



Republic of Korea

Airworthiness Certification of Unmanned Aerial System

- Name : Maj. Na, Kyeong-min(ROK), Hwang, Ki-Lyong(KAL)
- E-mail : kminn@korea.kr, klhwang@koreanair.com



Contents



PART I

Introduction to ROK UAV Military
Airworthiness Certification Procedure

PART II

Military lightweight UAV Developed by KAL





Part I

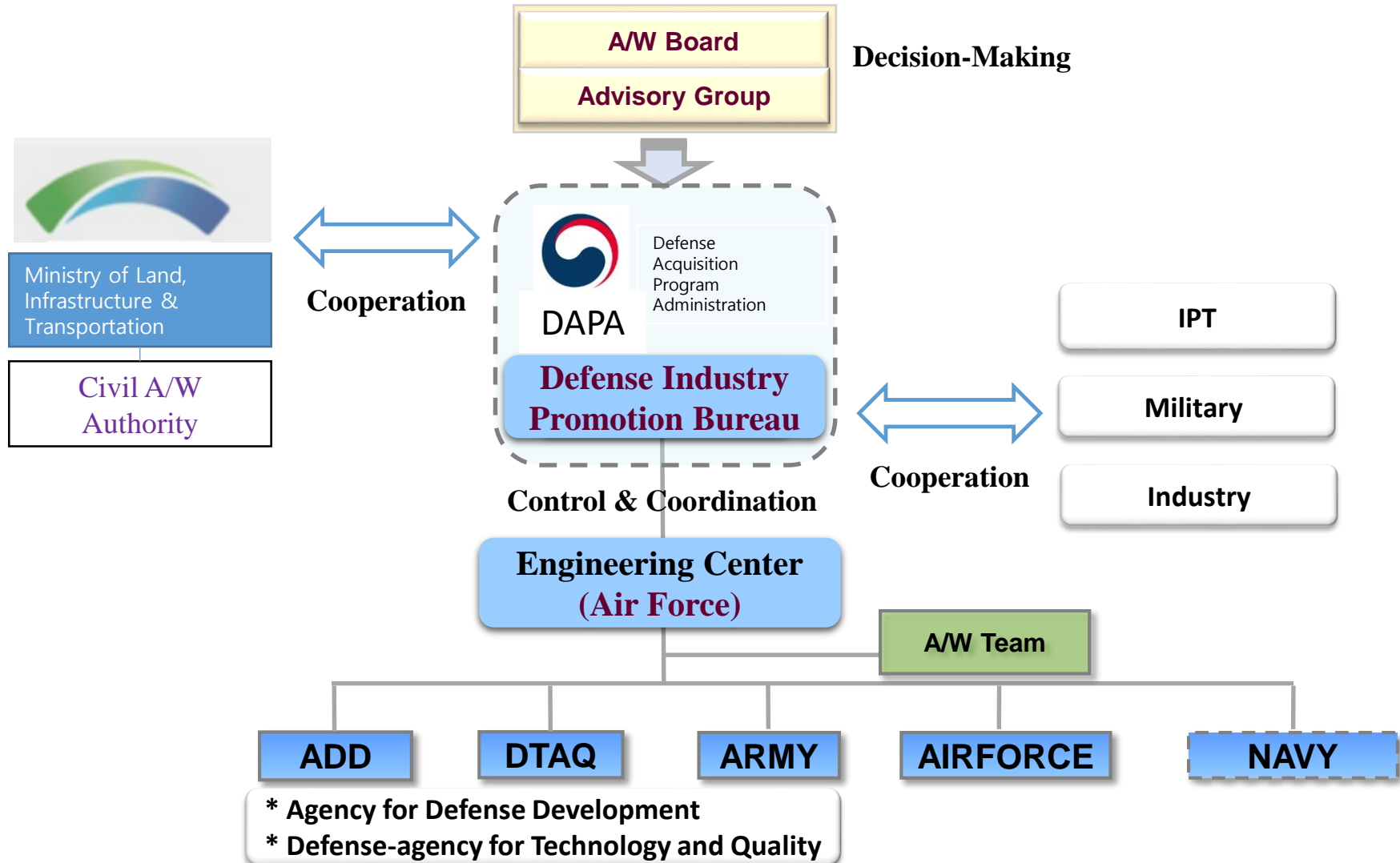
Introduction to ROK UAV Military Airworthiness Certification Procedure



- Name : Maj. Na, Kyeong-min(ROK)
- Contact Number : 82-10-4211-0421
- E-mail : kminn@korea.kr



ROK Airworthiness Certification Organization



ROK Military Airworthiness System



■ Airworthiness Elements & Infrastructure

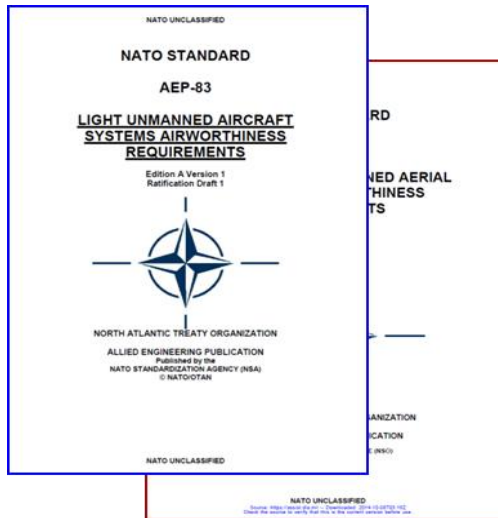


ROK Military Airworthiness Standard



■ Standard Airworthiness Certification Criteria

✓ STANAG -4671 & 4703



✓ ROK Military SACC



SACC : Standard Airworthiness Certification Criteria

■ Case of STANAG-4671 tailored for Korea Army UAV A/W Criteria

-	Not apply for Korea's Lightweight UAV		Restrictions
Items	480 items		10 items
Contents	Different Configuration and Functions		Restricted application Items for Light UAV * Icing, Lightning, Bird Strike, etc.
	Criteria	RQ-102	
	Multi Engine	Single Engine	
	Turbine Engine	Rotary Engine	
	Wheel Break	Use Net Arresting Station	
	Retracted-type Landing Gear	Fixed Landing Gear	
	Parachute landing	Emergency Parachute	
	Hydraulic System	Not exist	
	Balked landing	Application is impossible for Operation Concept (Engine is shutdown before landing)	

■ UAV Airworthiness Development Plan

- ✓ UAV category must be Subdivided in detail
 - STANAG-4671 : 150Kg ~ 20,000Kg
 - STANAG-4703 : 66J(49 ft-lb) ~ 150Kg

- ✓ Experiences of ROK AW Authority
 - Corps level UAV, Division level scout UAV, MUAV, HUAV etc

- ✓ Collaboration Work
 - Amendment of STANAG



Part I

Military lightweight UAV Developed by KAL (Project Name : RQ-102)

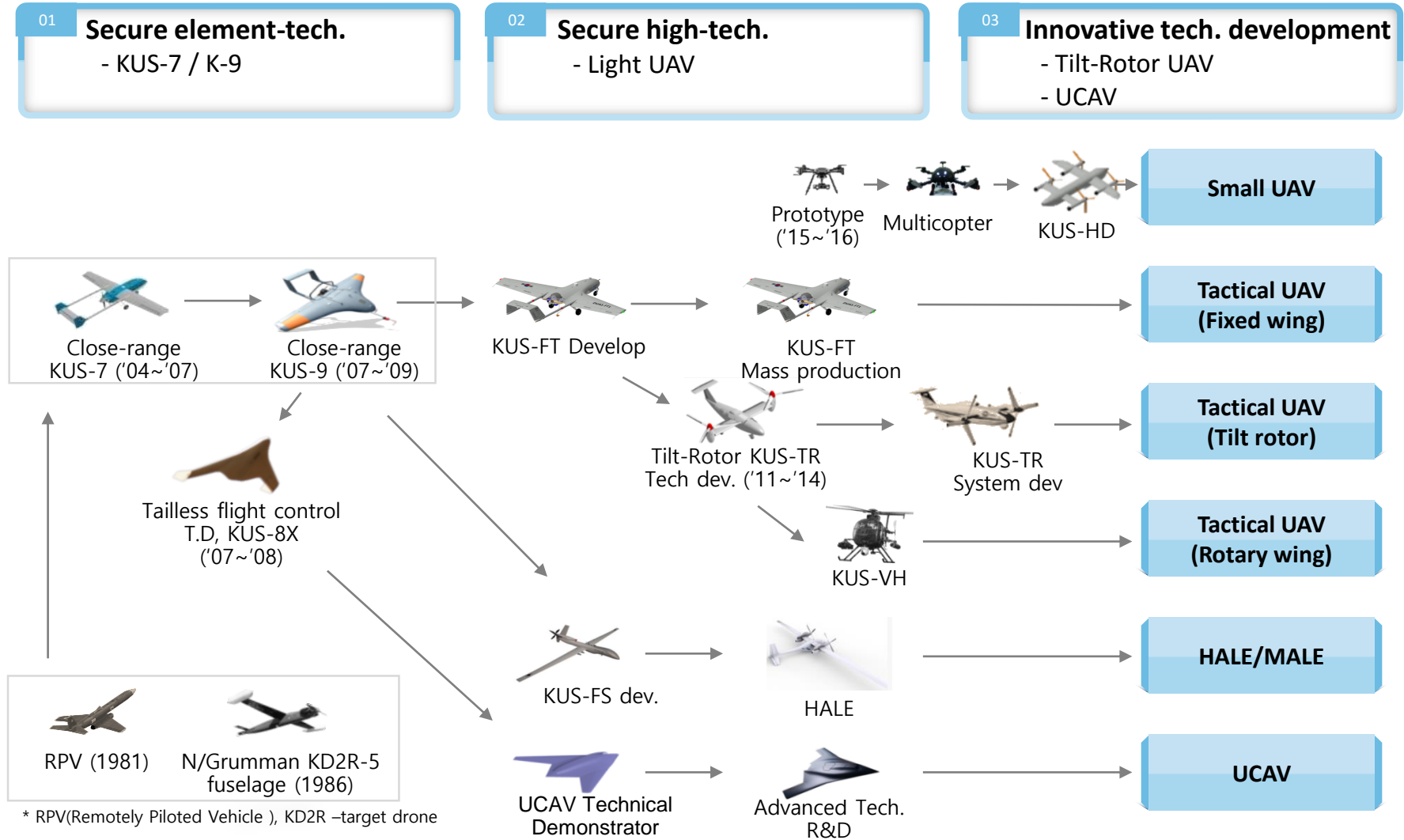


- Name : Hwang, Ki-Lyong(KAL)
- Contact Number : 82-10-2987-3340
- E-mail : klhwang@koreanair.com

KAL UAV Development Milestone



■ Korean Air Line offers a comprehensive range of UAS



What is RQ-102?



Reconnaissance

RQ-102



**Lightweight Military
UAV developed by Korea
(Currently operating)**

Radio Controlled
Drone

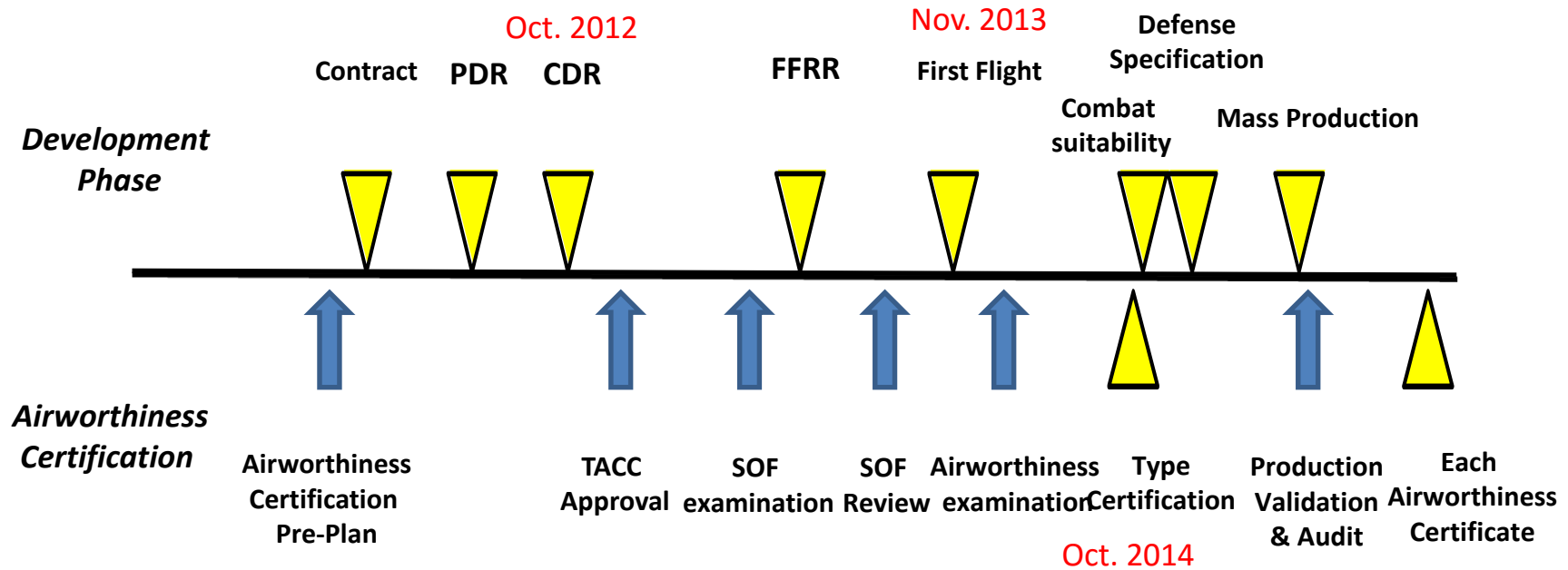
Aircraft (Serial)
Number



RQ-102 Development Process



■ Airworthiness Verification & Validation Step

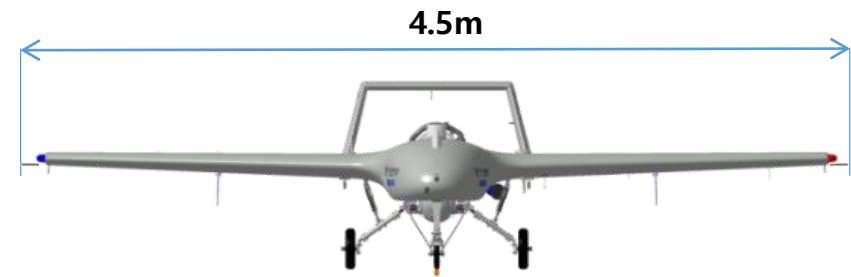


RQ-102 Specification



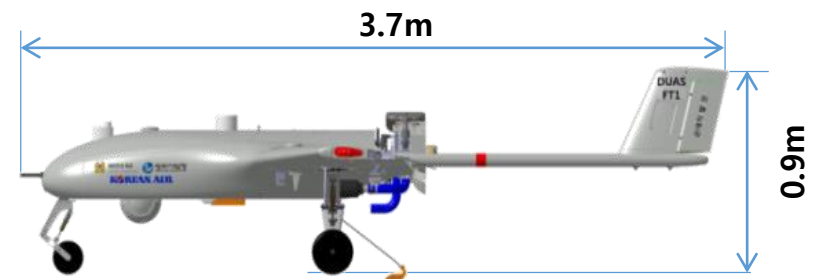
■ General Characteristic

Size	3.7m (L) x 4.5m (W) x 0.9m(H)
MTOW	150 kg
Power Plant	35hp Rotary Engine
Take-off	Launcher (Automatic)
Landing	Arrest hook & net



■ Performance

Max. Speed	TAS 000 km/h
Max. Altitude	0 km
Endurance	0 hrs
Operation Range	000 km (In clear day, LOS)



RQ-102 UAV System (1/2)



■ A tactical UAV for ISR mission

- ✓ 24hour of Continuous reconnaissance operation
- ✓ Autonomous operation : Take off, Mission flight & Landing
- ✓ Designed for moving forces not requiring a runway
- ✓ Designed to aid mobile operations in mountainous regions



RQ-102 UAV System (2/2)



■ System Composition

4 Air-vehicles



2 Ground Control Station (LRS, GCS)



Ground Vehicle Transporter



Ground Support Equipment



Launcher & Recovery net



Precision Location Tracker



Airvehicle Test Equipment



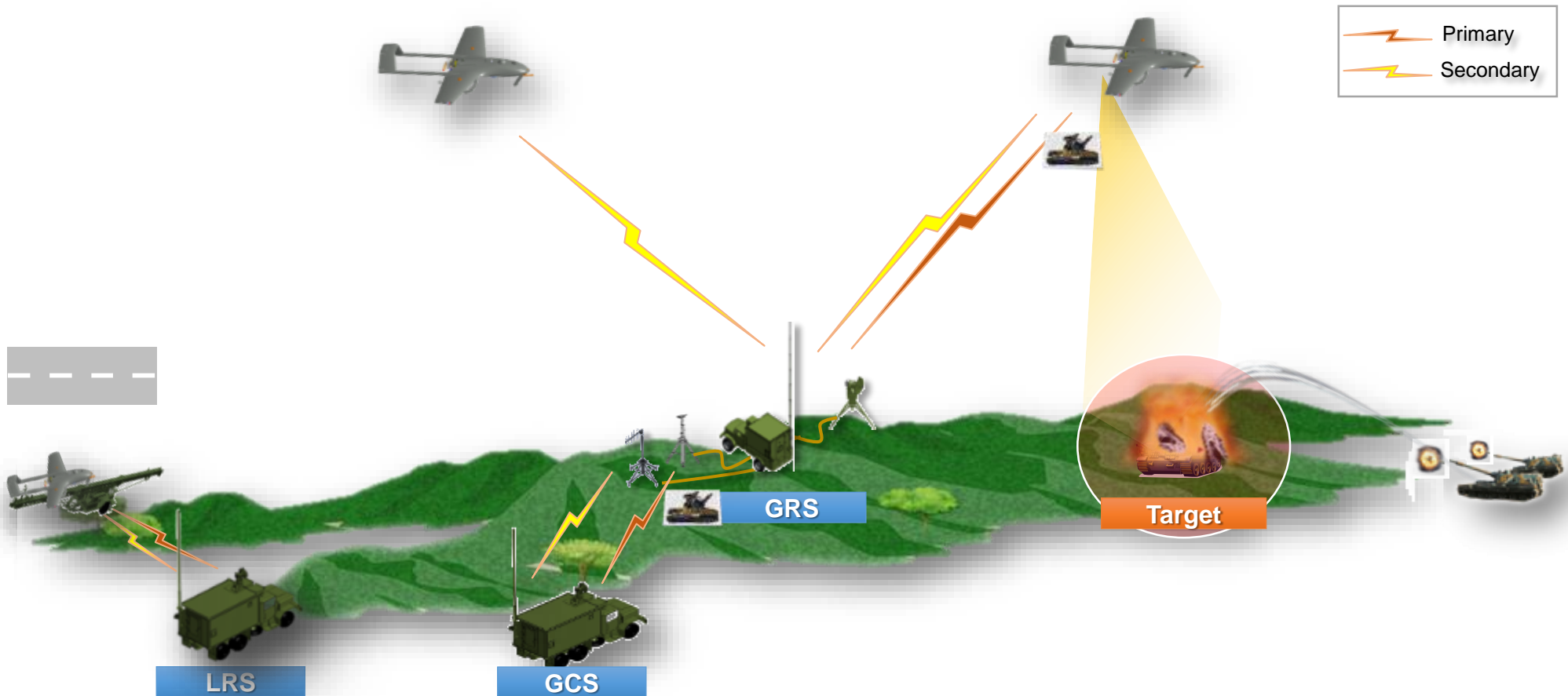
Ground Relay Station



RQ-102 Operation Concept



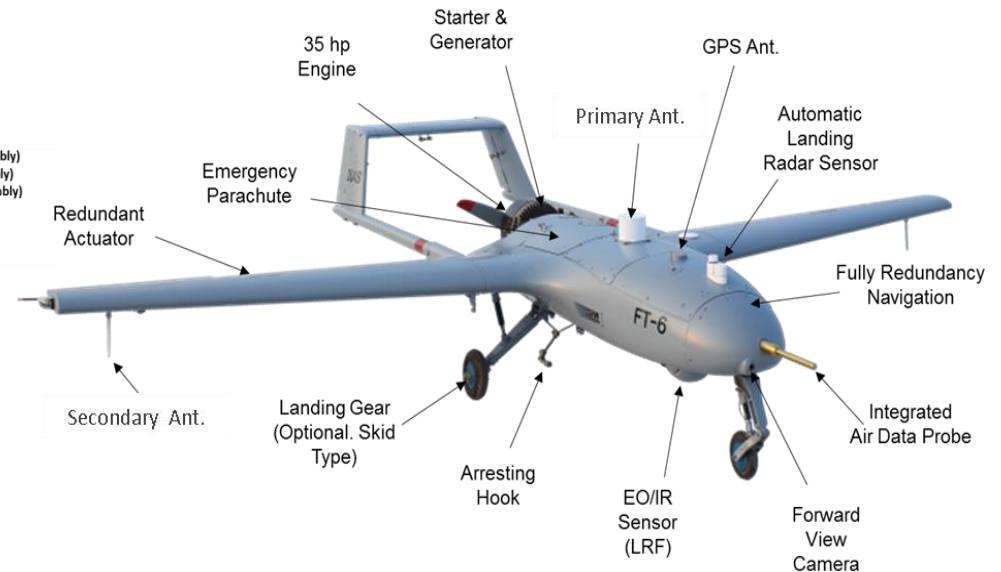
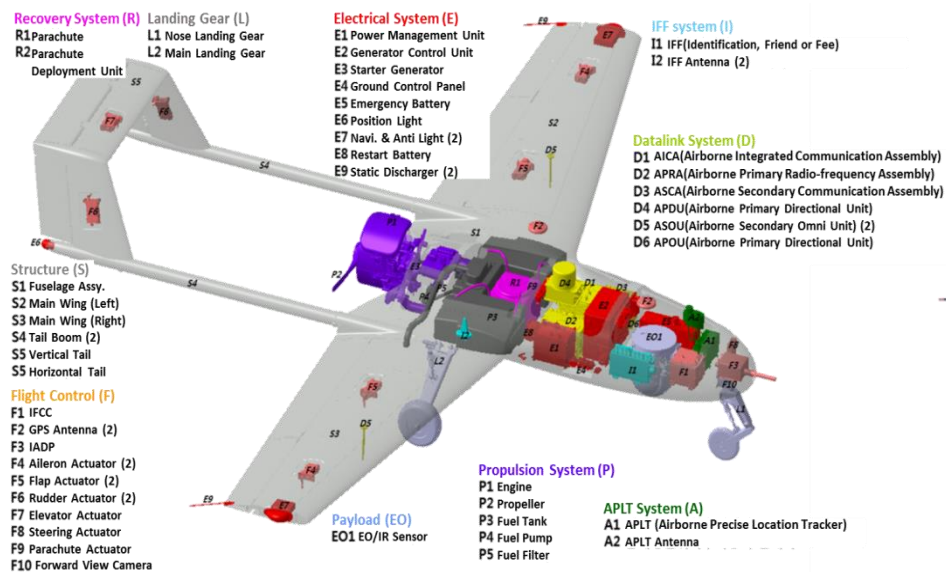
- LRS/GCS controls UAVs directly or using GRS
- 24hrs mission available by controlling two UAVs simultaneously



RQ-102 Features (1/2)

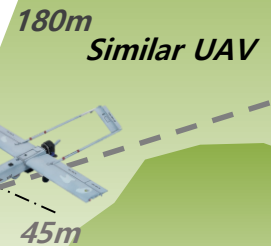


- Dually redundant flight critical equipment
- Remote engine start system
- Mid-air engine restart capability
- Automatic landing with precision location tracking technology
- Multiple recovery methods : Arresting hook, net, parachute deployment
- Designed for mobility : Simple Disassembly of wings from fuselage for moving/storage



Landing Path

- nology
RQ-102
- 



■ Meet safety requirements

✓ Safety requirements met STANAG-4671

✓ ROK Certifying Authorities has approved the safety requirements of RQ-102 UAV

(i) at UAV System level, the combination of all catastrophic failure conditions is characterised by an occurrence of 10^{-5} per flight hour or less (with the calculation method subject to Certifying Authority agreement), and,

■ Safety requirements of RQ-102 = $??? \times 10^{-0}$ /FH,

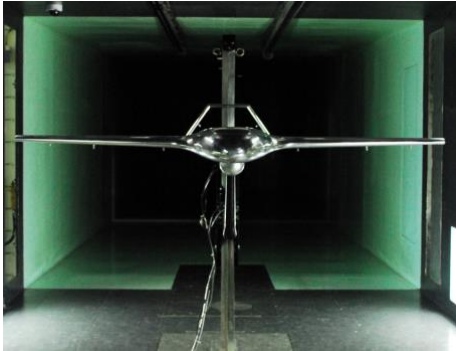
✂ In conclusion, **RQ-102 Safety Met for STANAG-4671**

Severity occurrence frequency		Catastrophic	Hazardous	Major	Minor	No safety effect
Frequent	$>10^{-0}/h$					
Probable	$<10^{-0}/h$					
Remote	$<10^{-0}/h$					
Extremely Remote	$<10^{-0}/h$					
Extremely Improbable	$<10^{-0}/h$					
Tracking						
Total						

	Unacceptable
	Undesirable
	Acceptable

Open
Tracking
Closed

Ground Test



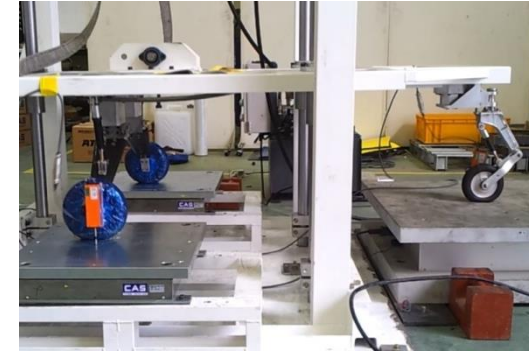
Wind Tunnel



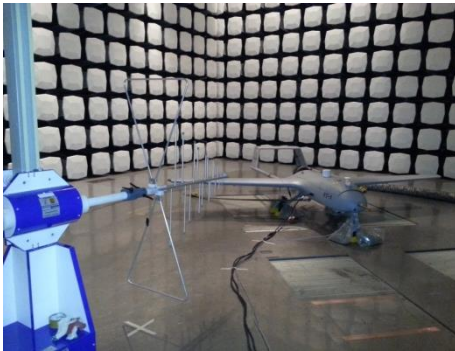
Static Load



GVT



Landing Gear Drop



Intra EMC



EMI



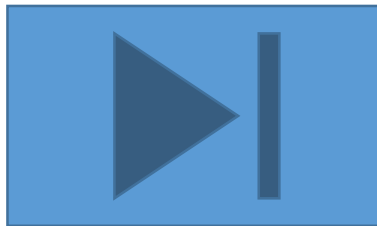
Temperature



Rain

- About 200 flights during development period

“Watch the RQ-102 Video”



■ Certified by Republic of Korea

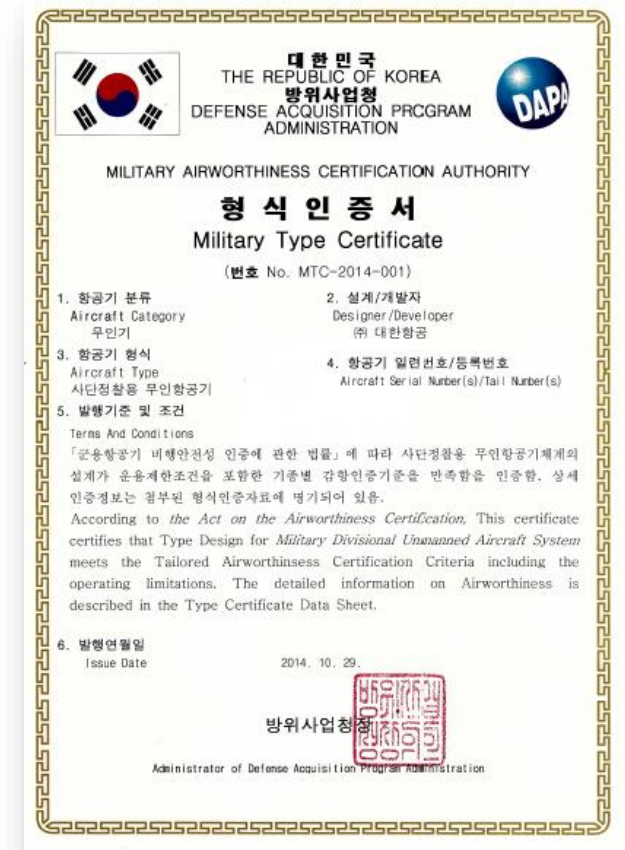
- ✓ 1st Military type certificate awarded in UAV

■ Dualization of flight critical equipment

- ✓ Flight control computer
- ✓ Navigation system
- ✓ GCS & LRS
- ✓ Primary and secondary datalink

■ Recovery plan

- ✓ Use auxiliary battery when generator fail
- ✓ Remote engine restart
- ✓ Datalink recovery flight when link-loss
- ✓ Parachute deployed for safe recovery of air vehicle for emergency



STANAG-4671 / Military type