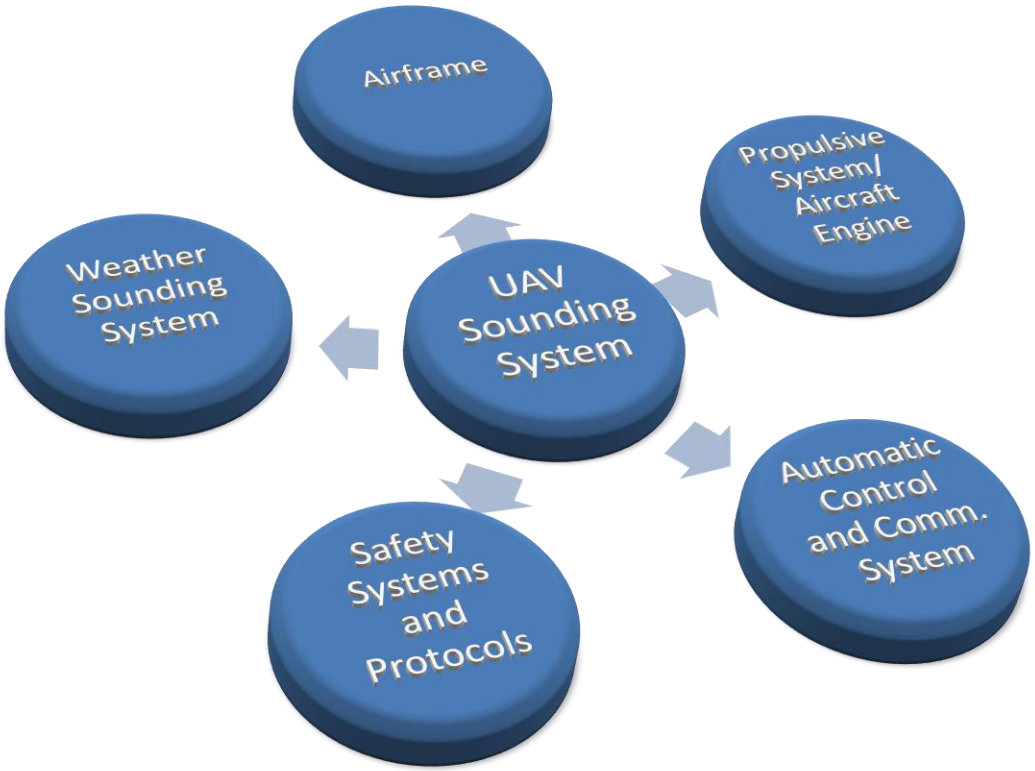
- Concept of Operation



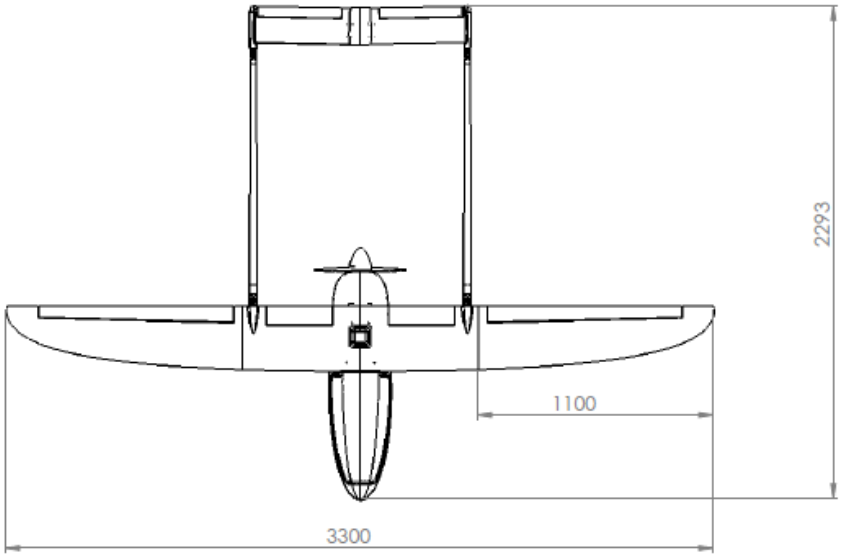
UAS Design Methodology

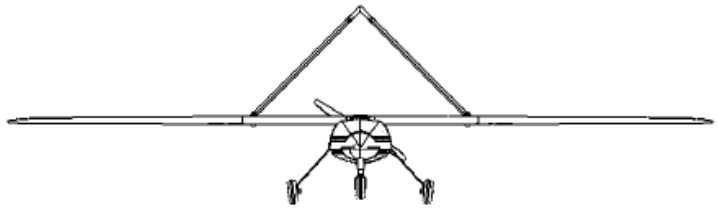


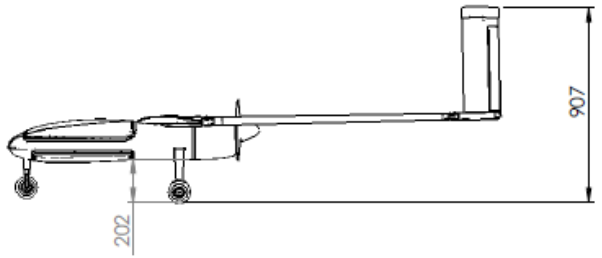
UAS Components



Airframe design (specifications and performance)



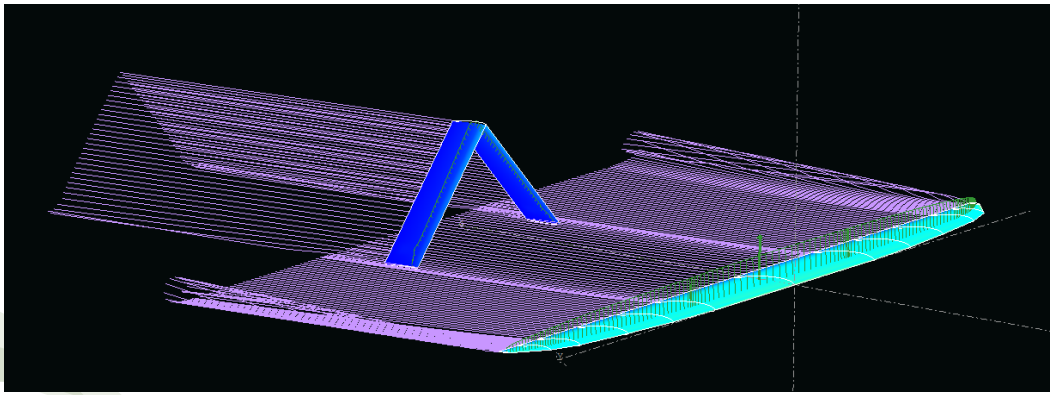


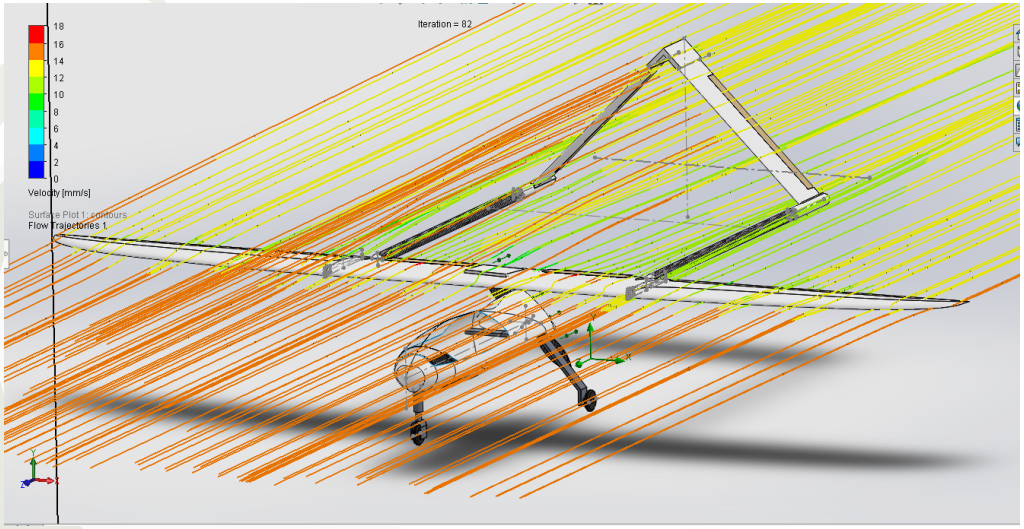


Spec.'s	value
MTOW	21.5 kg
Empty weight	10 kg
Wing span	3.3 m
Length	2.27 m
Wing area	0.79 m^2
Power plant	2.5 hp
Max. payload	10 kg

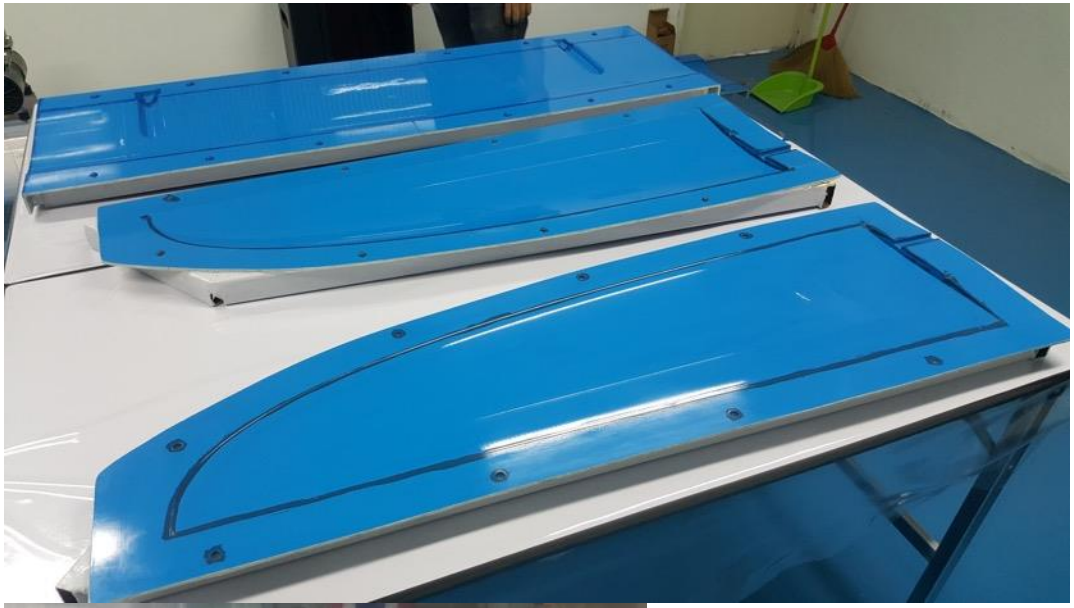
Performance	value
Endurance	8 hours
Cruise speed	22 m/s
Stall speed	13 m/s
Max. speed	36 m/s
Take-off run	30 m
CL max.	1.3
CL max. (45^o flap)	1.7

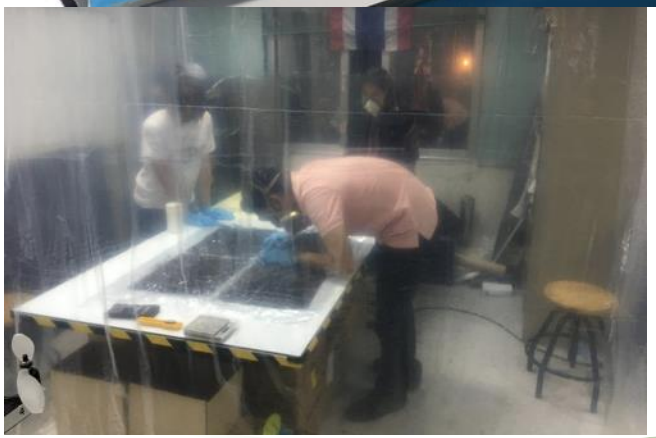
Airfeame design and basic analysis





Airframe manufacturing

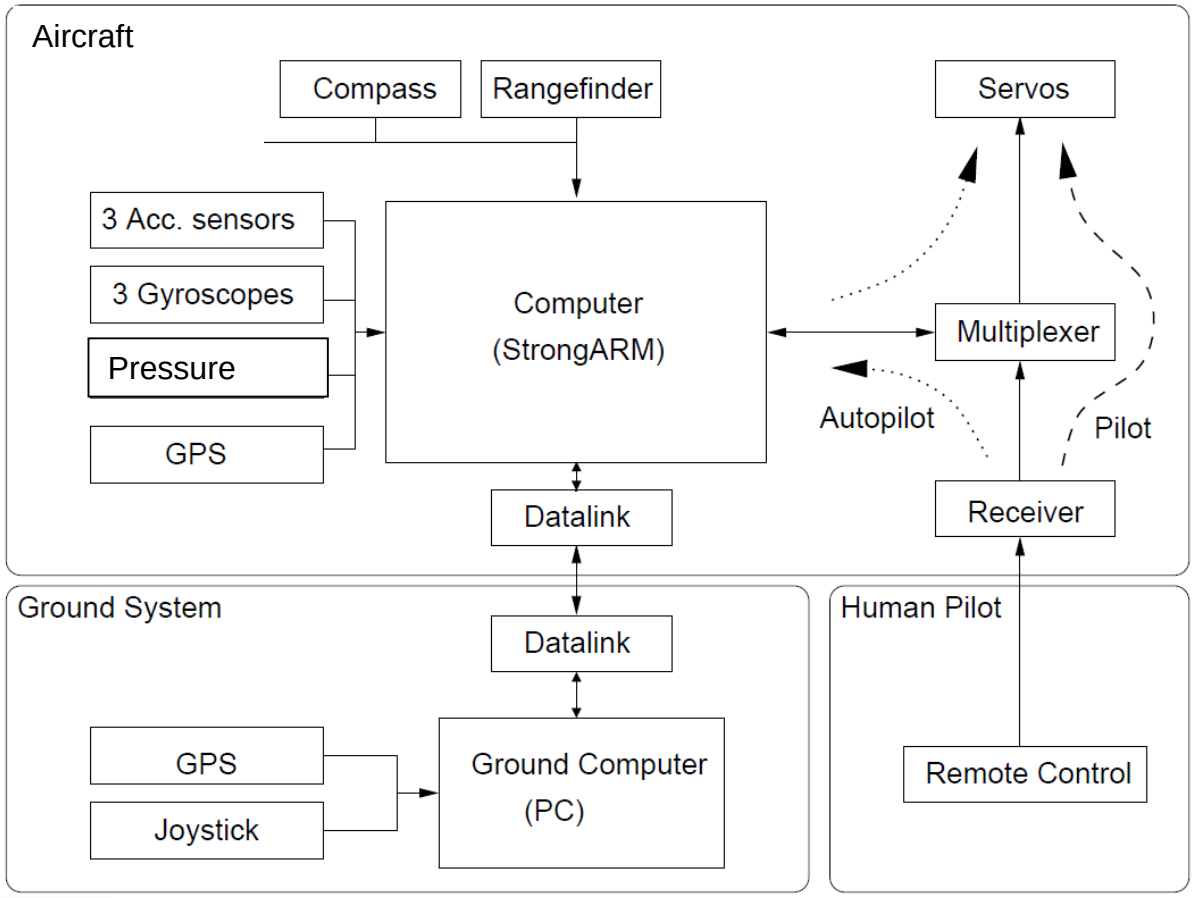




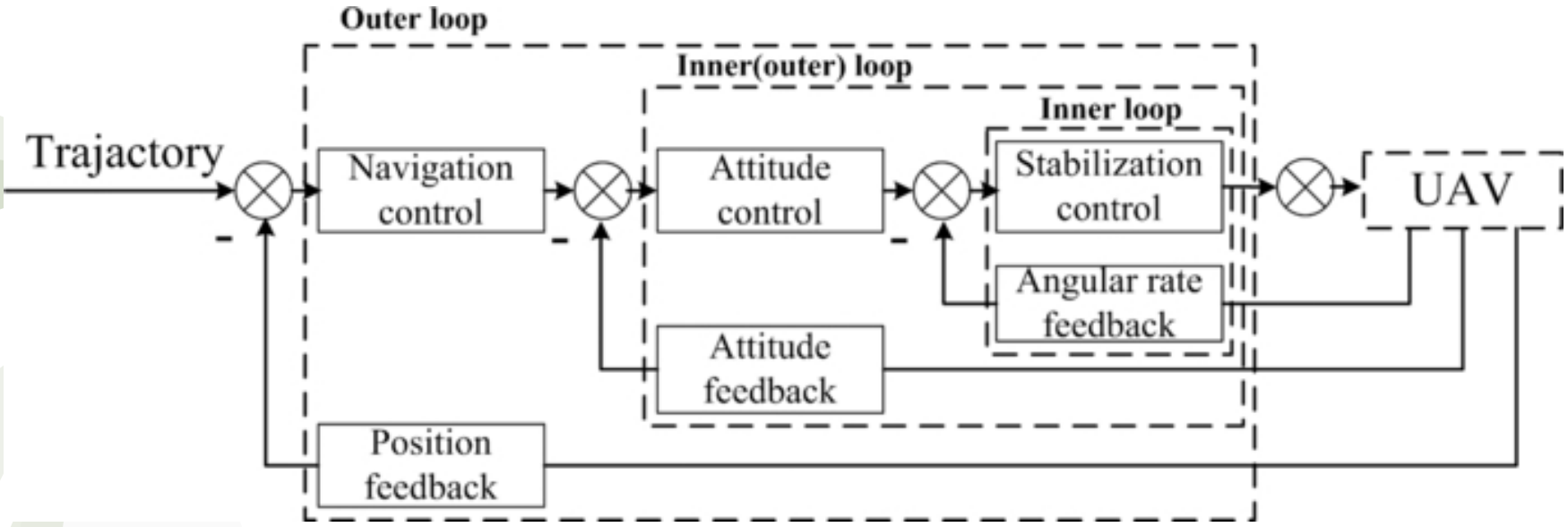
Propulsion system/aircraft engine

Specifications	value
Engine Type	EFI two-stroke, single cylinder, air cooled
Power	2.5 kW (3.4 hp)
Fuel consumption	400 g/kWh in cruise
Fuel type	Automotive 95+ octane
Displacement	28 cc (1.74 cu in)
Speed range	1600-8500 rpm
Recommended 2-blade propellers	16x10, 18x8, 18x10, 19x11, 20x8
Engine weight (including generator, cooling system, servo, air filter)	1.5 kg
Muffler	Combined reactive-dissipative
Sound level, measured from 30 m distance	59 dB

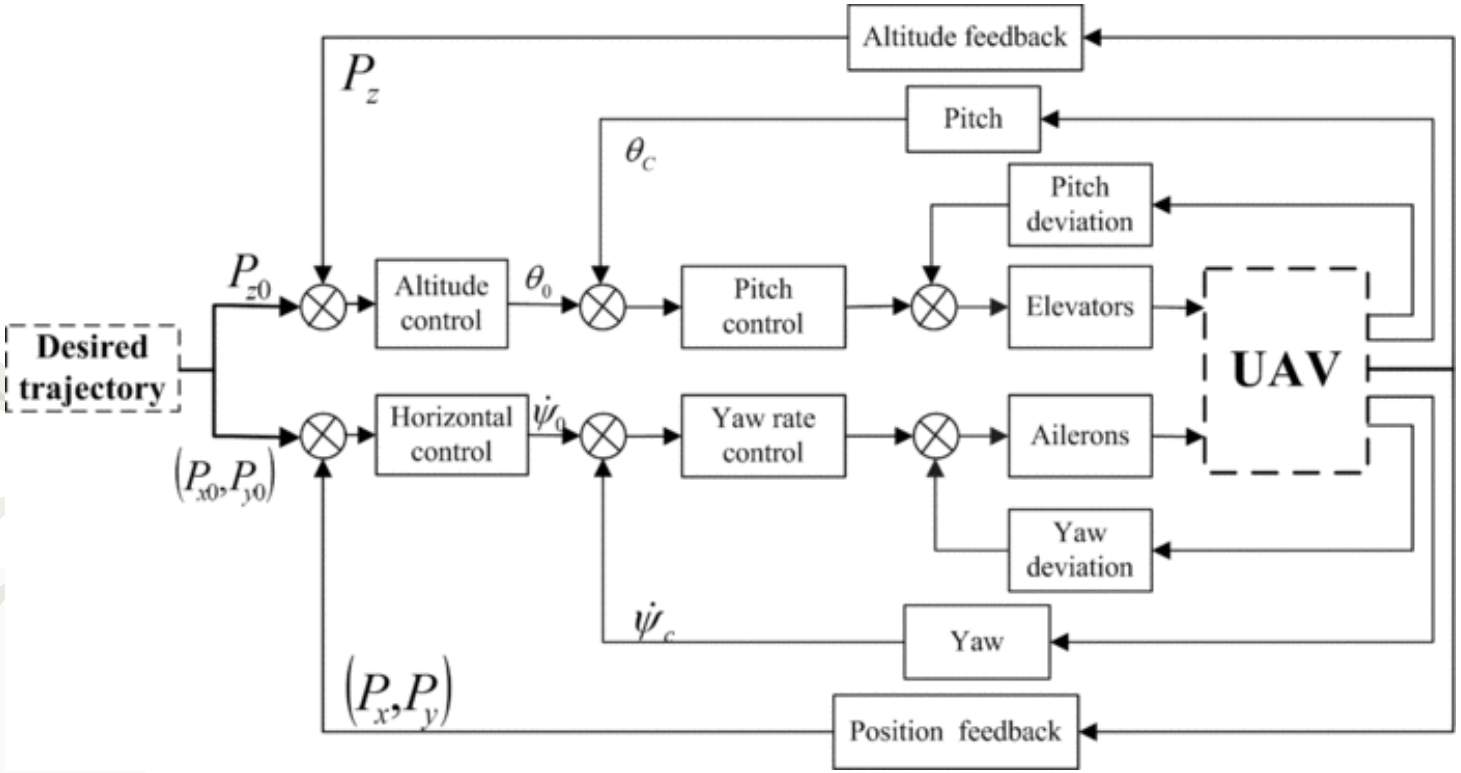
Automatic control concepts and communication systems



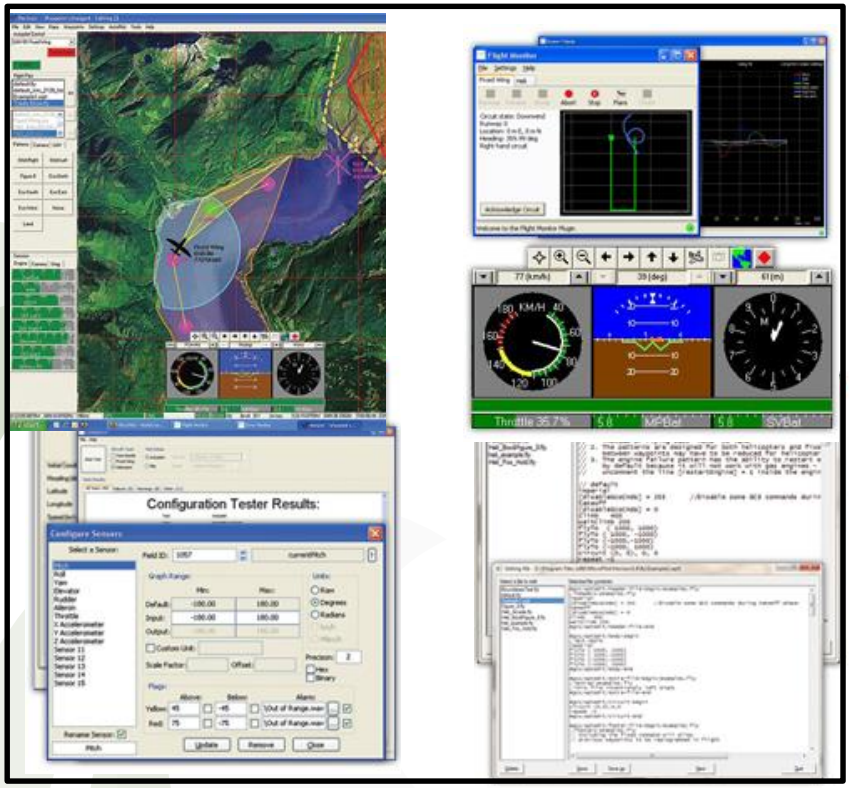
Aircraft control algorithm (low level)



Navigation algorithm

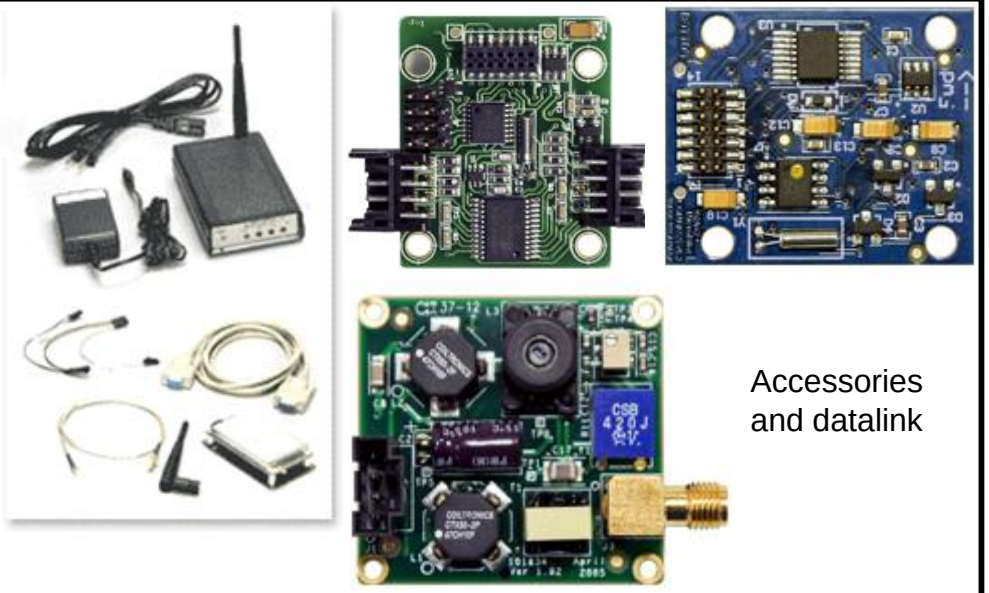


Ground control software, hardware and communication systems



Ground Control Software

Flight Control Computer

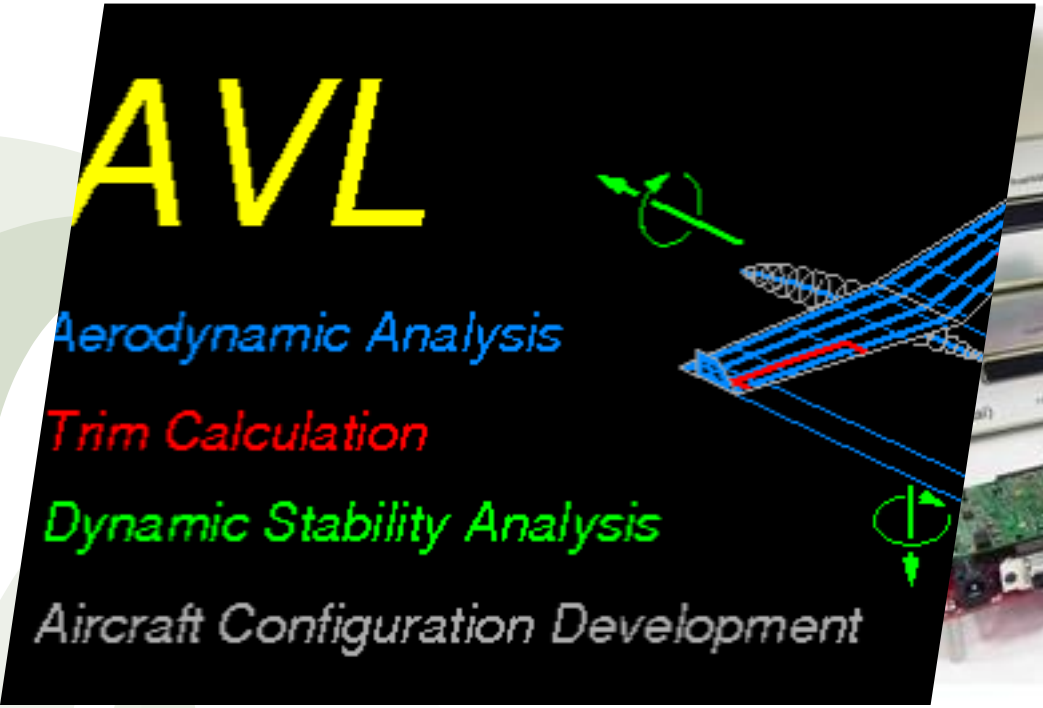


Accessories and datalink

AGL

Compass

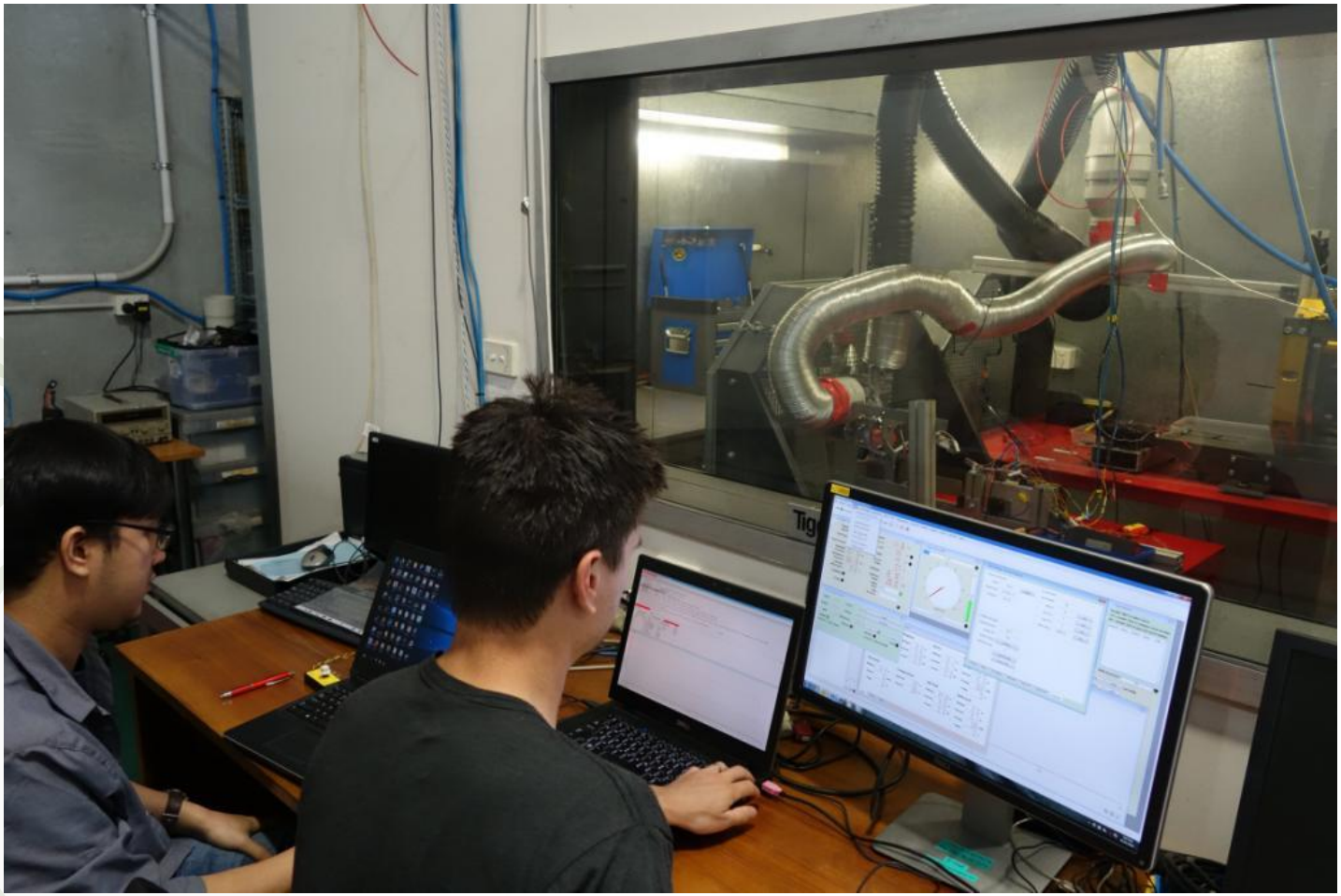
Hardware in the loop (HIL) testing



(MIT-NASA) Aerodynamics and Stability Analysis Software

Automatic control system testing on a scaled-model aircraft

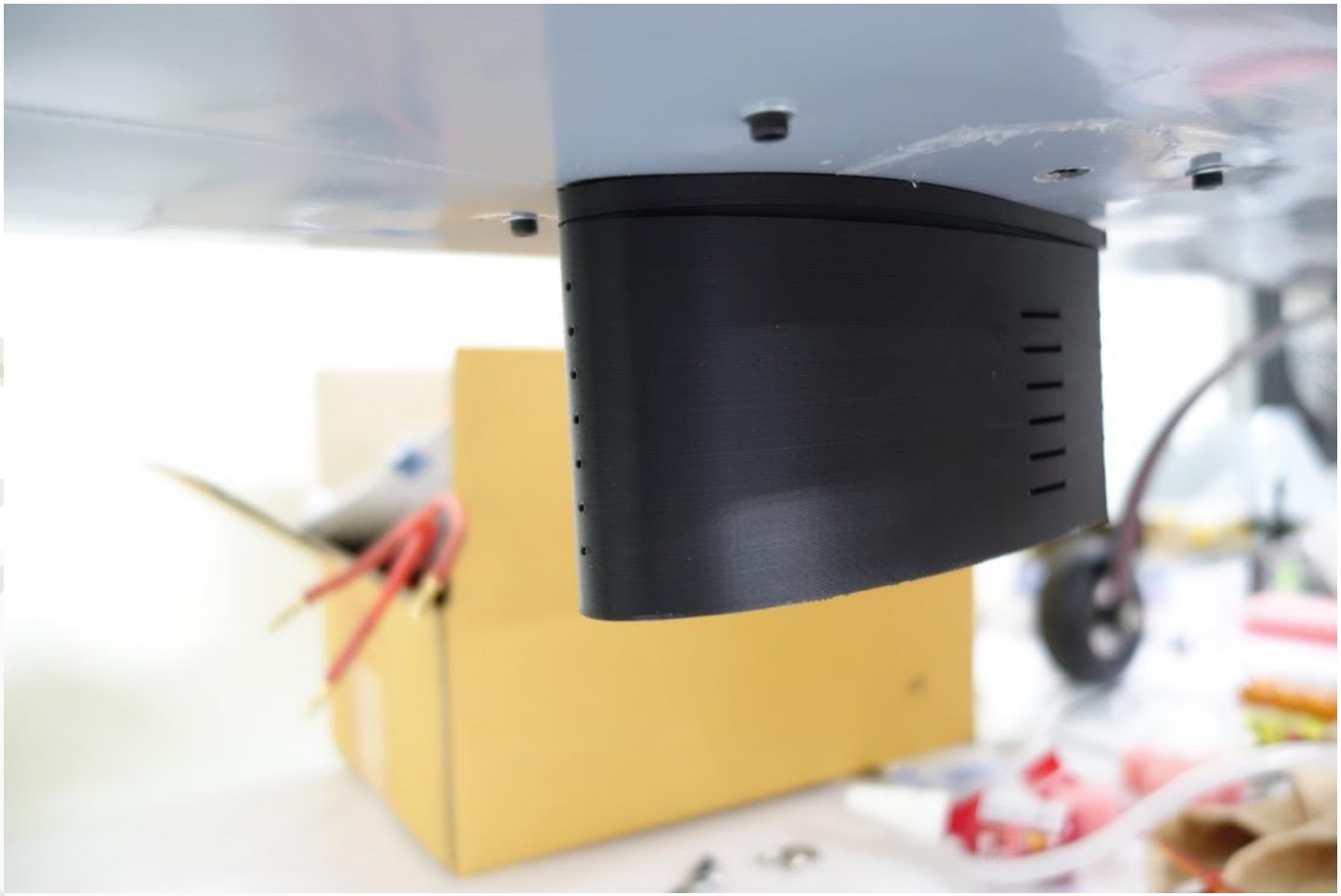
Propulsion system testing



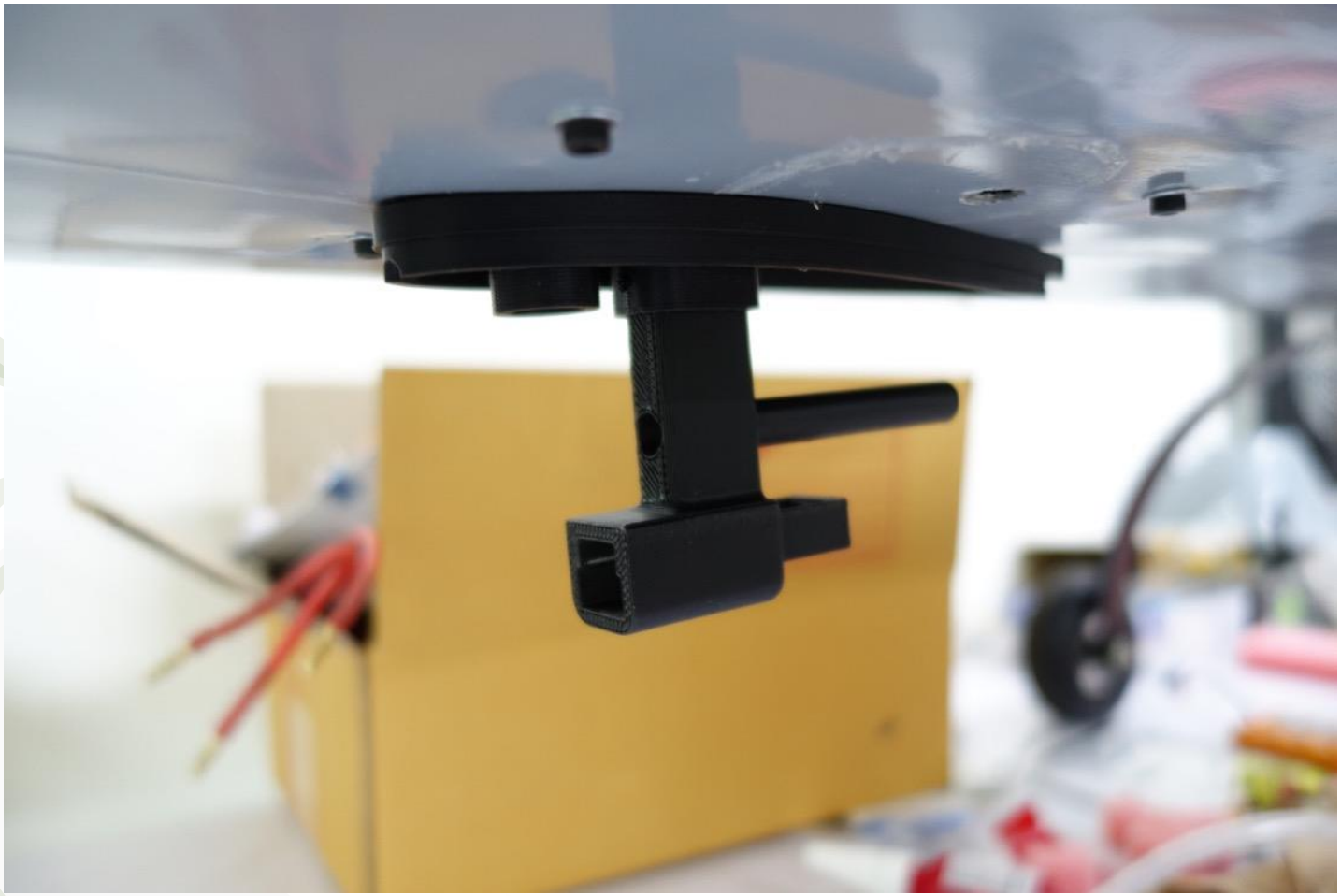
Compatibility tuning of automatic control and propulsion systems

Flight testing at Nakorn Sawan Airport

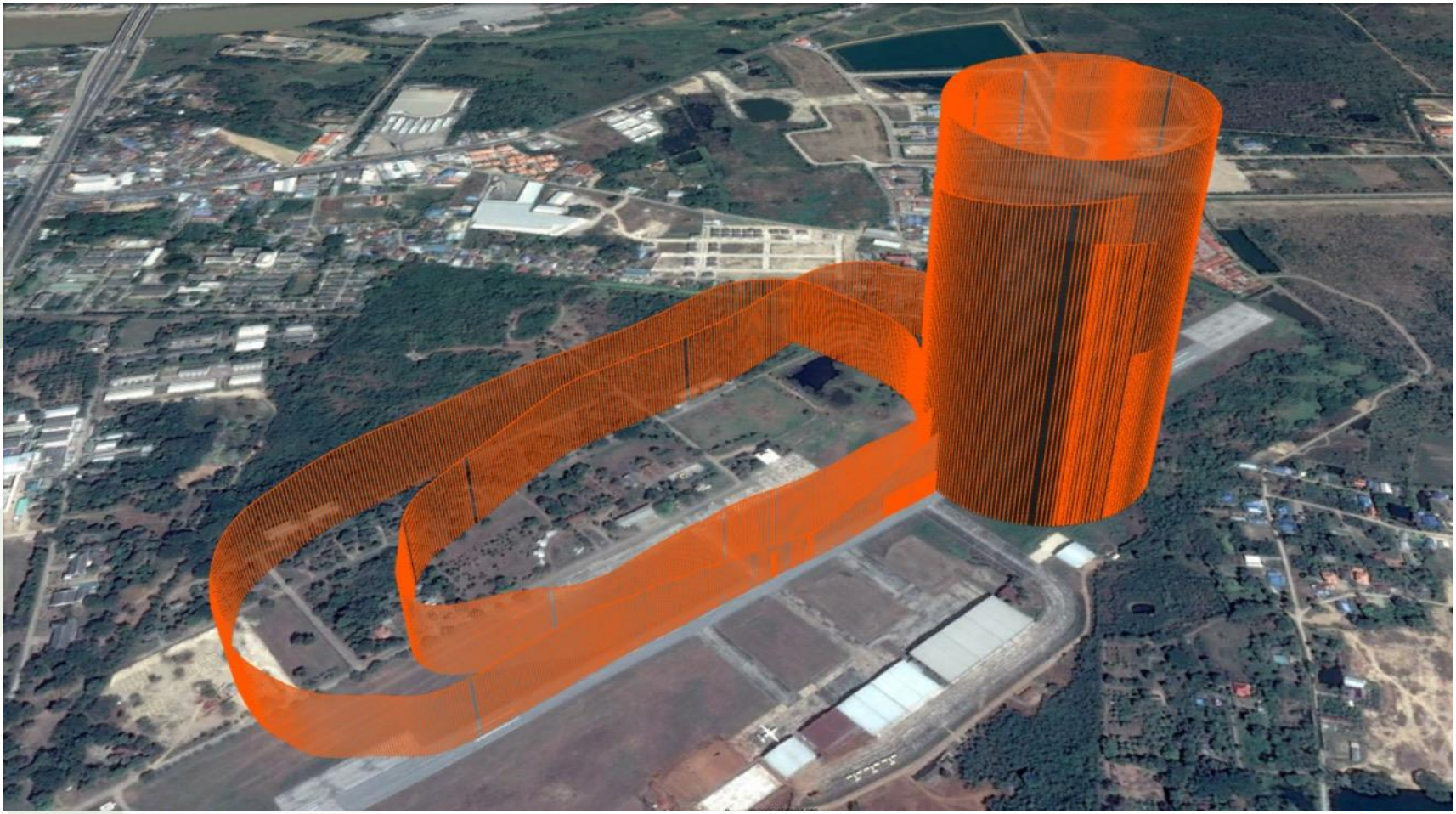
Weather sounding system



Weather sounding system



Example flight path



Current State of the Development

- The systems has finished the testing to the service altitude of 9000 ft.
- To go further, nevertheless, the development need to acquire the clearance from the related authority and regulator (CAAT, etc.)
- This project will be marked as a historic point where such a civilian unmanned aircraft can be performed in the commercial-airspace.

Future Development Possibilities

- The know-how and knowledge from this pilot project will lead to the new paradigm of weather modification operation.
- The systems can be enhanced to fly higher and retrofit to perform different task such as tropical-weather research or chemical-flare deploy as well as information gathering for further break-through in tropical region weather modification research.
- The development team aims to equip the aircraft with Silver-Iodine flare for high altitude rain making application.

Thank you!

www.facebook.com/isaaclab.aeroku