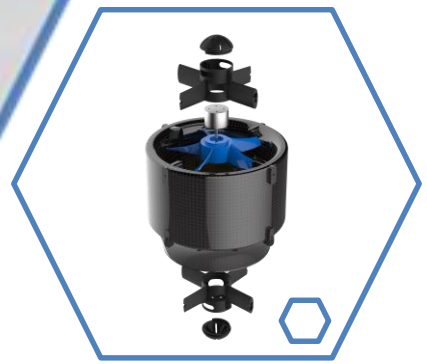


Heavy Lift
Transport & logistics
UAVs

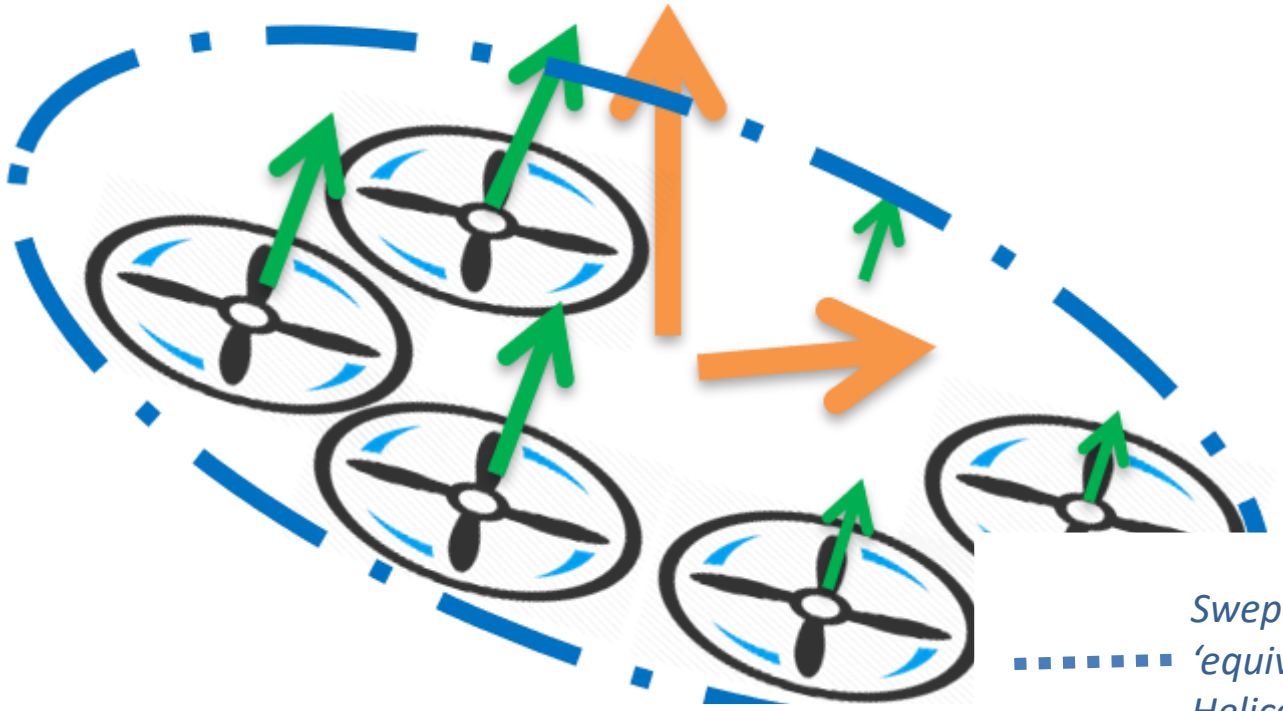
Turbo-drones for Logistics
Specifications & Use cases

Fondations

- **Founded in 2017** (France - Chantilly & Angers) led by Pr Brotherton-Ratcliffe & Robert Vergnes.
- Member of the **Neva** European consortium, benefits from 6+ years of R&D.

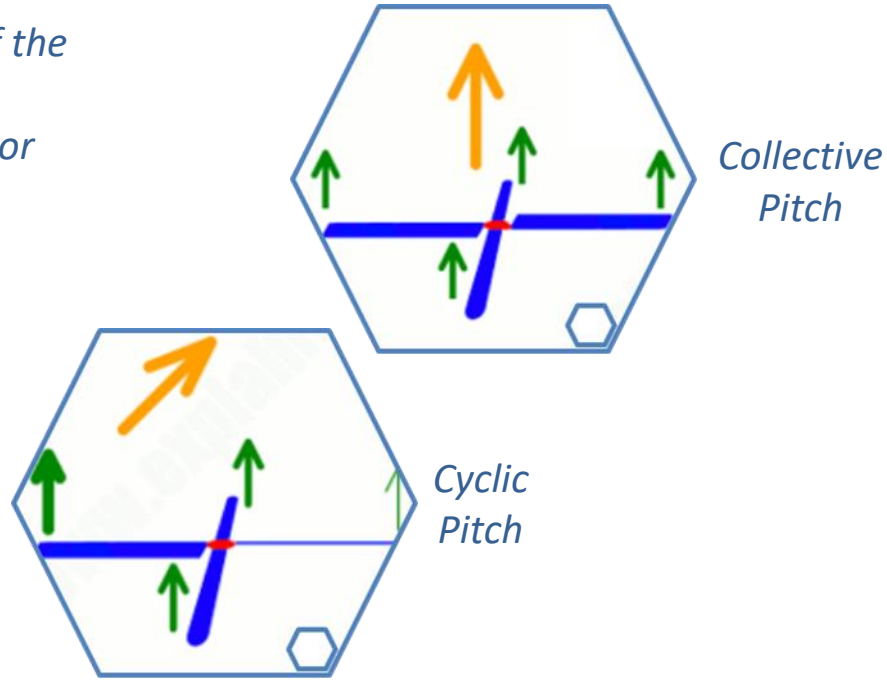
- Core technology: **Electric Turbines** (electric ducted fans - EDF) for **Distributed Propulsion**, energy sources and flight control.
- **Safety & Efficiency** serving new types of **Aerial Mobility.**

Distributed Propulsion



- Multi-rotors have No Cyclic – No Collective but **“simulates” helicopter Collective & Cyclic** by using the **thrust & position of each mini-rotors** (points of thrust).

Swept area of the ‘equivalent’ Helicopter rotor



Stable Flight !

- **Larger** is your **rotating-equivalent-wing** surface **larger** should be the **number of thrust points** you want to have.

OEM Turbines Technology

- **Plug & Play**
- Maintenance Schedule
- Time-meter (Hobbs-meter)*
- Competition grade ESC (Electronic speed Controller)
- **Highest Thrust density on the market for static thrust**
- **Highest Efficiency Turbines on the market for static thrust**
- Quality Controlled
- 10 Years Maintenance Plans
- **Compatible with all Flight Controllers**

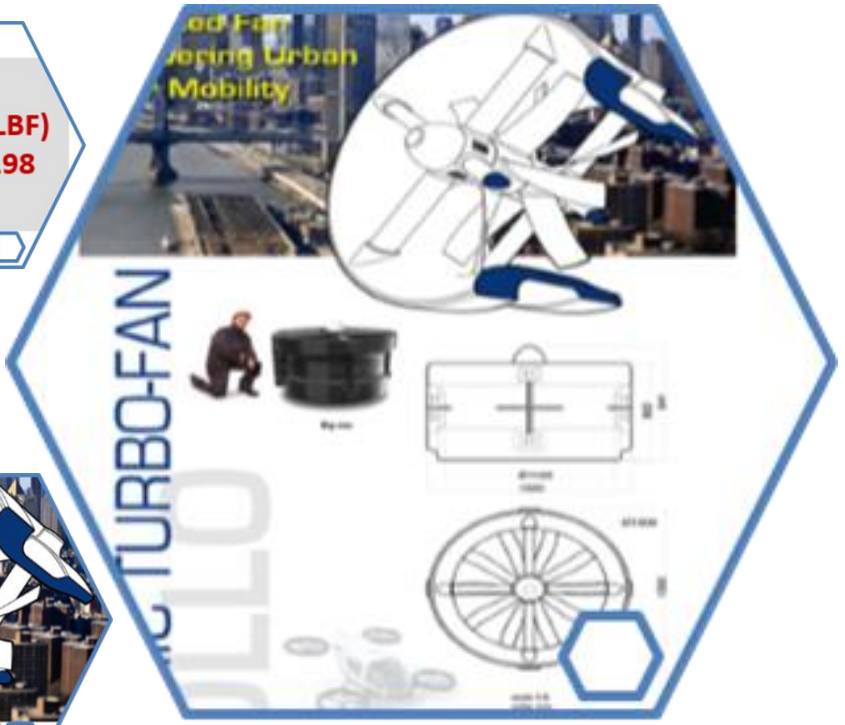
(*) depending on version

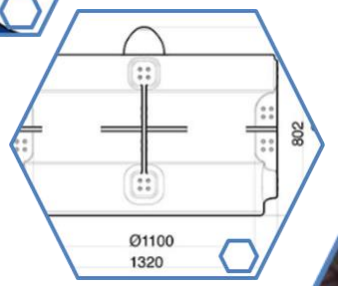
Thrust 3.7 KGF (8.2 LBF)

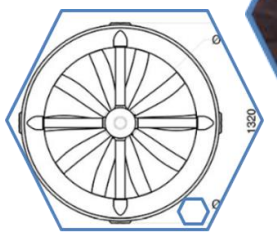
Available now !
Athena

Prototype alpha
Available Q2CY20
Apollo

Thrust 60 KGF (132 LBF) to 90 KGF (198 LBF)

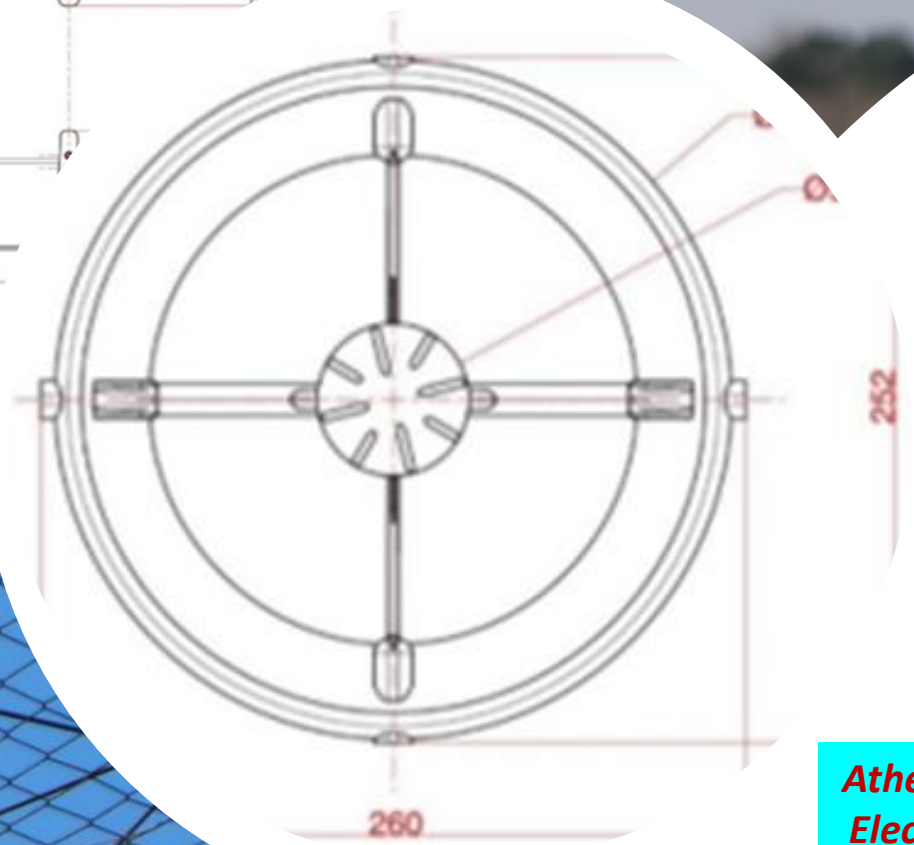




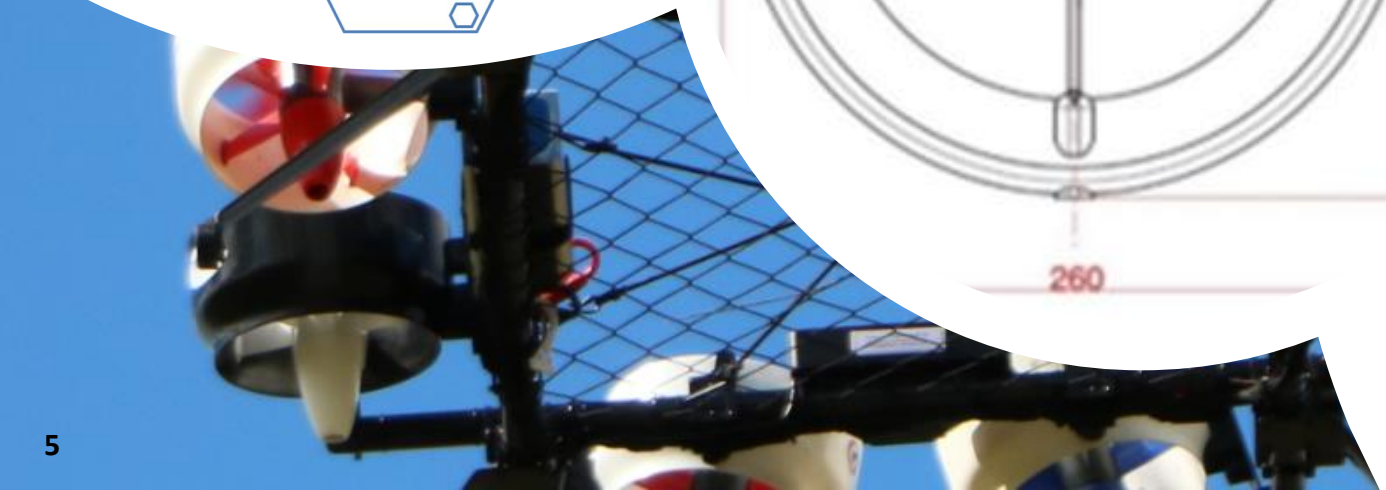


OEM Turbines Technology

Thrust 3.7
KGF (8.2 LBF)



Available now !
Athena



Specifications:

(Safety is intrinsic in the design of our Electric Turbofans (ETF), there are no un-caged propellers)

- **Internal redundancy with 2 separate stages, 2 motors and 2 Electronic Speed Controllers**
- **2 stages counter rotating**
- Reduced size
- High thrust density
- Greater efficiency (high power loading as measured in kg/kw) for VTOL and slow speed linear flight

Athena Series turbines are delivered fully assembled with Electronic Speed Controllers (ESC), motors and propellers

OEM Turbines Technology

- ESP is sole EMEA manufacturer for Neva Aerospace for Athena & Apollo Turbines
- **ESP has been awarded the " Seal of Excellence" by the European Union for its Apollo Project**
- *ESP "Pépite de la FrenchTech":*

https://lespepitestech.com/startup-de-la-french-tech/esp-sas

EASME

Why ESP ?

Key advantages & DNA

Safety…

Collision Tolerant

- **Multi turbine & battery redundancy**
  - Engine failure resilient
  - Intrinsically reliable
- Surrounding personnel risk friendly
- **Safe operation in civilian airspace (FLARM / ADS-B)**

Heavy Payload…

- **MTOW from 15Kg to 50Kg today, up to 150kg by Q4CY19**
- Agnostic & versatile payload types

Onboard Intelligence…

- **Flight safety artificial intelligence**
  - Smart guidance, identification, lock and target follow
  - GPS denied
- **Global Drone Information Management System**
  - Smart mission planner and scenarios

DRONES WITH ROTORS MEAN FREE BLADES :

POTENTIAL DANGER & RISK INCREASE

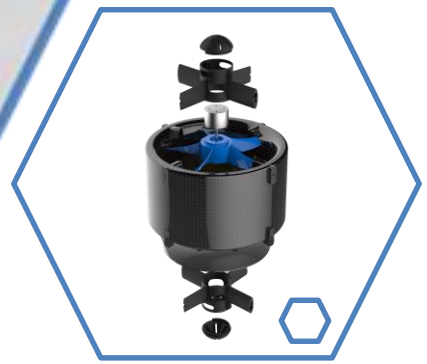
- FREE BLADES CAN INJURE PERSONNEL
- FREE BLADES CAN DAMMAGE ASSETS OR INSTIGATE SPARK

Full Personnel safety when flying …

SWITCH TO ELECTRIC DUCTED FANS FOR SAFETY FIRST COLISION TOLERANT DRONES

SAFER for HUMANS & ASSETS

- **SAFE : No Free Blades Rotating**
- **POWERFULL : Higher Thrust for Same Surface Area Footprint**



Heavy Lift
Transport & logistics
UAVs

USE CASES

May 2019

Sea Port & Drone Development

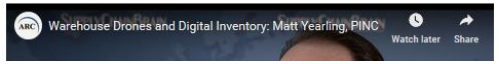
Warehouse|DC News

The Emerging Role for Warehouse Drones in the Supply Chain

Matt Yearling, CEO of PINC, a yard management and inventory robotics provider, discusses the immediate applicability of aerial robots or drones for expediting inventory checks in warehouses, tracking trailers in a yard, and counting inventory of new automobiles in a storage location.

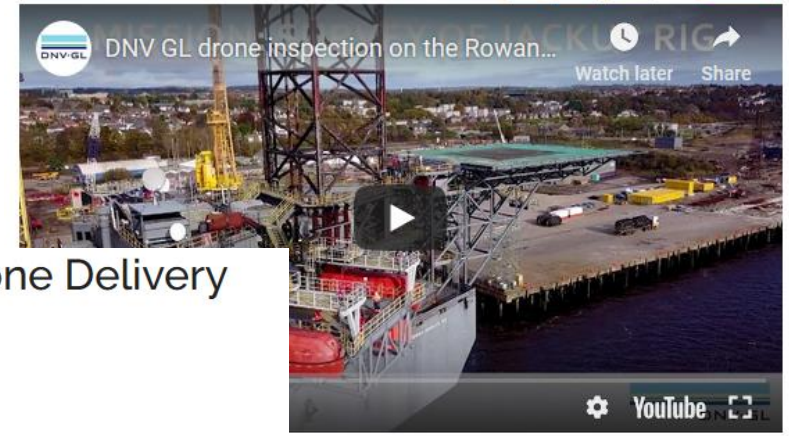
July 13, 2018 · By Bob Trebilcock ·

Five years is a lifetime in the world of technology, but maybe you remember how Jeff Bezos turned the supply chain world upside down in December 2013.



DNV GL Performs Jack-Up Rig Drone Inspection

08 Mar 2018 11.18am



y DNV GL of its surveyors using drones shows how easy it is to inspect large ing unmanned aerial vehicles (UAVs).

Innovation

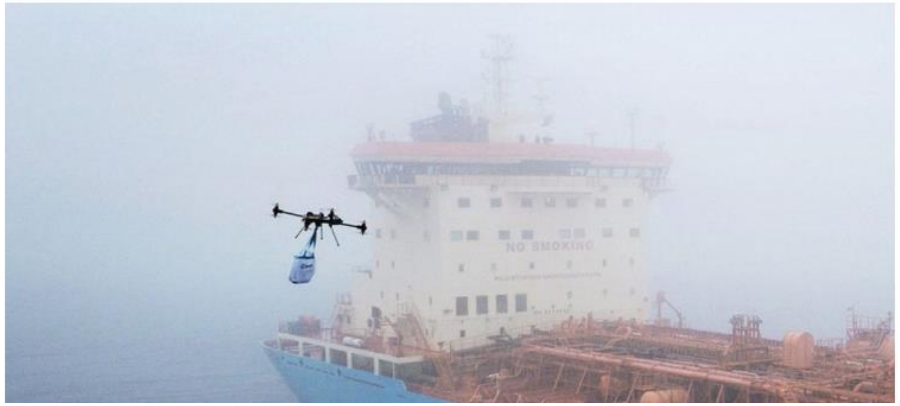
Airbus' Skyways drone trials world's first shore-to-ship deliveries

15 March 2019

EN

Maersk Tankers Claims First Drone Delivery to Ship at Sea

March 8, 2016 by Mike Schuler

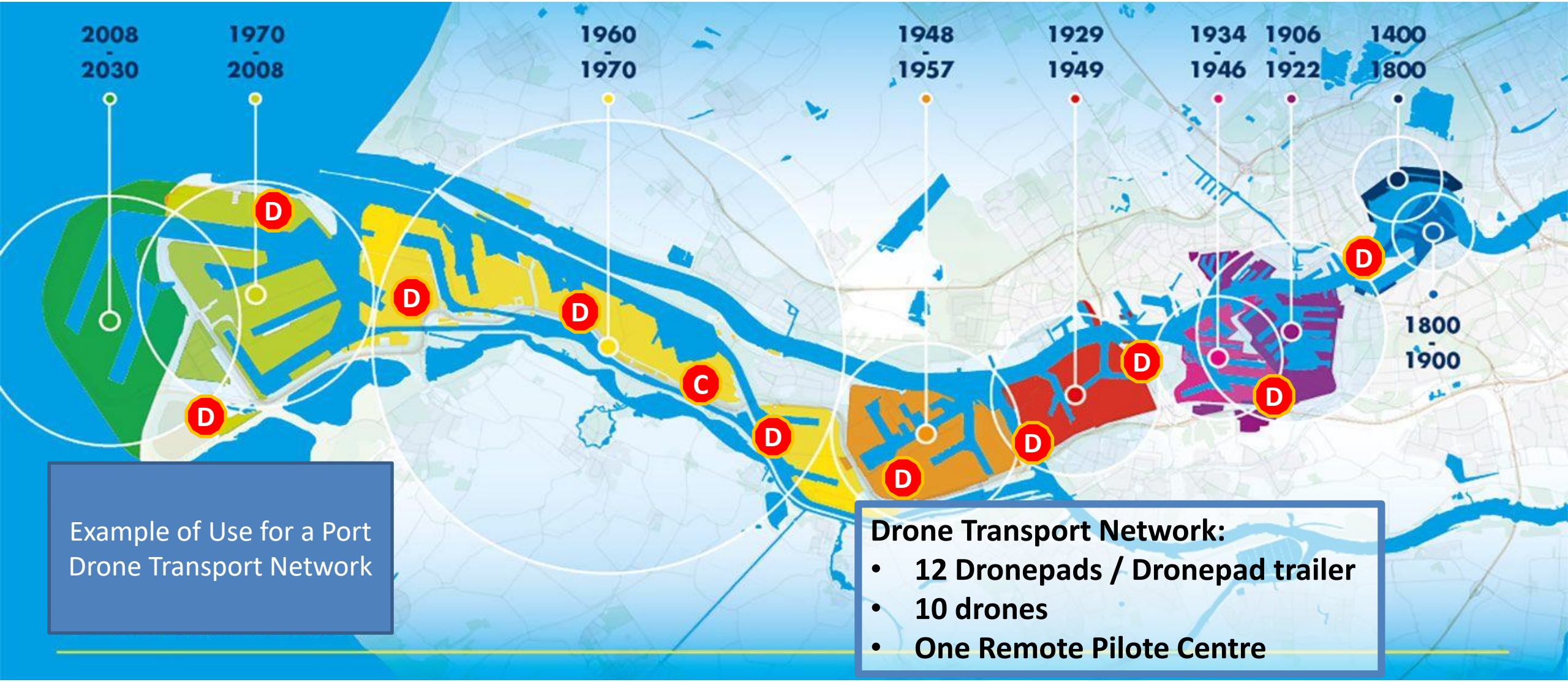


Heavy Drone Network (HDN) for Port Authority

- Provide **ultra-fast** on-site **transportation** for small packages (5kg to 50kg)
- Provides **support to emergency teams** (firefighters & Ambulance)
- Provides Port from/to Vessel fast transportation
- Container OCR ID and **localization**
- Provides on the spot **surveillance**

Heavy Drone Network for Port Authority

Proposed Network with Dronepads for Battery Reload



Example of Use for a Port Drone Transport Network

Drone Transport Network:

- **12 Dronepads / Dronepad trailer**
- **10 drones**
- **One Remote Pilote Centre**

D Minimum Dronepad Size or Size for Dronepad-Trailer : 9 SQM

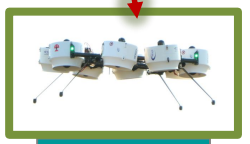
C Control & Command Centre

Transport Scenario

Aerial Bridge - Precision Landing

Return to ground station

3



Vertical Land Off

1

Vertical Take Off

2

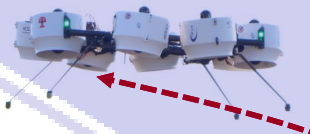
Complex Access

Emergency Scenario

Aerial Bridge - Precision Landing

Emergency Team Support

Medics
Fire extinguisher
Defibrilator
Medipack
Anti-venon & Blood supply



Return to ground station

3

2

Vertical Land Off

1

Vertical Take Off

Complex Access Emergency Area

Tracking OCR Containers

Our drones are equipped natively with 4G and can use your software onboard and/or connect to your PMS.(*)

OCR

Mobile 4G Link to Transfer
Data back Vidéo + OCR
Data-base with GPS
location

1 Vertical Take Off

2 OCR All Container in one given area

Complex Area

- ✓ Flight safety artificial intelligence
  - ✓ Smart guidance, identification, lock and target follow
  - ✓ GPS denied
- ✓ **Global Drone Information Management System**
  - ✓ Smart mission planner and scenarios

Transport Scenario

Aerial Bridge - Precision Landing

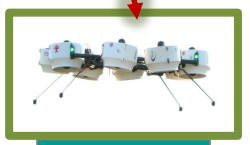
We provide ultra-fast on-site transportation for small packages (5kg to 50kg)

Return to ground station

3

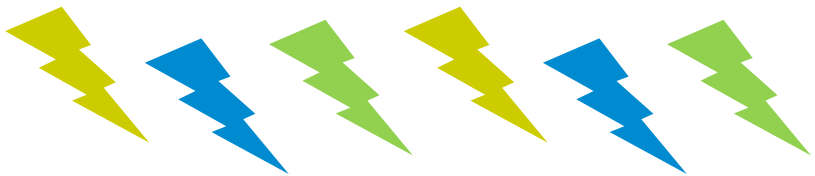
1

Vertical Take Off



Vertical Land Off

2



Complex Access

Tracking OCR Containers

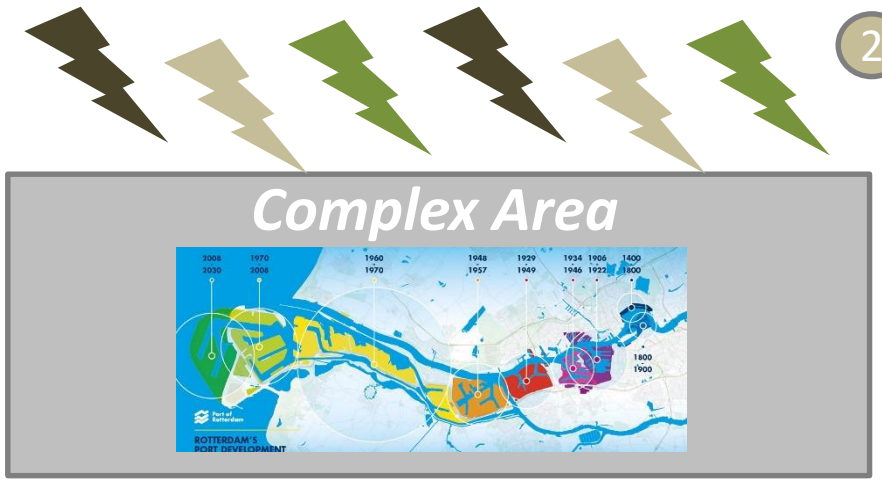
We provide container OCR ID identification & localization

OCR

Mobile 4G Link to Transfer Data back Vidéo + OCR Data-base with GPS location

1 Vertical Take Off

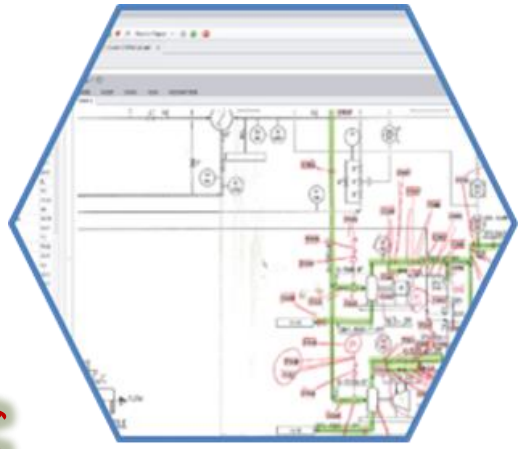
2 OCR All Container in one given area



- ✓ Flight safety artificial intelligence
  - ✓ Smart guidance, identification, lock and target follow
  - ✓ GPS denied
- ✓ **Global Drone Information Management System**
  - ✓ Smart mission planner and scenarios

Asset Inventory Management

We provide assets localization, tagging & management



1 Vertical Take Off

2 OCR All Container in one given area

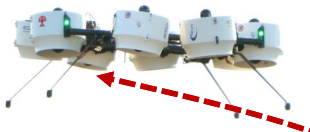
Complex Access or Hazardous Area

- ✓ Flight safety artificial intelligence
  - ✓ Smart guidance, identification, lock and target follow
  - ✓ GPS denied
- ✓ **Global Drone Information Management System**
  - ✓ Smart mission planner and scenarios

Emergency Rescue Scenario

Aerial Bridge - Precision Landing

We provide 24/7 support to emergency& rescue teams

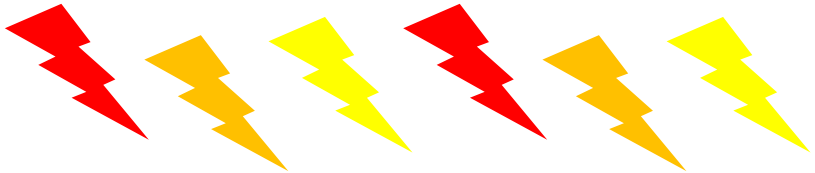


Return to ground station

3

2 Vertical Land Off

1 Vertical Take Off



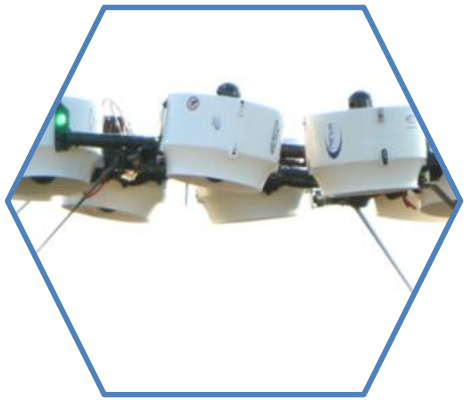
Complex Access Emergency Area

Emergency Rope Delivery

Bank to Bank river crossing

We provide 24/7 support to emergency& rescue teams

Ground Delivery Rope System – attached to Firefighter truck

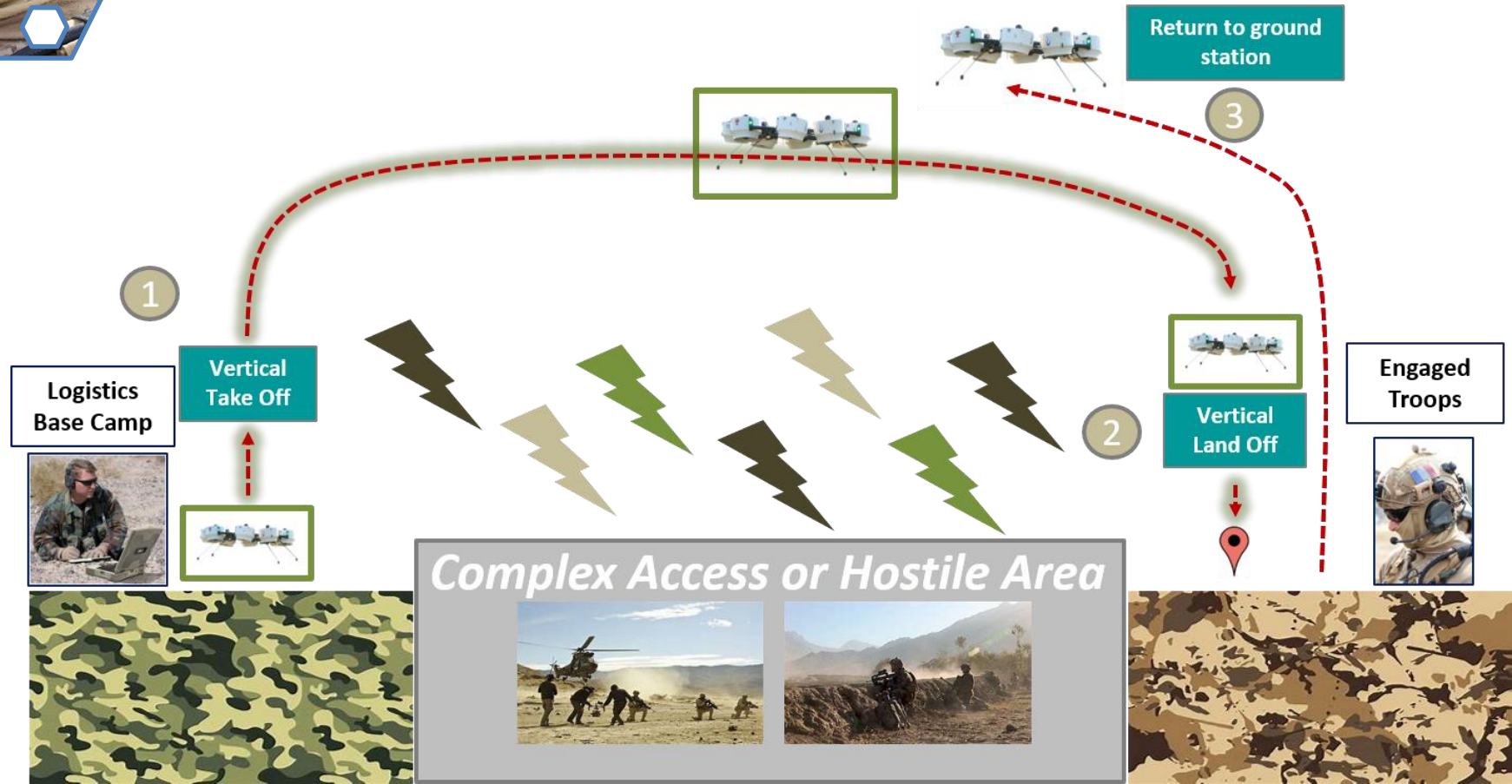


Defence Supply Bridge

Automated Aerial Bridge

We provide 24/7 support to engaged troops

Precision landing based on GPS coordinates – Radio/4G link



- **AERIAL SUPPLY BRIDGE:** Active combat theatre support (Ammunition & Misc refill)
- **TROOP ASSISTANCE:** Medical Aid (defibrillator, first aid packs)
- **TACTICAL COMMUNICATIONS:** Rapid secured communication link deployment.

Client's References & Use Case

- **AeroCorp US**, AERO began as the "special projects" division of InterMedia Development Corp. For the last 20 years, IDC continues to provide innovative "mission impossible" technical services and engineering support for the Department of Defense and has received a continuous 100% approval rating to date. IDC continues today to develop advanced technology systems and software in support of the U.S. Navy Headquarters, NavAir, and **U.S. Special Operations Command** (SOCOM).

- **M. J. Ratner, Technical Director of Aero-Corp US:** *"We integrated turbo-drone Wohler-b series in our fleet. Using static thrust EDFs provides a higher safety and allow for more flexibility for drone design. We recommend such solutions".*

AERO CORPORATION
Higher Vision™
Airspace Engineering & Remote Operations

— 04-2019

Client's References & Use Case

- **Royal Canadian Mounted Police** – R&D Dpt provides support to RCMP Special Operations and Missions.

- **Mr. M. Salitter, R&D at RCMP:** "We have tested several Neva's electric turbines and we are pleased with their compact dimensions and their thrust density. Neva's technology is key to improve the safety for heavy drone propulsion. I recommend the use of such product to improve drone safety".

Mission Scenarios

Automated Aerial Bridge

Video link: https://vimeo.com/330484360

- Calibration
- Indoor first flight
- Flight with 1x turbine removed
- Autopilot - 4G flight mission
- Late flight with Zoll AED PRO defibrillator payload
- Flight under rain & wind gust conditions

OEM heavy Drones

1st sales: NATO (DoD) member States

Max Take Off Weight (MTOW)

25Kg
Flight Time : 15-20 min

Dev Q4-2019: **150 Kg**
Flight Time : 20-30 min

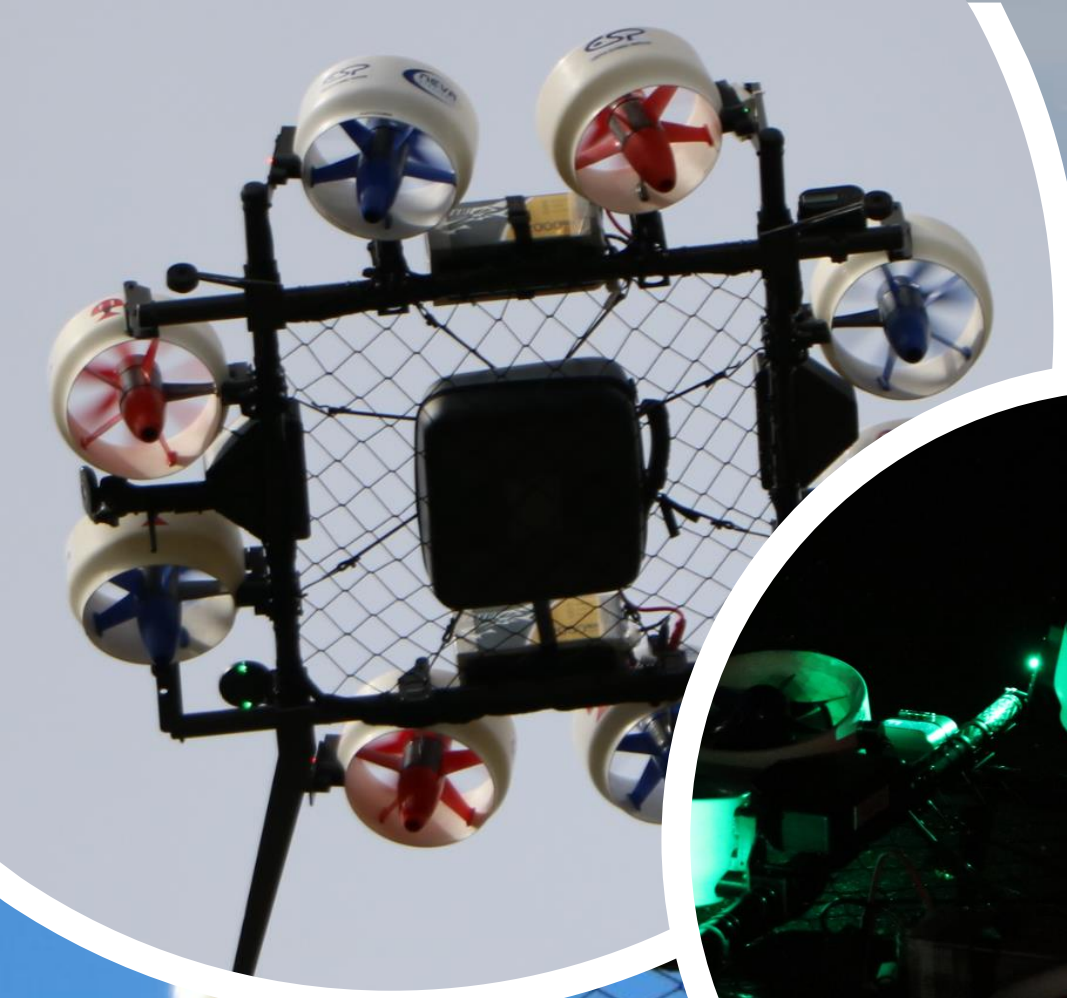
TRL9+

Personalized *depending on* ***YOUR missions***

- *Payload types*
- *Sensors*
- *Communications*

Scalable : 6 to 50+ turbines

EUROPEAN SUSTAINABLE PROPULSION



OEM heavy Drones

Sectors:

- Construction, Inspection, Oil & Gas
- Defence, Law Enforcement, Search & Rescue
- Logistics

Applications:

- Industrial Inspection, Asset Integrity & stock Management, Robotic Maintenance
- In-city / intra-site Transportation
- Active Defence, Surveillance, Supply to difficult access personnel, Law enforcement

Safety:

- Surrounding personnel risk friendly
- Aircraft awareness & Anti-collision

OEM heavy Drones

Onboard Key Components:

- Flight Controller: Pixhawk 2 Cube & GPS
- 4G Flight Management: Raspberry Pi 3B
- Tracker GSM-GPS (TKStar)
- Cameras: USB Camera, FPV Camera, Rpi IR Camera

Specifications:

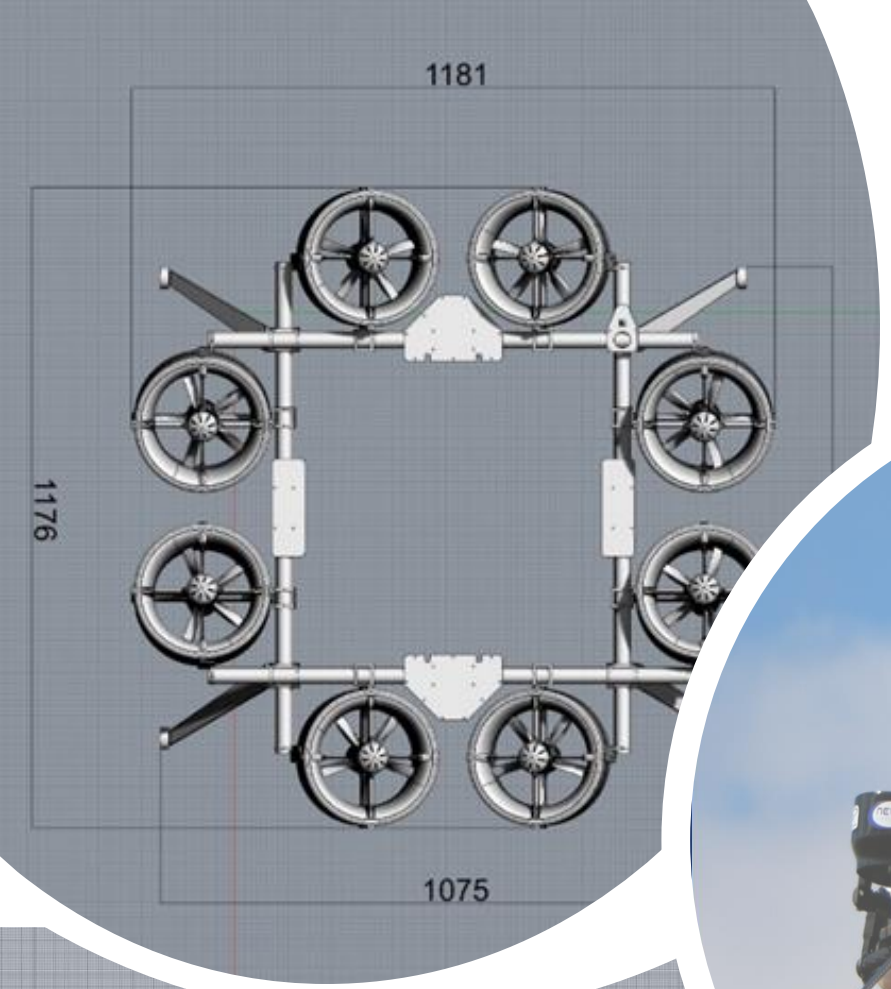
- UAV **MTOW up to 21Kg**
- UAV Payload from 1 to 5Kg
- Flight time: up 15 minutes(*)
- Multi-Turbines & Batteries redundancy
- Propulsion: 8 Turbines Athena V2
- Batteries: 8S (29.6V) 20C

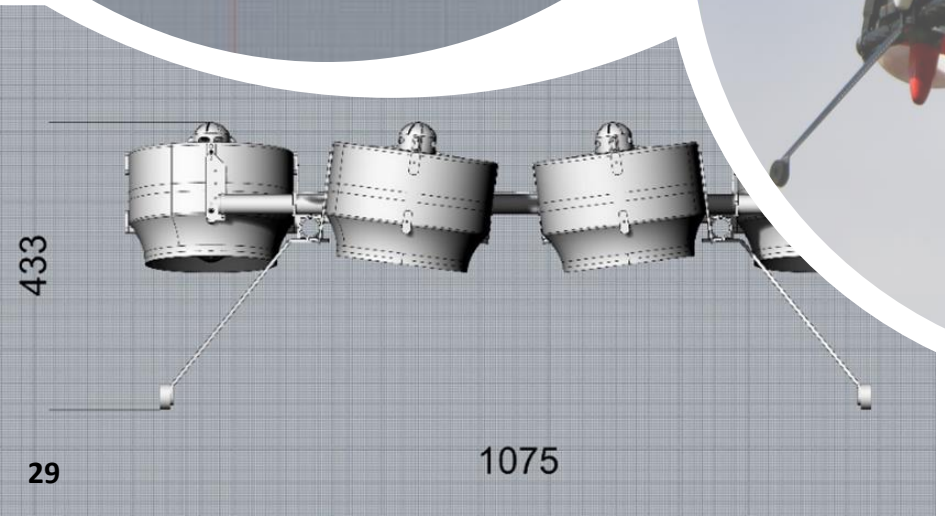
(*) Depending on payload & batteries choice, according to Performance Graphs

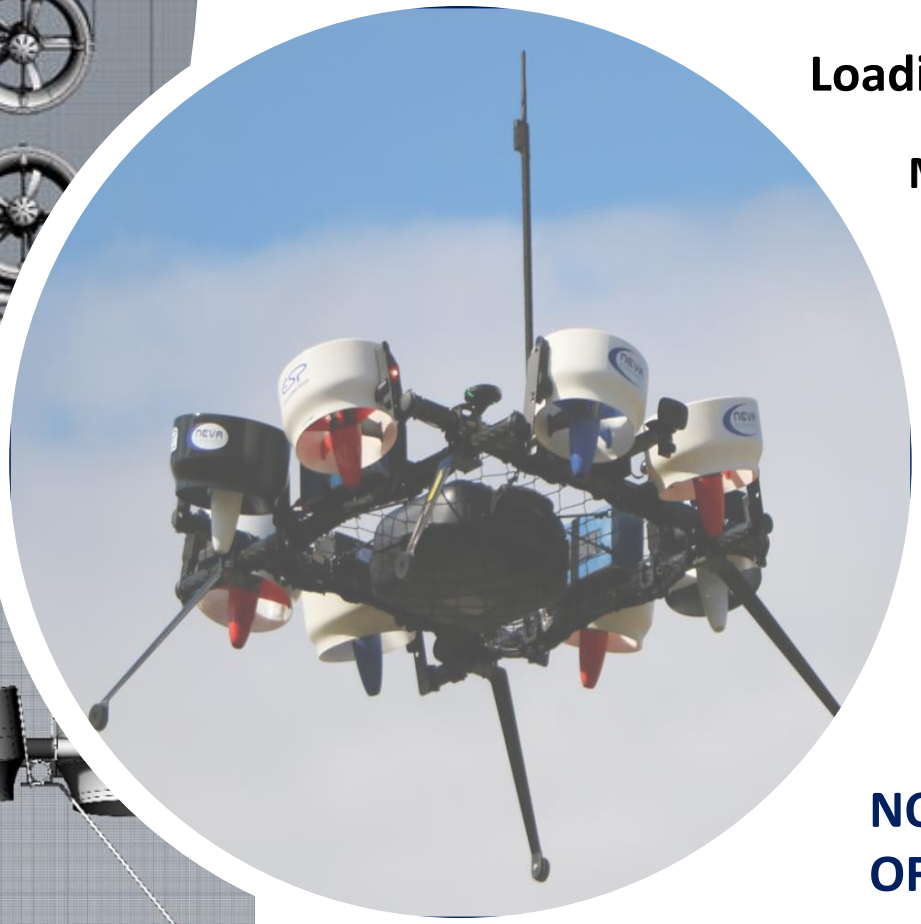
Ground Station & Trailer Key Components:

- Car-trailer for drone and equipment
- Ground station Toughbook & RC-Taranis
- Antenna(s) for Telemetry & 4G Route

OEM heavy Drones







Dry weight (no batteries) : **10 Kg** (22 Lb)
Dimensions : 1181 x 1176 x 433 mm

Loading payload & Batteries : **11 Kg** (22Lb)

MTOW : **21 Kg** (44Lb)

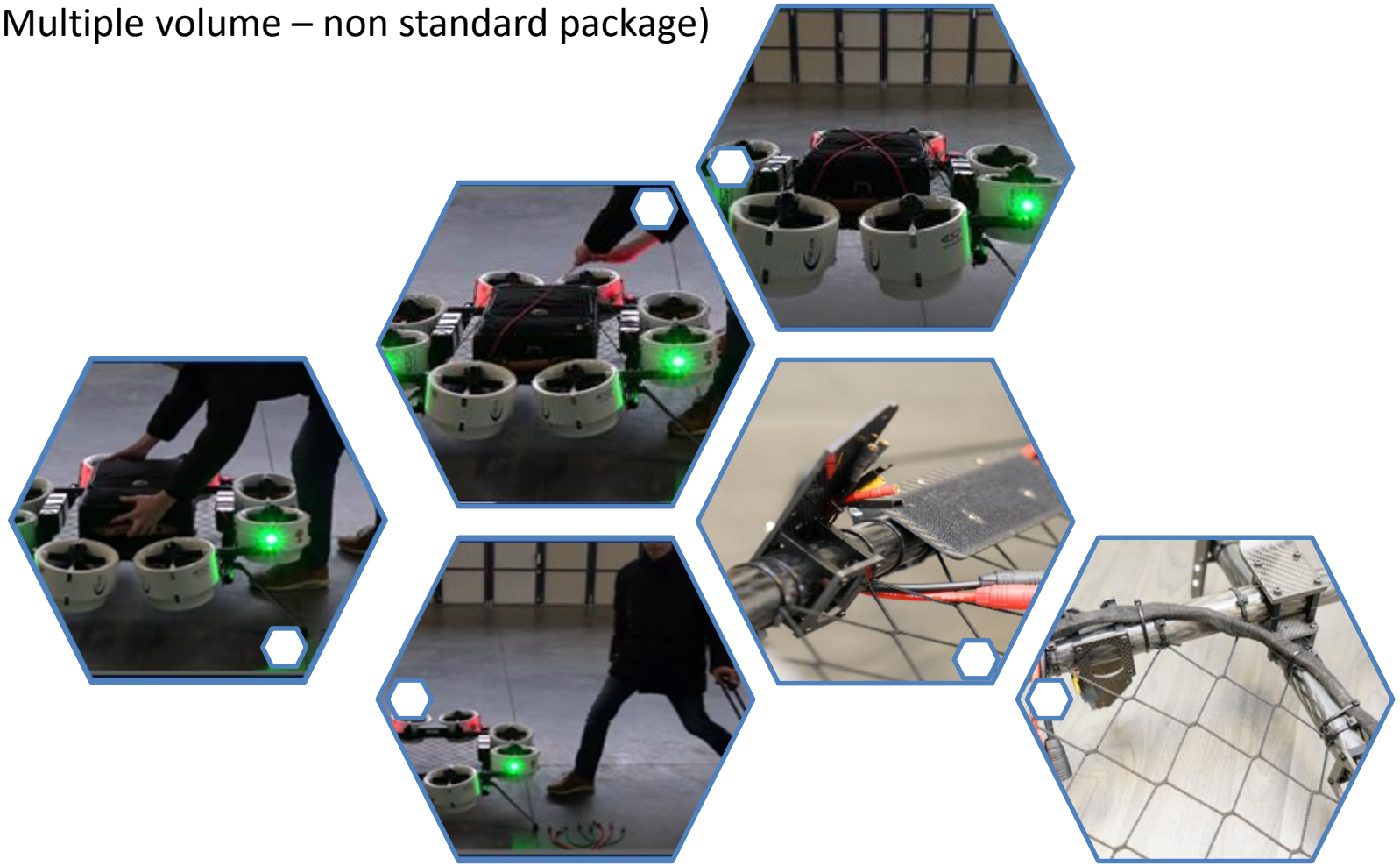
Maximum Operating Speed : **16 m/s**
Commercial operating speed : **8-10 m/s**
Appx : 0.5 Km per minute
- 10min Flight = 5 Km
- 15min Flight =7.5 Km

Maximum Wind Gust : **24 Knots**
Moderate Hail, Rain, Snow : **OK**

NO FLIGHT ALLOWED BEYOND WIND GUST OF 24 KNOTS (12 m/s - 44 Km/h – FORCE 5)

OEM heavy Drones

Max recommended Payload Size :
500 x 400 x 250 mm
(Multiple volume – non standard package)



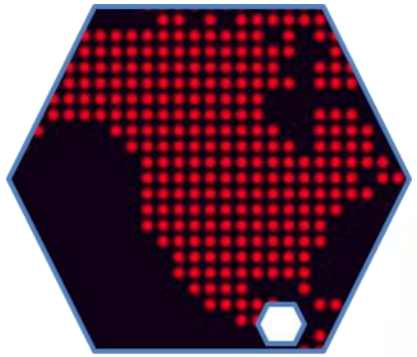
- All turbines and batteries connected together via one “Power Harness”

Power and Thrust Redundancy

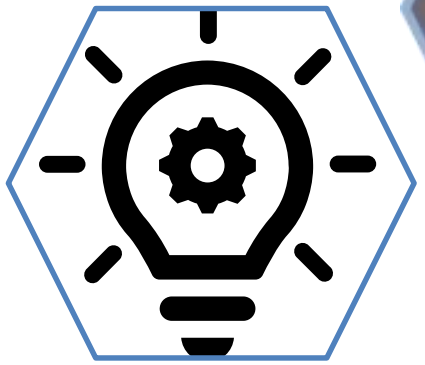
- Each battery has its own breaker.
- In case of battery failure, second battery can power all turbines.

Minimum Batteries C rating : 12 C
Suggested Batteries C Rating for operation: 20C
Note: redundancy may fail with lower C

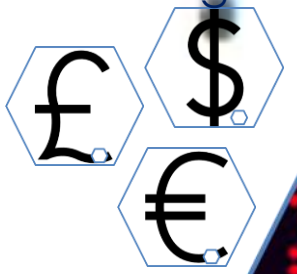
Smart Sales Solutions

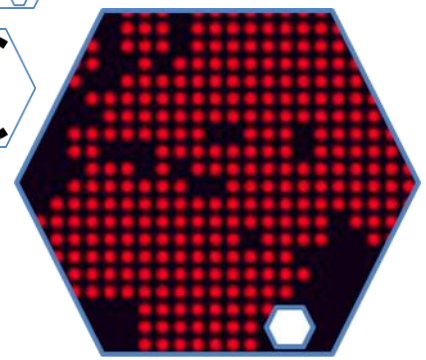


- **Client's pilot training services**
- **Maintenance Plan & associated engineering services**



- **EMEA 100%** Research, Development & Production
- **Sales from UK** (Neva Aerospace) **or France** (ESP)
- **Worldwide** coverage through appointed regional Sales Agents.





ESP & Neva Consortium

Our Sites

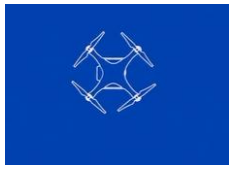
A consortium of 6 SMEs ready to serve our customers and partners needs

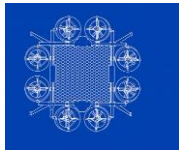
- **Holding HQ:** Brighton, UK
- **Main Workshops & Offices:** Located in France at Angers Loire Airport (West France), registered office in Chantilly (North France).
- **Manufacturing:** manufacturing takes place in the UK and in Paderborn (DE) at Schübeller Technologies factory and at SSTI Workshops in Vilnius (LT).

CONSORTIUM MEMBER

- **R&D:** Geola Technologies' Laboratory in Gatwick (UK).

Multi-Copter vs Turbo-drone





Multi-Copter

- Multi-copter flight time is less than 25% per the year due to weather restriction.
- Heavy Multi-copter cannot land when loaded if wind are higher than 10knot as they land facing the wind and their rotor may touch the ground.
- Heavy Multi-copter requires on-site maintenance specific knowledge to change propellers and motors and ESC.
- Heavy Multi-copter are dangerous due to the many free blades and propellers

Turbo-drone

- Turbo-drone can fly 75% of the year more than 6000 hours a year!
- Heavy Turbo-drone are collision tolerant while landing and can land while loaded with wind up to 25 Knot and 30knot gusts.
- Turbines on Heavy turbo Drone can be changed by a non professional operator in less than 15min without any calibration.
- Heavy turbo-drones are completely safe and tolerant to collision with human and objects.

Turbo-drone WINS

Helicopter vs Turbo-drone

Helicopter

- Helicopter flight time is less than 50% per the year due to maintenance restriction.
- Helicopters have only one rotor and one or two motor. Safety is provided by high maintenance schedule and certification.
- Helicopter TCO is very high : from €200/hr (small-size) to €4000/hr (heavy helicopter).
- Helicopter are expensive to purchase and finance from €250,000 to €15,000,000.

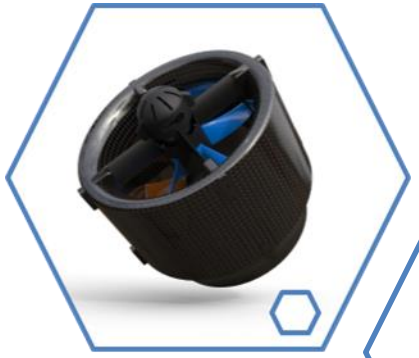
Turbo-drone

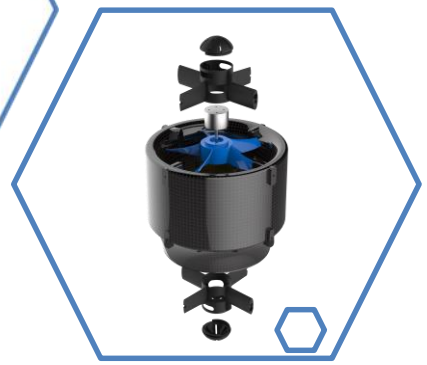
- Turbo-drone can fly 75% of the year more than 6000 hours a year!
- Turbo-drones have many redundant turbines which provide a higher safety. Turbines are electrical and maintenance is lower.
- Turbo-drone TCO is affordable: from €15/hr to €200/hr dependent on financing and run-time.
- Heavy turbo-drones cost from €100,000 to €500,000. For the same budget one can buy many turbo-drones.

Turbo-drone WINS

Focus on what you do best ...

Rely on us to keep them flying...





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