

RPAS Symposium

Workshop 1 – Airworthiness

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Personal background

- Born in 1967 – Israel
- Mechanical Engineer – Ben Gurion University
- Retired LTC from IAF - Pilot, Remote pilot .
- CAAI – Head of UAS department since 2010.
- JARUS, WG1 - OPS & RPL leader.

Israel RPAS – Civil activity

- UAS are part of Israeli airspace since the seventies.
- Until 2006 activity was under military ruling.
- 2006 – 2010 Civil Unmanned committee certification (MOD+MOT)
- 2010 UAS Department was established in the CAAI.
- 10 RPAS Design and manufacture companies.
- 73 Types and models, ~160 experimental airworthiness certificates 2014.
- Most of the RPAS are developed for export and military use.
- One Application for an RTC .

~ 4000 Experimental Flight hours in 2014

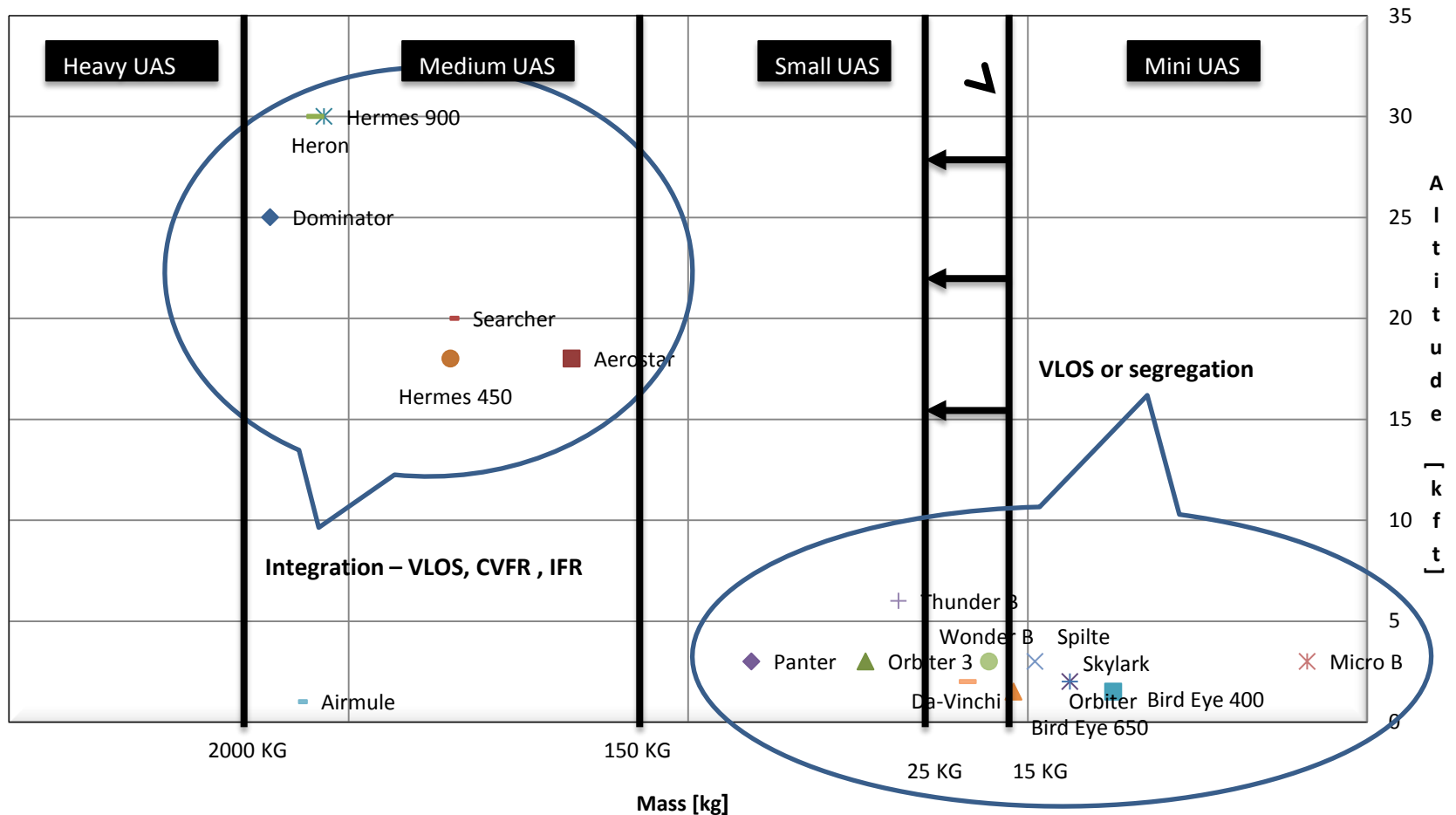


Aeronautics



Categorization

Mass Vs Operational altitude



Airworthiness Certificates



- Special airworthiness certificate - Experimental
- Special Continuous airworthiness certificate for RPAS :
 - Used for systems existing prior to Civil regulations (2007). Credit for past experience (IDF). RPAS major changes are approved by CAAI since 2007.
 - Used for systems 15-150 kg – certification basis by applicant (STANAG 4703, JARUS LURS...) - No application yet.
 - Used for systems under 15 kg in VLOS operations, based on minimum requirements, operational restrictions and risk analysis.
- Restricted TC
 - Based on STANAG 4671
 - Areas that are not covered by STANAG – Issue papers, CAAI special procedures.

Airworthiness Certification process Experimental

- Required data
 - Flight test plan
 - System description
 - Safety assessment report
 - Airframe, propulsion, EMC/EMI, LRU – substantiation and qualification
 - Software Development and verification (RPA, RPS)
 - System ATP/ATR
 - Manuals (Flight manual , checklists, maintenance)
 - * Different requirements according to T.O mass
- Compliance with special directives for RPAS (e.g. Altitude measurement, Data Recording , Envelope Monitoring of RPA; ...)
- Flight termination system – if required

Safety Criteria – people on the ground

$$Risk \left[\frac{fatalities}{flight_{hours}} \right] < 10^{-5}$$

$$Risk = \frac{A * \delta * Kill Probability}{Mtbupl}$$

- *Mtbupl*=Mean time between unplanned crashes or landings and severe Incidents. *Mtbupl* does not include accident confined to launch and recovery.
- A= Effective area[Top view]
- Kill Probability[KP]
 - Mini T.O Mass up to 15 kg, , A = 2M² KP = 0.1
 - Small 15kg < T.O Mass < 150kg , A = 5M² KP = 0.25
 - Medium 150kg < T.O Mass < 2000kg , A = 30M² KP = 0.5
 - Heavy 2000kg < T.O Mass , A = 518M² KP = 1
- δ = Population Density, inside Maximum engine out gliding distance.
- *Mtbupl* is set to 1 for first flight
- Max population density - 2000 people per square kilometer

Certification challenges for civil domestic use

- Airworthiness of small and mini RPAS
 - Downscale of manned aviation airworthiness standards (FAR, CS, STANAG, JARUS)?
 - COTS – certification
 - Software certification (open source)
 - Home build RPAS for commercial use!
- Unlimited BVLOS operations
 - No D&A



Toys with commercial capabilities !

Home build RPAS for commercial use!



**Airworthiness standards
or Safety assessment +
operational restrictions?**

**Market flood
Can we stop it?**

Certification Challenges for international use



- Evolution of military RPAS for civil use
 - Flight characteristic (speed, maneuverability) compliance with ATM requirements.
 - Flight control – payload that controls the flight path.
 - RPS Man machine interface design – Remote pilot vs payload operator / mission commander.
 - Required navigation performance.

Certification Challenges for international use

- Cyber protection – Hardware, software security.
- One common RPS with various RPA types
 - The CofA of the RPA includes the RPS (s).
 - Same RPS in different CofA(s) ?, CofA for the RPS?
 - Interoperability.
- One RPS with multiple control of RPA.
- High level of automation → autonomy.

Questions?

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