





ISRAEL AEROSPACE INDUSTRIES


**Facing the challenges of
UAS Airworthiness and Airspace Integration**

AAUS, RPAS in Australian Skies 2019, Canberra 17 July 2019

By Michael Allouche, IAI UAS Airworthiness Manager

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PRESENTATION TOPICS

- Introduction
- Israel Aerospace Industries & its UAS Division at a glance
- IAI Heron MALE Family UAS Airworthiness & Airspace Integration Design Features
- IAI Airworthiness & Airspace Integration Ongoing Experience
- Conclusive thoughts and reflections

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Michael Allouche - Personal Background

- Born in 1953 (France)
- In Israel since 1992
- Aerospace Engineering Diploma, "Supaéro" (Toulouse, France, 1976)
- 16 years professional experience in France
 - Autopilot design (SFENA)
 - Avionics Certification Manager at Airbus Industries (A320, first Fly By Wire commercial aircraft)
- 27 years professional experience at IAI
 - Galaxy (G200) Flight Control System (Stall Protection) Manager at Engineering Division
 - **UAS Airworthiness Manager** managing all activities leading to UAS Airworthiness Approvals from worldwide authorities
 - **UAS Rule-making activities**
 - EUROCAE UAS WG73 Airworthiness Leader (2008 -2016)
 - EUROCAE UAS (new) WG105 Co-chairman since 2016
 - JARUS WG6 & WG3 SME
 - ICAO RPAS Panel Member
 - Israeli Expert at NATO UAS Airworthiness WG (STANAG 4671)



EUROCAE 2019 Award

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3



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4



Israel Aerospace Industries


Creating a Difference



World Leading Aerospace Company

- Special mission and early warning aircraft
- Satellites and space systems
- Defense systems, missiles and loitering weapons
- **Unmanned Aircraft Systems**
- Radar and electronic intelligence
- Passenger-to-freighter aircraft conversions
- **Business Aircraft (Civilian Certification)**



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IAI – MALAT (UAS) at a glance...

Creating a Difference

- Founded in 1974, first operational system in 1980
- RPAS design, development, certification and production
- IAI-MALAT Core capabilities
 - System Engineering and integration
 - Unmanned Aircraft Platforms Development and production
 - Ground Control Segments Development, production and integration
 - Payloads & Communications
 - C4I Systems
 - ILS At all levels & concepts
 - Flight and Ground testing
 - "Power by the Hour" flight services

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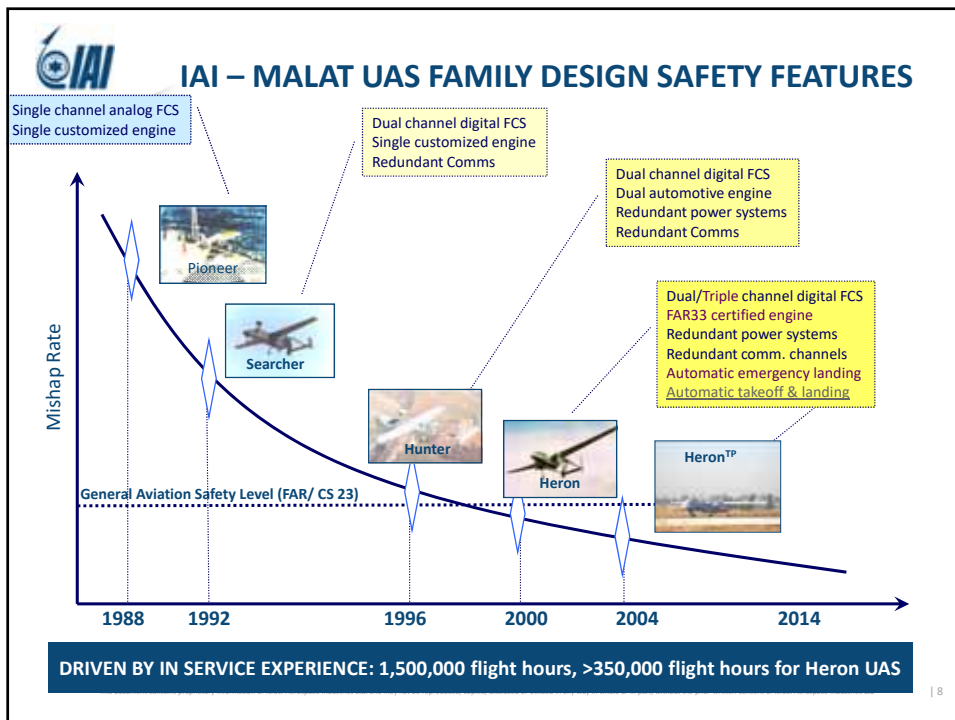
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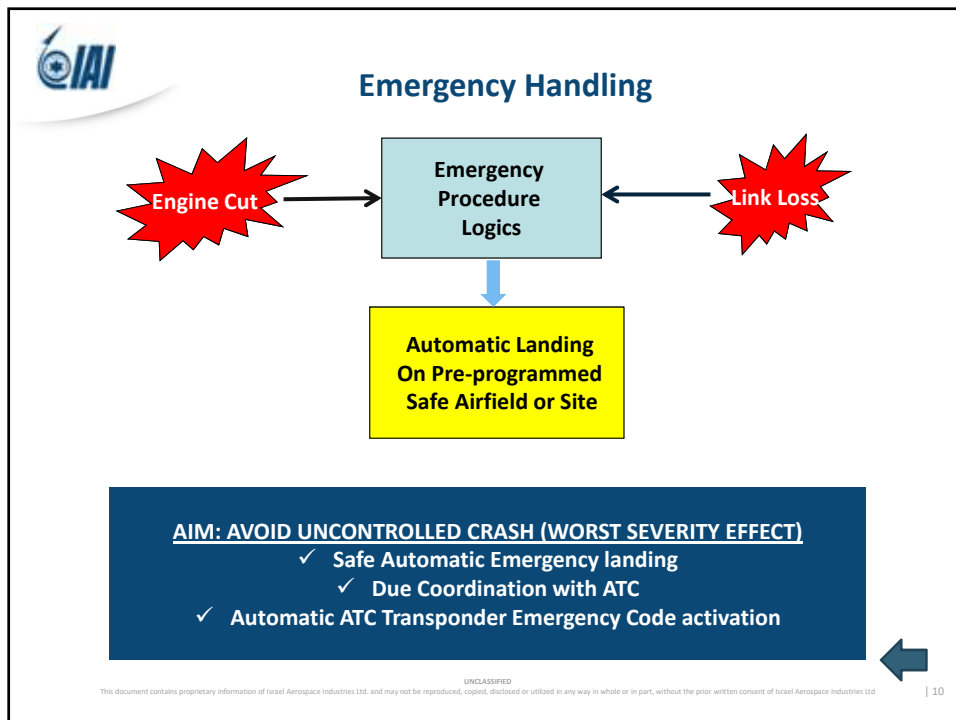
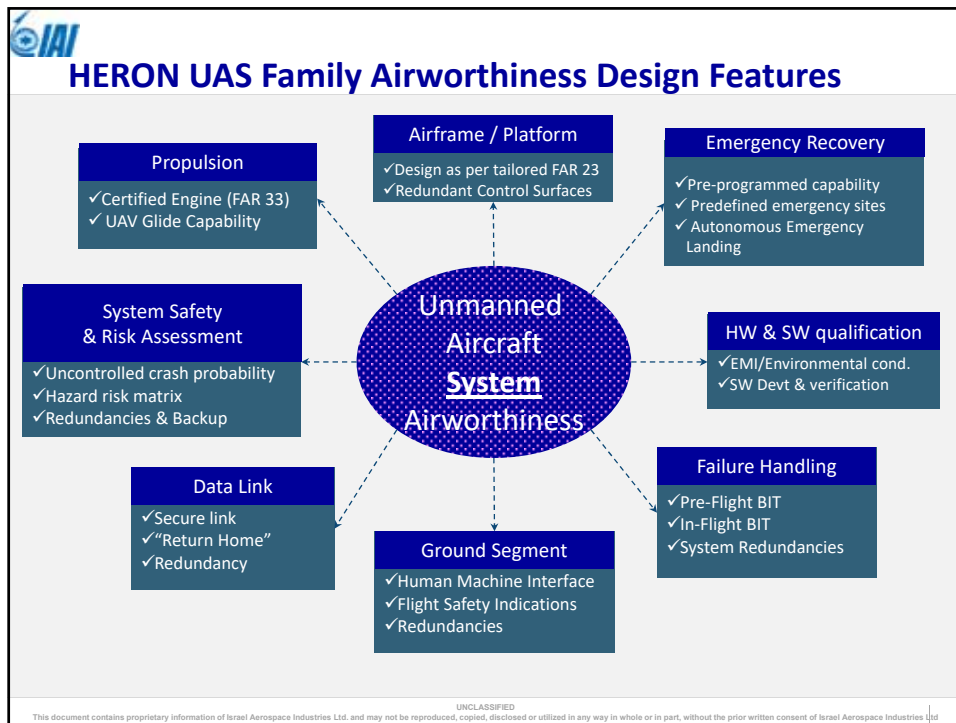


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Heron UAS Family Airspace integration Features

<p>ATC voice communications</p> <ul style="list-style-type: none"> ✓ Voice relay (UHF/VHF) ✓ Direct GCS to ATC 	<p>IFF / ATC Transponder</p> <ul style="list-style-type: none"> ✓ Civil mode III/A-C-S ✓ Automatic switch to emergency code (link loss)
<p>Anti-collision lights</p> <ul style="list-style-type: none"> ✓ Navigation lights ✓ Strobe light 	<p>Ground Segment</p> <ul style="list-style-type: none"> ✓ ATC constraints overlays ✓ UAV position / navigation ✓ ATC transponder ✓ Squawk code control
<p>Forward vision camera</p> <ul style="list-style-type: none"> ✓ See & Avoid during Take Off & landing phase 	<p>MPR Radar</p> <ul style="list-style-type: none"> ✓ Air to Air mode allows air threat detection
<p>Detect & Avoid</p> <ul style="list-style-type: none"> • Cooperative (TCAS, ADS-B) • Non Cooperative (Radar) 	


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DETECT AND AVOID FUNCTION

The diagram illustrates the Detect and Avoid (DAA) function. A central aircraft is shown with various sensors and communication links. On the left, 'Cooperative Intruders' are detected via TCAS/ACAS X and ADS-B. On the right, 'Non-Cooperative Intruders' are detected via DAA Radar and EO DAA. A Ground Control Station (GCS) is shown at the bottom, connected to the aircraft via a communication link.

DAA integration in Heron RPAS, based on emerging regulations & standards




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13




IAI MALAT ONGOING EXPERIENCE

- IAI HERON UAS Family has been granted **Airworthiness Approvals and certificates by worldwide military and civilian aviation authorities**
 - Israel (including from Civil Aviation Authority Israel) →
 - France, Germany, Australia, Brazil, Ecuador, USA, Canada etc... →
- **Airspace Integration demonstrations** (including with SATCOM) have been and are being successfully conducted in various types of environment and airspace e.g.
 - European Space Agency (in Spain) →
 - Frontex (European Coast Guard (in Greece) – starting end of September 2018
- **Towards UAS Type Certification : German Heron^{TP} Benchmark** →
- **IAI is actively participating in International Rule-making process** →

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14



IAI MALAT OPERATIONS IN ISRAEL


	Military UAV Operations	Non Military UAV Operations
Flight Authorization / Certification	Under Israel Air Force Authority / Flight Safety Board	Civil Aviation Authority (CAA) <ul style="list-style-type: none"> • "Experimental" CoA ▪ Special COA <i>For various IAI Heron UAS models</i>
Flight Plan Coordination	Military ATC	Civil ATC
Vertical & Horizontal Separation Rules	<i>Considering Israeli Airspace Management & Classification</i>	
	Military Separation Criteria	Civil Separation Criteria
GCS / ATC Voice Communications	Combined Civil & Military ATC	Combined Civil & Military ATC Transponder required
UAS Pilot	Military qualification	Civil UA pilot certification
UAS Aerodrome	IDF Approval	CAA Approval of Ein Shemer IAI-MALAT Flight Test Center

Unmanned Aircraft treated as other Manned Aircraft in the Airspace

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| 15


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CAA Special Certificate of Airworthiness

■ Granted to various Heron models

Example: G-HERON training flights in Israel with CAAI registration "4X-UMK"





Unmanned Aircraft treated as other Manned Aircraft in the Airspace

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IAI HERON UAS WORLDWIDE AIRWORTHINESS APPROVALS

- **Special Airworthiness Certificates** (for specific demonstration) e.g.
 - Australia (CASA)
 - Transport Canada
 - FAA
 - Greece
 - Spain
 - etc...

- **Airworthiness Certificates** (operation by foreign customer in relevant country) e.g.
 - French Heron Type Certificate (military DGA)
 - Canadian DND
 - Australian RAAF
 - German Heron (Military)
 - Brazilian Special Permit (civilian ANAC)
 - Singapore (Military)
 - etc...




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| 17



Back to 2008 already: Heron Flight demonstration for Australian Border Protection Command

SPECIAL CERTIFICATE OF AIRWORTHINESS		
1. Nationality & Registration Mark VH-BJJ	2. Manufacturer & Manufacturer's Designation of Aircraft Israel Aerospace Industries Ltd HERON-3 UAV	3. Aircraft Serial No. 169
4. Airworthiness Category: Experimental		
4(a) Purpose: CASR 21.31(1)(d) Exhibition		
<p>5. This certificate is issued pursuant to the Civil Aviation Regulations of Australia in respect of the above aircraft which is considered to be airworthy when maintained and operated in accordance with the Civil Aviation Regulations of Australia and any prescribed conditions set out as an Annex to this certificate.</p> <p>However, the above mentioned aircraft does not meet requirements in Annex 8 to the Convention on International Civil Aviation (ICAO) and therefore the aircraft must not be operated in international airspace or over the territory of a foreign country without the special permission of that country.</p> <p>Certificate issue date: 13/03/2008 Expiry date: 24/03/2008 (day/month/year)</p> <p>6. Subject to suspension or cancellation, pursuant to the Civil Aviation Regulations of Australia, this certificate shall remain in force until the expiry date before or the aircraft ceases to be registered on the Civil Aircraft Register of Australia.</p> <p>Certificate expiry date: 20/06/2008 (day/month/year)</p> <p>Note: • This certificate is subject to conditions as listed on the annex dated 13/03/2008 attached to this certificate and forms part of this certificate.</p> <p>NO ENTRIES MAY BE MADE ON THIS CERTIFICATE EXCEPT BY A DELEGATE OF THE AUTHORITY OR AN APPROPRIATE AT-TENDING PERSON.</p> <p>Any person finding this certificate should forward it to the Civil Aviation Safety Authority</p>		

New technology
Same Registration...
😊

CASA Approval including

- Heron Special Certificate of Airworthiness,
- IAI UA pilots and maintenance personnel
- Flights in Uncontrolled Airspace (Class G)
- ATC transponder / VHF Communications
- MPR (MMR) Air to Air Mode Credit
- NOTAM publication

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| 18

HERON MILITARY FRENCH TYPE CERTIFICATE

CERTIFICAT DE TYPE
Military Type Certificate

Numéro : D003-DGA
Number : D003-DGA

Israel Aerospace Industries
Malat Division
Ben Gurion International Airport
70100 Israel

conformément à la réglementation française relative à la navigabilité des aéronefs à l'Etat et utilisés par les services de douanes, de sécurité publique et
used in accordance with the French regulation concerning the airworthiness of
and for customs, public safety and civil safety services and used to:

Israel Aerospace Industries
Malat Division
Ben Gurion International Airport
70100 Israel

First UAS Military Type Certificate already granted to IAI in Nov. 2010

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HERON MILITARY FRENCH TYPE CERTIFICATE DATA SHEET

TYPE CERTIFICATE DATA SHEET

SIDM UAV SYSTEM


Type certificate holder:
Israel Aerospace Industries
Malat Division
Ben Gurion International Airport
70100 Israel

Type: Sidm
SIDM - HARPASID

TCDS Contents



- Definition
- Certification basis
- Air Vehicle
 - Type Definition
 - Engine & Propellers
 - Maximal Weight
- Limitations

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ROYAL AUSTRALIAN AIR FORCE - SPECIAL PERMIT

Category 2 UASOP granted in May 2015 -
"Heron may operate in any class of airspace with appropriate operational restrictions, including limited flight over populated areas".

Heron flying from Civilian Airport of Rockhampton

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| 21



German Heron Certificate of Airworthiness (2018)



SAATEG
Zwischenlösung

Luftfahrtamt der Bundeswehr
- Abteilung 2 -

Seite 1 von 2 Seiten

Verkehrszeugnis
- Vorläufige Zulassung zum Flugbetrieb -

VZD Nummer	Ausgabe	Stand	Stab
1300-34030-02	01	0	00

Luftfahrzeug der Bezeichnung (Lufkz 994)

Art des Luftfahrzeuges	Unbemanntes Luftfahrzeug
Modellbezeichnung	Model 1
Hersteller/Flugzeug	IAI-2010
Steuerkennzeichen	3801-00-02
Erhaltungsbetrieb	Israel Aerospace Industries Ltd. (IAI) Military Aircraft Group - MILAT (Israel)
Hersteller	Israel Aerospace Industries Ltd. (IAI) Military Aircraft Group - MILAT (Israel)
Montierendes Firm	Milcom Ltd. (Aeronaut. Solutions Group)
Wartung	Bundesamt für Ausrüstung, Informationstechnik und Robotik der Bundeswehr (BAAfBw) I.S.7

1. Über Einsatz im Flugbetrieb wird den verhängungsgemäßen Nachweis der Verkehrssicherheit gemäß Anlage 1 erbracht.
 2. Für das vorstehend beschriebene Luftfahrzeug ist die Vorläufige Zulassung zum Flugbetrieb gemäß Flugsicherungs-Anlage 2 erteilt.
 3. Diese Vorläufige Zulassung zum Flugbetrieb wird aufgrund der Zu-KI-10220-0001 erteilt.
 4. Über ein darüber A. Lufkz 994 2 erteilt Vorläufige Zulassung zum Flugbetrieb.

VZD Nummer	Ausgabe	Stand	Stab
1300-34030-02	01	02.02.2017	00

5. Diese Vorläufige Zulassung zum Flugbetrieb erhebt, wenn die Voraussetzungen und Bedingungen für die Erteilung nicht mehr erfüllt sind.



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| 22



Heron Flight Demonstrations in Europe

European Space Agency Conclusions (DeSIRE Project)
"The project has demonstrated that RPAS in BRLOS conditions relying on Satcom could timely proceed with ATC instructions/clearances in non-segregated airspace (civil controlled Class C), notably with a realistic separation exercise."





FRONTEX
EUROPEAN BORDER AND COAST GUARD AGENCY


Frontex, the European Border and Coast Guard Agency, has demonstrated the use of HERON Remotely Piloted Aircraft Systems (RPAS) in non-military controlled airspace (last quarter 2018)
(Flight Permit by Hellenic CAA)



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| 23

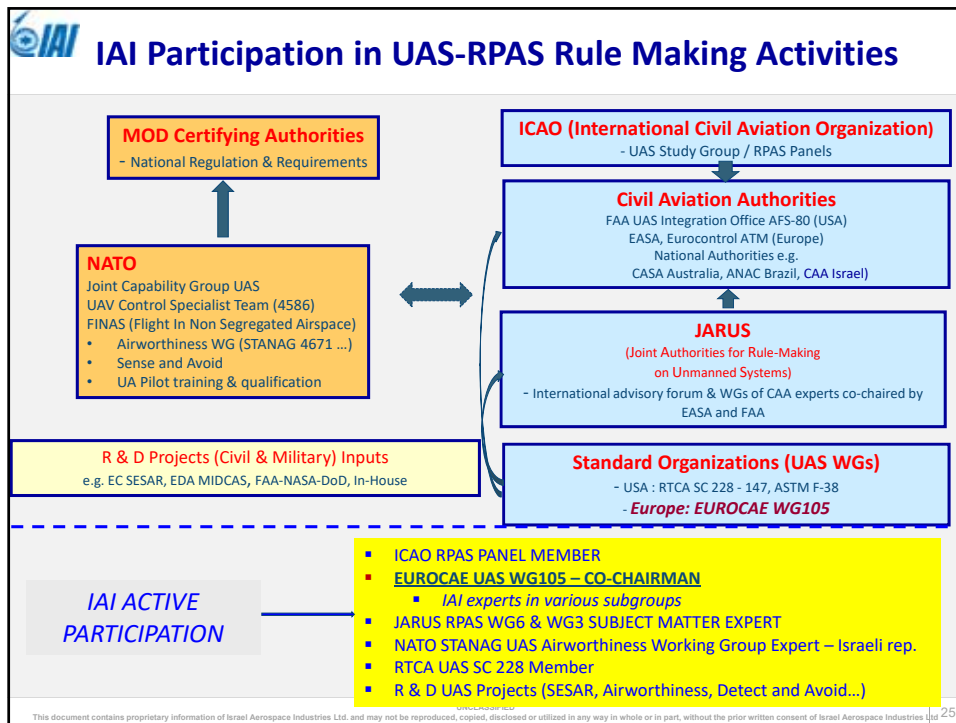


Frontex Demonstration in Crete – Sept. to Dec 2018

- Maritime Surveillance over sea and shores
- Operated from Tympaki HAF airbase
- Commanded by Hellenic Coast Guard
- 600 Flight hours
- 52 Flights, FL 050
- Mission time 8~18 Hours



- HCAA Flight Permit based upon
 - CAAI Special Certificate of Airworthiness
 - Submitted technical documentation of the system and the training certificates of the operating personnel
- *Stepwise Airspace Operations in due coordination with ATC* ←



- ### UAS-RPAS RULE-MAKING OVERVIEW – IAI INVOLVEMENT
- **ICAO RPAS PANEL**
 - Annex 8 Airworthiness (SARP – Standards & Recommended Practices) – new RPAS Parts
 - Airworthiness Manual update
 - **EASA New Drone Regulation (11-06-19) – Specific & Certified Categories**
 - Inputs to previous EASA UAS Policy (though EC Project USICO)
 - Establishment of Acceptable Means of Compliance (though EUROCAE)
 - **JARUS Subject Matter Expert**
 - WG3: CS-UAS preparation (CS-23 tailoring)
 - WG6: Safety
 - AMC “1309” EUROCAE-JARUS Conciliation Report)
 - Specific Operational Risk Assessment Methodology (“SORA”)
 - **NATO USAR (UAS Airworthiness Requirements) Subject Matter Expert**
 - Inputs to first French DGA USAR
 - Inputs to STANAG 4671 Editions
- ←
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IAI G-HERON^{TP} TYPE CERTIFICATION BENCHMARK

- Heron^{TP}** was subject to a **successful detailed certification assessment against NATO STANAG 4671** (Uav System Airworthiness Requirements) by German Military Aviation Authority (GMAA) as a **prerequisite for contract award**

- Detailed Type Certification Program agreed with GMAA in accordance with NATO STANAG 4671 currently under process following contract award**
- Heron^{TP} Certification Assets can be used as a benchmark for future civil certification of IAI Heron RPAS family***




Heron^{TP} basic characteristics

- MTOW : 5400 kg
- Wingspan : 26 m
- Total length: 14 m

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| 27



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| 28



CONCLUSIVE THOUGHTS AND REFLECTIONS ON WORLD UAS RULE MAKING (1/2)

- **Pragmatic Approach while preserving safety**
- **Stepwise confidence building process**
 - *“Crawl, Walk and...Run”*
- **Correct understanding of similarities *but also* differences between manned and unmanned aviation**



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| 29



CONCLUSIVE THOUGHTS AND REFLECTIONS ON WORLD UAS RULE MAKING (2/2)

- **Risk based approach**
 - Operational versus Design Mitigations : the proper balance
 - “SORA” (or equivalent): promising methodology – harmonization issues?
 - Legacy System / In Service Experience
- **Forthcoming regulatory challenges**
 - Fully autonomous systems
 - Unmanned cargo aircraft

IAI, as a large aerospace company, will continue to bring its manned and unmanned aviation expertise and experience in the World UAS Rule-making process



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| 30

 **AN OLD ADAGE**
and its applicability to the UAS Rule-Making World Community...

QUOTE (*)	APPLICABILITY
<i>The day is short,</i>	YES
<i>the work is much,</i>	YES
<i>the workers are lazy,</i>	WHY? CERTAINLY NOT!...☺
<i>the reward is great,</i>	YES
<i>and the Master is pressing</i>	YES

(*) Talmud, Ethics of the Fathers 2, 15



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