



**Avionics'06 Conference
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March 9, 2006**

**Federating
The
International
UAV
Community**

UAV Systems : Global Review

**Peter van Blyenburgh
UVS INTERNATIONAL**



OVERVIEW

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- 1 UVS International : Introduction**
- 2 UAV Systems : Definition & Categories**
- 3 UAV Systems Referenced**
- 4 UAV Systems : Review By Category**
- 5 UAVs in Inventory, On Order, In Development**
- 6 UAV Applications (Military & Civil/Commercial)**
- 7 The Problems & Starting To Resolve Them**



INTRODUCTION

Federating
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1997 Non-profit association founded in Paris, France as Euro UVS

1999 Registered with in Den Haag, The Netherlands

Operates out of offices in Paris, France

2004 Changed its name to UVS International – Global Scope

Global outreach to international aviation stakeholders

2006 237 Corporate & Institutional Members in 35 countries

Recognized internationally as UVS industry & service
community representative



MEMBERS IN 35 COUNTRIES

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- Argentina
- Australia
- Austria
- Belgium
- Botswana
- Canada
- Croatia
- Czech Rep.
- Denmark
- Finland
- France

- Germany
- Greece
- Hungary
- India
- Israel
- Italy
- Japan
- Luxembourg
- Netherlands
- New Zealand
- Norway
- Portugal
- Russian Fed.

- Singapore
- South Africa
- South Korea
- Spain
- Sweden
- Switzerland
- Tunisia
- Turkey
- UK
- Ukraine
- USA

= Honorary Members = representatives of national military & CAA + EASA + EDA + Eurocontrol + FAA + NATO + WEAO

= Corporate Members

Working Groups

UAV DACH
Euro UAV Industry Consultation Body

Partner Associations

AESiNT (Spain)
ATCA
Japan UAV Association
UAVS, UK
UNITE, USA
UVS Canada
UVS N.Zealand Australia



UAV SYSTEM

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UAV Aircraft designed to operate with no human pilot onboard

- ✂ One or several UAVs with their associated payload(s);
- ✂ UAV System Elements necessary to enable flight:
 - the control station(s) & antenna systems
 - all associated software & health monitoring systems
 - communication links (ground/air & air/ground)
 - data terminals (payload exploitation)
 - flight termination system
 - launch & recovery systems
 - ground support & maintenance equipment
 - power generation, distribution & supply
 - air traffic control communications equipment (voice & data)
 - handling, storage & transport equipment
 - all required documentation related to aforementioned.

JAA UAV TF

Flight includes taxiing, take-off & recovery or landing



CATEGORIES

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For differentiation of currently existing systems.
Not for certification purposes.

Tactical

Strateg.

Sp.Task

		Mass	Range	Flight Alt.	Endurance
?	Micro ???	< 5 kg	< 10 km	250 m	1 hour
Mini	Mini	< 20/25/30/150 ⚡	< 10	150/250/300 ⚡	< 2
CR	Close Range	25-150	10 - 30	3.000	2 - 4
SR	Short Range	50-250	30 - 70	3.000	3 - 6
MR	Medium Range	150-500	70 - 200	5.000	6 - 10
MRE	MR Endurance	500-1500	> 500	8.000	10 - 18
LADP	Low Alt. Deep Penetration	250-2500	> 250	50 - 9.000	0,5 - 1
LALE	Low Alt. Long Endurance	15-25	> 500	3.000	> 24
MALE	Medium Alt. Long Endur.	1000-1500	> 500	5/8.000	24 - 48
HALE	High Alt. Long Endur.	2500-5000	> 2000	20.000	24 - 48
Strato	Stratospheric	>2500	> 2000	> 20.000	> 48
EXO	Exo-stratospheric	TBD	TBD	> 30.500	TBD
UCAV	Unmanned combat AV	>1000	+/- 1500	12.000	+/- 2
LET	Lethal	TBD	300	4.000	3 - 4
DEC	Decoys	150-500	0 - 500	50 - 5.000	< 4

⚡ = According to national legal restrictions



AIRFRAME TYPES

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Fixed Wing	Single Engine Twin Engines Pusher Engine Puller Engine Single Wing Circular Wing Twin Wing Flying Wing Tail-Sitter	Eagle, Heron, Global Hawk, Predator Hermes 450T & 1500, Colugo, DragonEye Sperwer, Shadow, Searcher, Seeker Alba, Exdrone, DragonDrone SilverFox XB-2 Jasoos, Outrider, Backpack Helios, X-13, Zephyr SkyTote
Rotary Wing	Motorised Rotor Gyroplane Canard Rotor Wing Pendular Rotor Shrouded Rotor Tilt Rotor	A-160, FireScout, Orka, SNARK RPG Mk II X-50 DragonFly HeteI-M FanTail, Cypher, GoldenEye, HoverEye Eagle Eye
Motorized Para-Foil Lighter-than-Air Flapping Wing Optionally Piloted	Eagle, Little Bird, Perseus, Stemme, Surveyor 2500	Snow Goose, Blueeye Airscan, O.V.O. Micro UAVs

FUEL TYPES

Two-Stroke	Standard Petrol	AvGas
Electric	Solar/Electric	Diesel



LAUNCH METHODS

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Air-Launched	<ul style="list-style-type: none"> - Manned Aircraft - Balloon - Tracked Para-foil - UAV (Predator) 	<ul style="list-style-type: none"> Zephyr Exdrone Finder DragonEye 	<ul style="list-style-type: none"> QinetiQ BAI Aerosystems NRL AeroVironment
Bungee Cord	(hand-tensioned)	- Black Widow	AeroVironment
Canister-launched	(hand-held)	- MATE	Dutch Space
Car/Truck-launched		- Aerosonde	Aerosonde
Container-launched	<ul style="list-style-type: none"> - Pneumatic - RATO 	- Snow Goose	MMIST
Hand-launched		Neptune	DRS Technologies
		KZO	Rheinmetall DE
		- Aladin	EMT
		- Carolo	Mavionics
		- Tracker	EADS D&SS
Launcher	<ul style="list-style-type: none"> - Bungee - Hydraulic - Pneumatic - Atmospheric 	LUNA	EMT
RATO (rocket assisted take-off)		Phoenix	BAE Systems
Weapon-launched		Sperwer	Sagem
Torpedo Tube-launched		Vulture Mk II	ATE
Wheeled Take-Off		Pioneer	Pioneer UAV Inc
VTOL		Under development	Under development
		- Predator	General Atomics AS
		- Global Hawk	Northrop Grumman
		RMax	Yamaha Motor Co



RECOVERY METHODS

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Belly Landing
Deep Stall
Expendable
Net Recovery-Land - No airbag
Net Recovery-Land + Airbag
Net Recovery-Naval
Parachute & A/C in standard position
Parachute & A/C in upside-down position
Parachute + Airbag
Para-foil
Skid Landing

In-Flight Recovery by Manned Aircraft
Vertical Cable - Wing Snatch (SkyHook)
VTOL

Water Surface Landing

Wheeled Recovery
Wheeled Recovery with Arresting Hook

Aerosonde
Aladin
Harpy

Vulture Mk II
Pioneer
Crecerelle
Phoenix
Sperwer
Snow Goose
- Sojka III
- Ranger

ScanEagle
- FireScout
- Little Bird
- RPH2
- Neptune
- Neptune
Predator
Hunter

Aerosonde
EMT
IMI

ATE
Pioneer UAV Inc.
Sagem
BAE Systems
Sagem
MMIST
VTUL a PVO
RUAG Aerospace

Boeing/Insitu
Northrop Grumman
Boeing
Fuji Heavy Ind.
BAI Aerosystems
DRS Technologies
General Atomics AS
IAI-Malat



UAV SYSTEMS REFERENCED

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Applications	Qty	%
Civil/Commercial	55	10,1
Military	397	72,29
Dual Purpose	44	8
Research UAVs	35	6,43
Developmental vehicle	219	40,25
Total Nr UAVs Referenced	544	Incl. teamed efforts
Nr of Producers/Developers	207	
Nr of Countries	43	



UAVs Referenced by Category & Status

		% Ref'd UAVs	STATUS
35	Micro	6,4 %	DC
123	Mini	22,6 %	DC MR ES TD IS
77	Close Range	14,1 %	NL DC MR ES TD IS NS
105	Short Range	19,3 %	NL DC MR ES TD IS NS
101	Medium Range	18,5 %	NL DC MR ES TD IS NS
17	Medium Range Endurance	3,1 %	DC MR ES TD IS
16	Low Altitude Deep Penetration	2,9 %	NL DC MR TD IS NS
6	Low Altitude Long Endurance	1,1 %	DC MR TD IS
21	Medium Altitude Long Endurance	3,8 %	DC MR ES TD IS
22	High Altitude Long Endurance	4 %	DC TD IS
16	UCAV	2,9 %	DC TD
2	Stratospheric	0,3 %	DC TD
3	Exo Stratospheric	0,5 %	DC TD

NL = Nolonger in production DC = Development continuing MR = Market ready ES = Entering service
 TD = Test/demo system ordered IS = In inventory/in service NS = No longer in service



MICRO UAVs



Mikado II

EMT, Germany

Micro VTOL

Epsom & Sony
Japan



Carolo
C40

Mavionics & Rheinmetall, Germany



LADF

Allied Aerospace, USA



OAV

AeroVironment, USA



FanTail

ST, Singapore

DO-MAV 1



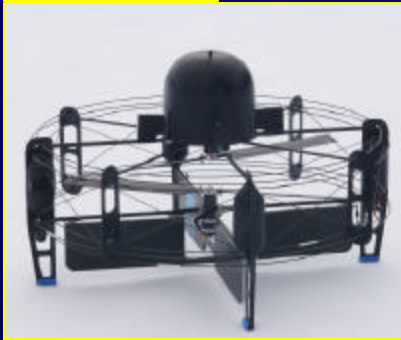
EADS-Dornier, Germany

MITE



NRL, USA

FanCopter



EMT, Germany

Black Widow



AeroVironment, USA



MINI UAVs



M60

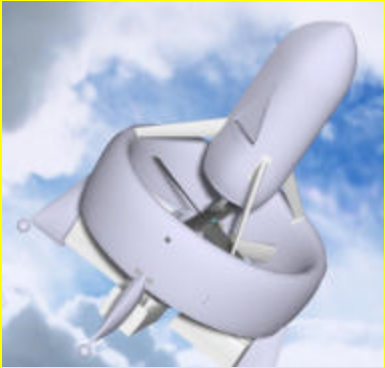
TAG, USA



Colugo

Kawada & Hitachi, Japan

HoverEye



Bertin Technologies, France



Puma

AeroVironment, USA



Skorpio

EADS & SurveyCopter, France



Aladin

EMT, Germany



Tracker

EADS D&SS & SurveyCopter, France



MINI UAVs



I-Copter II

VTOL-Aerospace, Australia

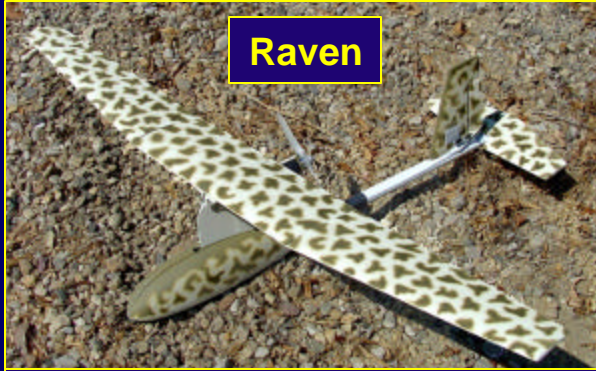
SkyLark

Elbit Systems Israel



Dragon Eye

Naval Research Lab, USA



Raven

AeroVironment, USA



Javelin

BAI Aerosystems, USA



BackPack

Mission Technologies, USA



Desert Hawk

Lockheed Martin, USA



Pointer

AeroVironment, USA



MINI UAVs

Non-military applications only

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RoboCopter

Kawada, Japan



RPH2

Fuji Heavy Industries, Japan



YH300SL

Yanmar, Japan



R-Max

Yamaha Motors, Japan



CLOSE RANGE UAVs

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**RMax
Type 2**

Yamaha Motor Company, Japan



LUNA

EMT, Germany



X-Vision

SCR, Spain



Camcopter

Schiebel Elektronische Geräte, Austria



CLOSE RANGE UAVs

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Exdrone

BAI Aerosystems, USA



SilverFox

Adv. Ceramics Research, USA



SurveyCopter

SurveyCopter, France



SkyTote

AeroVironment, USA



MinO

QinetiQ, UK



SpyThere

IAI-Malat, Israel



Mini-Vanguard

Mission Technologies, USA



SHORT RANGE UAVs



Sagem D&S, France



Sagem Défense & Sécurité, France



BAE Systems, UK



Aurora Flight Sciences, USA



DRS Technologies, USA



Elbit Systems, Israel



VTUL a PVO, Czech Rep.



SHORT RANGE UAVs

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Finder

Naval Research Lab, USA



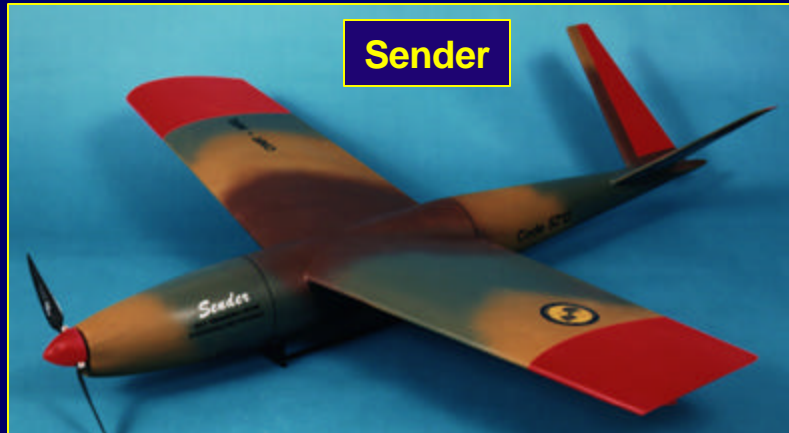
Pioneer

Pioneer UAV Inc, USA



Dragon Warrior

Naval Research Lab, USA



Sender

Naval Research Lab., USA



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**Galileo
Avionica, Italy**

Techment, Sweden





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KZO



Rheinmetall Def. Electronics, Germany

**Sperwer
& Ugglan**



Sagem Défense & Sécurité, France

Ranger



RUAG Aerospace, Switzerland

Orka



EADS-D&SS, France



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Shadow 200



AAI Corp., USA

Shadow 400



AAI Corp., USA

Fire Scout



Northrop Grumman, USA

Hunter



IAI, Israel & TRW, USA



Ezycopter



Yosine, Taiwan

MEDIUM RANGE UAVs

Night Intruder



Korean Aerospace Ind., South Korea

Seeker I



Denel Aerosystems, South Africa

GoldenEye 50



Aurora FS, USA

Hermes 180



Elbit System-Silver Arrow Div., Israel

Searcher I



Israeli Aircraft Industries, Israel

Helix-M



ECT & Isnav, France

Eagle Eye



Bell Helicopter-Textron, USA



MEDIUM RANGE ENDURANCE UAVs

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Seeker II



Denel Aerosystems, South Africa

Shadow 600



AAI Corp., USA

Hermes 450S



Elbit Systems - Silver Arrow, Israel

Searcher II



Israel Aircraft Industries, Israel



MEDIUM RANGE ENDURANCE UAVs

SNARK



TRG Helicorp, N. Zealand

E-Hunter



Israeli Aircraft Industries, Israel

Falco



Galileo Avionica, Italy

Sperwer B

**Sagem D&S
France**



Dragonfly



Boeing, USA



LOW ALTITUDE DEEP PENETRATION UAVs

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Mirach 150

Galileo Avionica, Italy



CL289

EADS, France & Germany



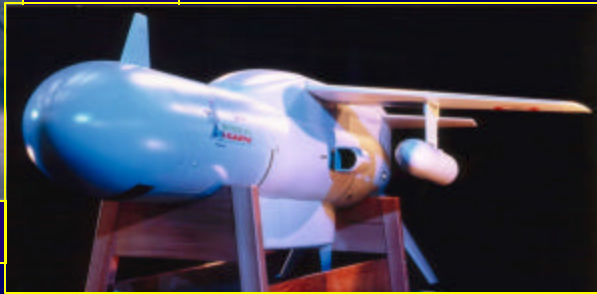
Surveyor 600

EADS-D&SS, France & Galileo Avionica, Italy



Nibbio

Galileo Avionica, Italy





LOW ALTITUDE LONG ENDURANCE UAVs

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✈ = Civil/commercial applications

Aerosonde Mk III ✈

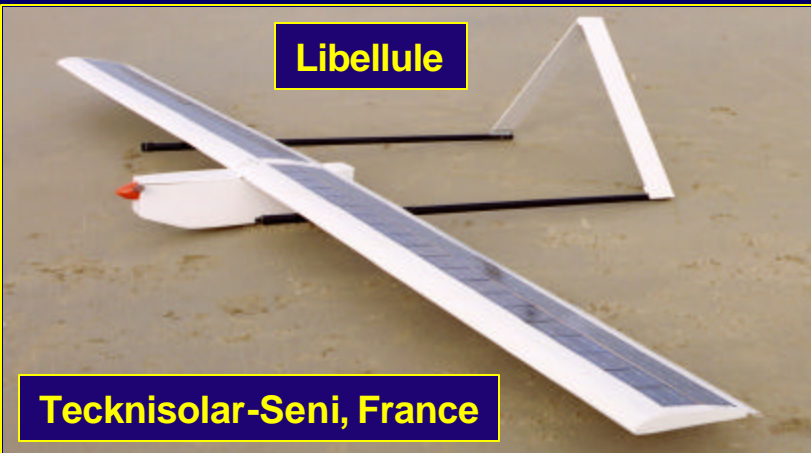


Aerosonde Mk II ✈



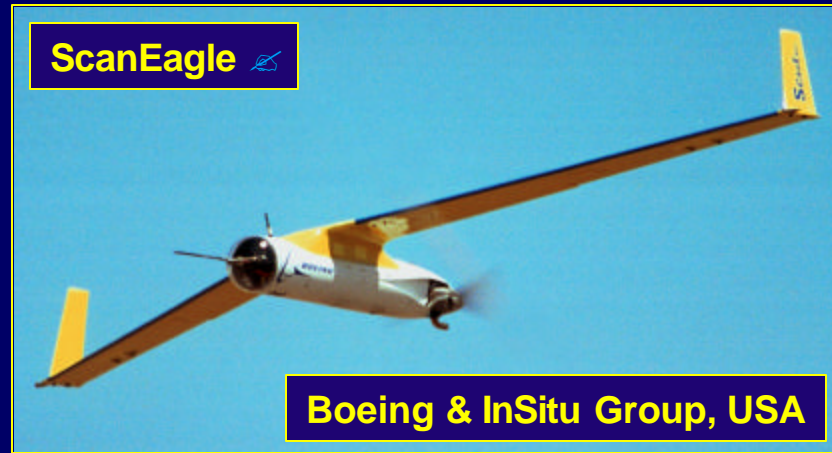
Aerosonde, Australia

Libellule



Tecknisolar-Seni, France

ScanEagle ✈



Boeing & InSitu Group, USA



MEDIUM ALTITUDE LONG ENDURANCE UAVs

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Predator



General Atomics AS, USA

Eagle-1



EADS D&SS, France & IAI-Malat Div., Israel

Heron



IAI-Malat Div., Israel

Hermes 1500



Elbit Systems - Silver Arrow, Israel



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 = Research applications





HIGH ALTITUDE LONG ENDURANCE UAVs

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Global Hawk

Northrop Grumman, USA



Predator B

General Atomics AS, USA



Theseus 

Aurora Flight Sciences, USA



Helios 

AeroVironment & NASA Dryden, USA

 = Civil/commercial applications

 = Solar Powered Research Applications



UCAVs



Sharq

Dassault Aviation, France



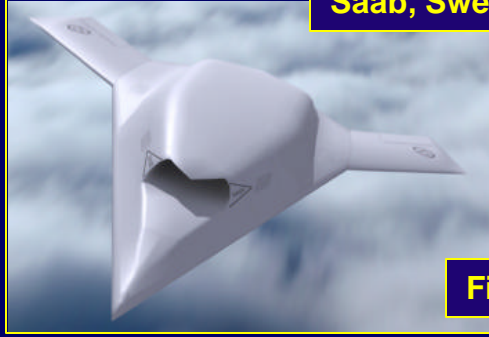
Neuron

BAE Systems, UK



Corax

Saab, Sweden



Filur

Boeing, USA



X-45A

EADS, Germany



Photo: Jane's

Barrakuda

Northrop Grumman, USA



X-47B

Alenia Aeronautica, Italy



Sky-X



OFFENSIVE/LETHAL UAVs

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Taifun



Rheinmetall DE, Germany

Anti-Radar
Anti-Vehicle &
Anti-Structure

The Taifun UAV is a white, V-shaped aircraft with a large white nose cone and red accents on the wings and tail. It is shown in a studio setting, mounted on a red support structure.

LOCAAS



Lockheed Martin, USA

Anti-Radar
Anti-Vehicle &
Anti-Structure

The LOCAAS UAV is a grey, V-shaped aircraft with a large nose cone and a red square on the side. It is shown in flight against a blue sky.

K100



EADS-CAC Systèmes, France

Anti-Vehicle

(concept demonstrator – Did not go into production)

The K100 UAV is a dark grey, V-shaped aircraft with a large nose cone and a black tail. It is shown on a wooden post in a grassy field.

Harpy



IAI-MBT, Israel

Anti-Radar

The Harpy UAV is a brown, V-shaped aircraft with a large nose cone and a black tail. It is shown in flight against a blue sky, with a white smoke trail behind it.



DECOYS

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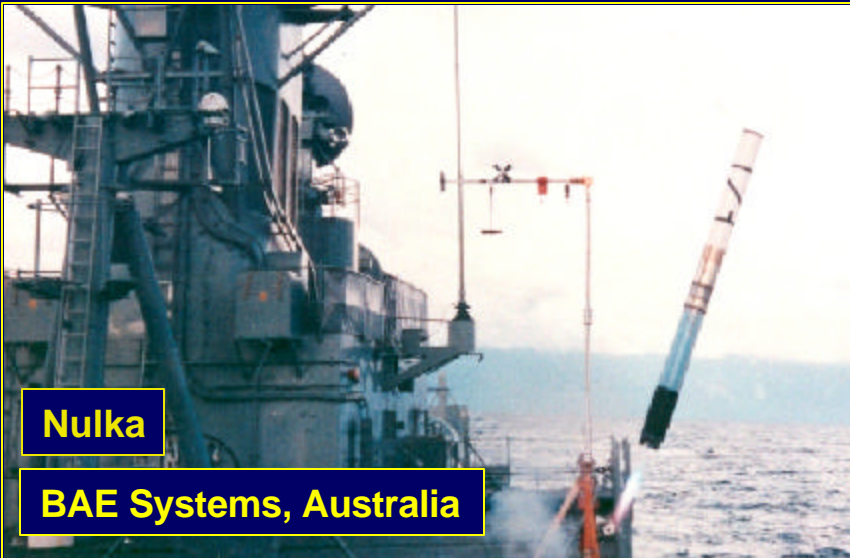
Flyrt

Naval Research Lab., USA



Chukar

Northrop Grumman, USA



Nulka

BAE Systems, Australia



ITALD

IMI, Israel



Optionally Piloted Aircraft & Modified Certified Aircraft

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Eagle

Excelnet, Malaysia



Herti-1A

BAE Systems, UK



Pelican

General Atomics Aeronautical Systems, USA



Proteus

Scaled Composites, USA



Surveyor 2500

EADS-DS & Dyn'Aero, France



UAV PRODUCING COUNTRIES

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42 World-Wide

Argentina	India	Russia
Australia	Iran	Singapore
Austria	Israel	South Africa
Brazil	Italy	South Korea
Bulgaria	Japan	Spain
Canada	Jordan	Sweden
Chile	Malaysia	Switzerland
China (PR)	Netherlands	Tunisia
Croatia	New Zealand	Taiwan
Czech Rep.	Norway	Turkey
Equator	Pakistan	Ukraine
France	Poland	UAE
Germany	Portugal	UK
Greece	Romania	USA

= Current Producers

= Ongoing R&D

= Future Producers?

22 International Industrial Co-operation Developments



MILITARY UAVs IN INVENTORY

Europe

<u>In service in</u>	<u>Model</u>	<u>Manufacturer</u>
Belgium	Hunter-B	Eagle Consortium & IAI, Israel
Bulgaria	Yastreb	Aviotechnica, Bulgaria
Czech Rep.	Sojka III	VTUL a PVO, Czech Republic
Denmark	Sperwer	Sagem D&S, France
Finland	Ranger	RUAG Aerospace, Switzerland
France	CL289	EADS, France & Germany
	Crecerelle	Sagem, France
	Crecerelle EW	Sagem, France
	Pointer	AeroVironment, USA
	Hunter-F	IAI, Israel & TRW, USA
	SurveyCopter II	SurveyCopter, France
Germany	Aladin	EMT, Germany
	CL289	EADS-Dornier, Germany
	KZO	Rheinmetall Def. Electr., Germany
	LUNA	EMT, Germany
Italy	Mirach 20 & 26	Galileo Avionica, Italy
	Predator	General Atomics AS, USA
	Pointer & Raven	AeroVironment, USA
Netherlands	Sperwer	Sagem, France
Romania	Shadow 600	AAI Corp., USA
Russia	KA-137	Kamov, Russia
	Tu-141 Strizh	Tupolev, Russia
	Tu-143 & Tu-243	Tupolev, Russia
	Pchela/Shmel	Yakovlev, Russia
Sweden	Ugglan	Sagem, France
	Mini-Vanguard	Mission Technologies, USA
Switzerland	Ranger	RUAG Aerospace, Switzerland
Turkey	GNAT	General Atomics AS, USA
	Harpy	IAI-MBT, Israel
UK	Phoenix	BAE Systems, UK

Delivered but not (yet) in service

In Service

Test/Evaluation

Demonstrator

No longer in service

Canada

Sperwer		Sagem, France
SilverFox		Advanced Ceramics, USA
SkyLark		Elbit Systems, Israel

MILITARY UAVs IN INVENTORY



USA

Delivered but not (yet) in service

In Service

Test/Evaluation

Demonstrator

No Longer in Service

<u>Model</u>		<u>Manufacturer</u>
Aerosky		Aeronautics UAV Systems, <u>Israel</u>
Black Widow		AeroVironment, USA
BQM-74C Recce		Northrop Grumman, USA
Chiron		Aurora Flight Sciences Corp., USA
Dragon Drone		L-3 BAI Aerosystems, USA
Dragon Eye		AeroVironment & BAI Aerosystems, USA
Dakota		Naval Research Lab., USA
Dragon Warrior		Sikorsky Aircraft, USA
Evolution		L-3 BAI Aerosystems, USA
Exdrone		L-3 BAI Aerosystems, USA
Fire Scout		Northrop Grumman, USA
Global Hawk		Northrop Grumman, USA
Gnat & I.Gnat		General Atomics AS, USA
Hermes 450		Elbit Systems, <u>Israel</u>
Hunter		Northrop Grumman, USA & IAI, <u>Israel</u>
Itald		Israel Military Industries, <u>Israel</u>
K-Max		Kaman Aerospace, USA
LADF		Allied Aerospace, USA (formerly MicroCraft)
MALD		Northrop Grumman, USA
MicroStar		BAE Systems, USA
Neptune		DRS Technologies, USA
Nulka		BAE Systems, Australia & US Navy
Outrider		Alliant TechSystems, USA
Pelikan		Cirpas, USA
Pioneer		Pioneer UAV Inc., USA
Pointer I & II		AeroVironment, USA
Predator		General Atomics AS, USA
Predator B		General Atomics AS, USA
Raven		AeroVironment, USA
Raptor		NASA Dryden, USA
RMax		Yamaha Motor Company, <u>Japan</u>
Sender		Naval Research Lab., USA
Sentry		DRS Technologies, USA
Shadow 200		AAI Corp., USA
SnowGoose		MMIST, <u>Canada</u>
Tern		L-3 BAI Aerosystems, USA



Military UAVs On Order

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✍ Demonstrator

✍ Interim System

Europe

<u>Customer</u>	<u>Designation</u>	<u>Manufacturer</u>
France	Carapace	EADS DS, France
	Eagle 1	EADS DS, France & IAI-Malat, Israel
	Sperwer	Sagem, France
	Tracker	EADS DS, France & SurveyCopter, France
Germany	KZO	Rheinmetall Def. Electronics, Germany
	Aladin	EMT, Germany
	Sperwer	Sagem, France
Greece	Falco	Galileo Avionica, Italy
Italy	WK 450	Thales, UK & Elbit Systems, Israel
UK		

North America

<u>Customer</u>	<u>Designation</u>	<u>Manufacturer</u>
Canada	SkyLark	Elbit Systems, Israel
USA	Dragon Eye & Raven	AeroVironment, USA
	Fire Scout	Northrop Grumman, USA
	Global Hawk	Northrop Grumman, USA
	Snow Goose	MMIST, Canada
	Neptune	DRS Technologies, USA
	OAV	Allied Aerospace, USA
	Pointer II	AeroVironment, USA
	Predator	General Atomics AS, USA
	Predator B	General Atomics AS, USA
	ScanEagle	Boeing & Insitu Group, USA
	Shadow 200	AAI Corp., USA



Military Requirements Current & Upcoming

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Europe

Cyprus	SR or MR
Europe	MALE & UCAV
France	Mini, CR, LADP, Naval, MALE & HALE
Germany	Micro?, Mini, MALE/HALE
Italy	MRE
NATO	MALE
Netherlands	MALE
Norway	MR or MRE, and/or MALE
Poland	Mini, MR or MRE, and MALE
Spain	MR or MRE & MALE
Sweden	SR, MR, MRE, MALE/HALE
Turkey	MRE & MALE
UK	MALE ? & (HALE?)

North America

Canada	MRE & MALE?
USA	Micro, Mini, CR, MR, MALE & HALE

Others

Australia	MR & MALE/HALE
Chili	CR/MR
China	MRE or MALE
India	SR & MALE
Indonesia	MR VTOL
Japan	MR & HALE
Jordan	CR & MR
Malaysia	MR?
Pakistan	SR, MR & MALE?
Peru	MR
Philippines	SR or MR
Saudi Arabia	SR, MR, MRE, MALE
Singapore	CR, SR, HALE
South Africa	MR, MALE?
South Korea	MRE VTOL
Sri Lanka	SR
Taiwan	MR
Thailand	MR or MRE
Ukraine	MRE
U.A.E.	MALE



UAVs UNDER DVPT

Europe

Hardware
in
various
stages
of
development

	<u>Manufacturer</u>	<u>Designation</u>
Belgium Croatia France	VITO Soko Alcore Technologies Bertin Technologies Dassault Aviation DSTU (Dassault & Sagem) ECT & Isnav EADS DS EADS & Galileo Avionica	Pegasus (solar powered HALE) B4 MR Azimut & Biodrone & Epsilon & Futura SmartBall & HoverEye (Mini VTOL) Duc (Small/Large) (UCAV) Slow-Fast (Moyen Duc) Hétel VTOL Eagle 2 & Orka & Surveyor 2500 Surveyor 600 (LADP)
Germany	EADS Corp. Research EADS & Northrop Grumman EADS Rheinmetall DE Rheinmetall DE & Mavionics	QuaddroCopter (Micro) EuroHawk (HALE) Barrakuda (UCAV demonstrator) Taifun (offensive UAV) Carolo (Micro) Heliplat (Solar-powered HALE)
International	European Consortium A European Consortium B European Consortium C Alenia Aeronautica	Neuron (UCAV demonstrator) EuroMale X-Sky (UCAV demonstrator) unnamed rotorcraft APID VTOL
Italy Norway	SiMiCon Scandicraft	Armor CR Ka-37 & Ka-137 Strekoza & Albatross (Tilt Rotor)
Portugal Russia	IST & OGMA Irkut Kamov Yakovlev	Alo Siva Fuel cell powered MRE Sharc & Filur (UCAV demonstrators)
Spain	SCR & INTA EADS CASA Boeing R&T Europe	Herti (MALE demonstrator) Corax (UCAV demonstrator) U-99 (UCAV demonstrator) CyberOne & Swift-Eye (Mini)
Sweden UK	Saab BAE Systems Cranfield University Cyberflight QinetiQ & Cranfield Aero. QinetiQ Remote Group Roke Manor Research	MinO (Mini-Observer) Zephyr (Solar-powered HALE) Small programmable airship Unnamed powered para-foil (expendable)



UAVs UNDER DVPT

USA

Hardware in
various stages
of development

Manufacturer

Advanced Soaring Systems
AeroVironment
Allied Aerospace
Aurora Flight Sciences
BAE Systems
BAI Aerosystems
Bell Helicopter/Lockheed Martin
Boeing

Boeing & Insitu Group
Carolina Unmanned Vehicles
Dragon Fly Pictures
DRS Technologies
General Atomics AS

Gulfstream
Honeywell
Kaman Aerospace
Lockheed Martin
Lockheed Martin Voigt
Lutronix
Mission Technologies
MLB
NASA Dryden
Naval Research Lab.
Northrop Grumman

SAIC
Scaled Composites
Sikorsky

Systems Research & Dvpt Corp.

Designation

Apex
Micro & Mini UAVs
LADF & OAV
GoldenEye 50 & 100 + MarsFlyer
MicroStar & Scimitar
Isis
UCAR
A160 Hummingbird
Dragon Fly
Heliwing
X-36 UCAV research vehicle
X-45A UCAV
UCAR
Seascan & ScanEagle
SLURS
DP4
Sentry HP & Neptune
Predator B
Mariner
Gulfstream V HALE
Organic UAV
K-Max Burro
UCAR
Locaas
Kolibri
BackPack
Micro UAVs & BAT
I-2000
Various types of UAVs
BQM-145A
Fire Scout & SeaScout
Global Hawk
Sea Ferret
X-47B Pegasus UCAV
UCAR
Weaponized Hunter
Vigilante
Proteus
Cypher II?
UCAR
Archangel

Federating
The
International
UAV
Community



MILITARY PURPOSE UAVs

Federating
The
International
UAV
Community

Israel

Countries other than Canada, Europe, Israel & USA

IN INVENTORY

IAI:

- Harpy
- Scout
- Searcher
- Heron

Elbit Systems:
Hermes 450S

ON ORDER

Elbit Systems:
- Hermes 450S
- Skylark

ONGOING DEVELOPMENT

IAI:

- Heron TP
- HA310 (fuel-cell)
- HA315 (fuel-cell)

Elbit Systems:
- Hermes 1500
- Hermes 700
- Hermes 180
- Seagull

IN INVENTORY

Algeria
Australia
Bahrain
Botswana
China
Egypt
India
Indonesia
Iran
Israel
Japan
Malaysia
Pakistan
Qatar
Russian Fed.
Singapore
South Korea
South Africa
Sri Lanka
Syria
Thailand
Turkey (see Europe)
Ukraine
UAE

ON ORDER

Australia
China
India
Japan
Pakistan
Russia
South Korea
South Africa
Ukraine

ONGOING & UPCOMING REQUIREMENTS

Australia
China
India
Indonesia
Japan
Jordan
Malaysia
Oman
Pakistan
Peru
Philippines
Russia
Saudi Arabia
Singapore
South Africa
South Korea
Sri Lanka
Taiwan
Thailand
Ukraine
U.A.E.

ONGOING DEVELOPMENTS

Australia
Brazil
Chile
China
Equador
Egypt
India
Iran
Japan
Jordan
Malaysia
New Zealand
Pakistan
Russia
Singapore
South Korea
South Africa
Taiwan
Ukraine
U.A.E.



MILITARY APPLICATIONS

Federating
The
International
UAV
Community

CURRENT

Reconnaissance
Surveillance
Target Acquisition
Decoy
Battle Damage Assessmt
Weapons Delivery

FUTURE

Aerial Mine Detection	Radar Saturation
Artillery Correction	Sensor Delivery
Battle Management	SIGINT
Comms & Data Relay	Target Designation
Command & Control Relay	Treaty Monitoring
Digital Mapping	Urban Warfare
Electronic Warfare	Offensive Missions:
Flight Path Recce	-anti-radar
NBC Recce	-anti-vehicle
Perimetric Surveillance	-anti-ship
Psychological Warfare	-anti-structure
Radar Jamming	Maritime Surveillance

DRIVERS: Dangerous missions -> No risk to pilot
Lesser political risks
Information = Power & Permits Precision Strike
Cost-Effectiveness in relation to manned A/C



Recent Military UAV Deployments

Federating
The
International
UAV
Community

Bosnia '93-'96

France Crecerelle
UN Fox AT
USA Gnat 750
Pioneer
Predator

Kosovo '98-'99

France CL-289
Crecerelle
Hunter
Germany CL-289
UK Phoenix
USA Hunter
Pioneer
Predator

Kosovo '05-

Belgium Hunter

Australia '01 +++

USA Global Hawk

Afghanistan '01-now

Canada Sperwer
SkyLark (upcom)
Germany Aladin
LUNA
USA DragonEye
Global Hawk
Pointer
Predator
Shadow 200

Djibouti/Yemen '02

USA Predator

East Timor '02

Australia Aerosonde III

Solomon Islands '03

Australia Aerosonde III
Avatar

South Korea '03

USA Shadow 200

Iraq '03 -now

Australia (upcoming)
SkyLark
Italy Predator
Japan RMax
UK Desert Hawk (eval)
Phoenix
USA DarkStar B (eval)
Desert Hawk
DragonEye
Global Hawk
I.Gnat
Hunter
Pioneer
Predator
Puma
Raven
ScanEagle
Shadow 200
SilverFox
Tern



CIVILIAN & COMMERCIAL APPLICATIONS

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CURRENT

Publicity Spots
TV, Cinema
Atmospheric Research
Meteorological Purposes
Agricultural Applications
Illegal Immigrant Control

UPCOMING

Forest Fire Detection
Environmental Monitoring
Border Patrol

FUTURE

Aerial Surveying
Mineral Detection
Atmospheric Sampling
Wildlife Monitoring
Power Cable Verification
Pipeline Control
Pollution Control
Search & Rescue
Disaster Relief
Homeland Security
Law Enforcement
Mapping

Telecommunications
Nuclear Fall-Out Detection
News Broadcasting
Farming & Ranching
Fishing Industry
Maritime Surveillance
Perimeter Surveillance
Industrial Site Surveillance
Rail Line Monitoring
Avalanche Control
Riot Control
Traffic Surveillance

DRIVERS: Cost-Effectiveness
Missions impossible with manned aircraft
Missions more efficient than with manned aircraft



WHAT ARE THE PROBLEMS?

Unifying
The
International
UAV
Community

Emerging market

Products not fully mature

Most military UAV systems are still “user specific”

Insufficient safety & reliability

High development costs + low volume production ->

High acquisition cost

Operational costs still too high -> High ownership cost

Insufficient R&D funding

Few UAV system integrators have aeronautical experience

No airworthiness norms

No ATM regulations

Sense & Avoid : the critical issue

Flight in non-segregated airspace is impossible

Uncoordinated individual national initiatives

Up to now no international consensus on how to proceed

Result: Civil/commercial market cannot develop



THE SOLUTION TO "SEE & AVOID" ?





WHAT SHOULD BE DONE ?

Unifying
The
International
UAV
Community

- ✍ **Airworthiness norms for UAVs are to be defined**
- ✍ **Standards - Sense & Avoid (operational requirements) to be defined**
- ✍ **Definition of ATM regulations is to be initiated**
- ✍ **INDUSTRY SHOULD BE THE DYNAMO**
- ✍ **National approaches in co-operation with CAAs & military**
- ✍ **Efforts to be co-ordinated on an European scale in co-operation with NATO, EDA, Eurocontrol, JAA, EASA, DG TREN, national CAAs**
- ✍ **Approaches on both sides of the Atlantic should be co-ordinated:**
 - industry: Access 5, ASTM, CANSO, EUROCAE, RTCA, UVS Canada, UVS
 - authorities: EASA, Eurocontrol, JAA, NATO, FAA, ICAO
- ✍ **Efforts to be coordinated internationally (beyond Europe & N. America)**
 - Australia, Japan, S.Africa, Singapore (civil/com flight experience)
- ✍ **International approaches should be harmonized at the earliest stage**

A common terminology in English should be defined



UAV Systems: Rules & Regulations

Federating
The
International
UAV
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European Activities

Europe

JAA/Eurocontrol UAV TF

Europe

Euro UAV ICB

Eurocontrol ANT

EDA – 2C

France

DGA-DE/CEV - USAR

EDA - S&A

NATO

Air Group 7 - FINAS

USEP

AG7 FINAS - USAR

EASA – A.NPA

Sweden

UAV System Vision

EMAAG

UK

ASTRAEA

CANSO

Europe

EUROCAE WG-73



WG-73 on UAV Systems



EUROCAE is the European aeronautical standards organisation.

EUROCAE has an existing co-operative agreement with with RTCA.

Feb 2005

**EUROCAE becomes a member of UVS International;
UVS International becomes a member of EUROCAE**

Aug 2005

**EUROCAE & UVSI meet with RTCA SC203 and agree
on co-ordination & harmonisation of WG outputs**

Jan 2006

- EUROCAE Council agrees on the creation of WG-73**
- EUROCAE announces WG-73 on UAV systems**
- EUROCAE & UVSI send out Calls for Participation**

20 & 21 Apr 2006

WG-73 kick-off meeting at Eurocontrol HQs, Brussels



WG-73 on UAV Systems



Participation

Include international industry & regulatory authorities
Participation is funded by the participants

3 annual meetings (3 to 4 days each) + 1 in USA

Co-ordination

EASA, EDA, Eurocontrol, CANSO, Euro UAV ICB,
FAA, national CAAs, NATO-FINAS, RTCA

Objectives

Take an inventory of work already done & ongoing internationally

Initiate Sub-Groups to deal, amongst others, with:

- Terms & Definitions
- Sense & Avoid
- Command & Control
- Civil USAR (fixed wing)
- Civil USAR (rotary wing)

Preparation of non-solicited proposal to EASA re civil UAV system
airworthiness (USAR) regulations for fixed & rotary wing UAVs



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Community**

UVS INTERNATIONAL

**86 rue Michel-Ange
75016 Paris, France**

Tel.: 33-1-46.51.88.65

Fax: 33-1-46.51.05.22

pvb@uvs-international.org

pvb@uvs-info.com

www.uvs-international.org

www.uvs-info.com