EGU General Assembly 2023

FlyRADAR

HYPERION

Technical choices , constrains and specifications of FlyRadar UAV

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under MSCA-RISE2020 grant agreement No 101007973

E.G.U. Vienna, Austria & Online | 23–28 April 2023

Sommary

1. Constraints linked to the Field according to WP 1 et 2
2. Technical requirements according to WP2.1 et 2.2
3. Radar requirements according WP3.3
4. Specifications
5. Technical choices
6. First tests
7. Conclusions and remaining work

Sites selected according to WP1 and WP2

Name of Site	Country	Coordinates		Lithology	Structure	Interest	Comments	Martian analog	References
		Lat	Lon						
Tabernas	Spain	37°03'N	2°23'W	Sediments	Flat Layers	Science	Active process	Yes	Canton et al., 2003
Dallol	Ethiopia	14°14'N	40°17'E	Volcanic deposit, salt layer, sediments		Science	Active process	Possibly	Lopez Garcia et al., 2020
Port Tarfaya	Morocco	27°38'N	13°02'W	Sand	Dunes	GeoSite*	Active process	Yes	Gardin et al., 2011
Azrou	Morocco	33°26'N	5°13'W	Volanic flows		GeoSite*	Very recent lava	Yes	Baadi etal., 2021
Tichka	Morocco	31°17'N	7°27'W	Plutonic rocks		Science	Fossil process	Possibly	Lécuyer et al., 2017
Foum Zabel	Morocco	32°10'N	4°22W	Carbonate layers		Science	Fossil process	No	Quiquerez et al., 2013
Bou Dahar	Morocco	37°17'N	3°25'W	Massive Carbonates		Science	Fossil process	No	Scheibner and Reijmer, 1999
Erfoud	Morocco	31°25'N	4°15'W	Silt cover		Science	Active process	Yes	*Bouaamlat et al., 2016*

Table 1: Selected sites for tests of the Fly Radar System.

***A "geosite" is a site of patrimonial interest that should be promoted for visit by the public*

Technical requirement according WP 2.2

	Earth	Mars
Vertical Resolution [m]	0.1 to 5 m	0.1 to 5 m
Horizontal Resolution [m]	0.1	0.1
Covered surface [km²]	1	0.5
Distance between tracks [m]	<10	<20

Table 1: Performance parameters expected from scientific requirements.

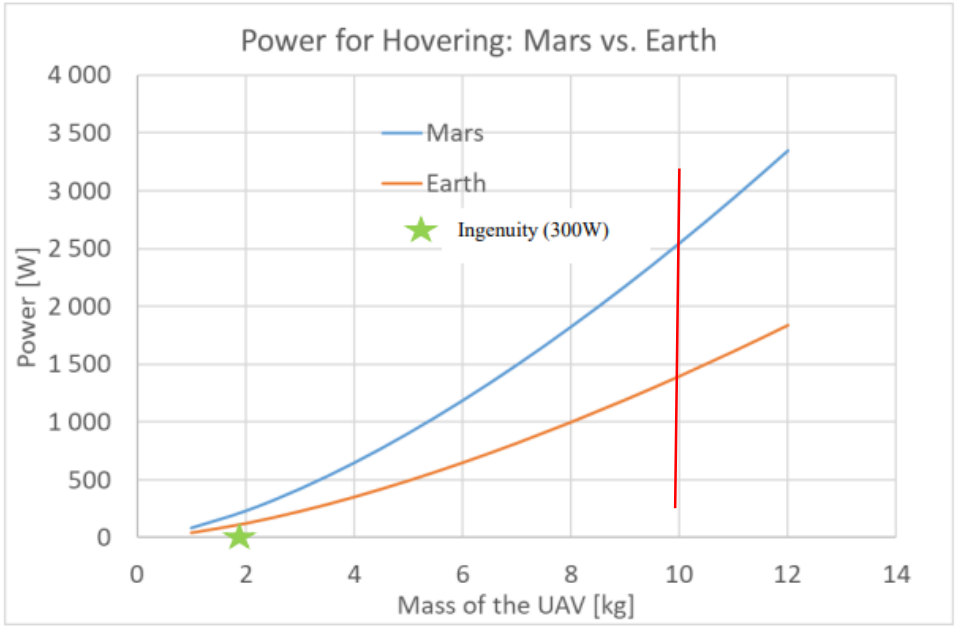


Figure 2: Power for hovering considering the theory of Rankin Froude and an efficiency of 0.5 in Martian ($g=3.71\ m.s^{-2}$, $\rho=0.020\ kg.m^{-3}$) and terrestrial ($g=9.81\ m.s^{-2}$, $\rho=1.225\ kg.m^{-3}$) conditions. The length of the blades is 0.5 m in both cases. The example of Ingenuity is reported (green star).

UAV performances

UAV on Earth:

- Battery system
- GNSS and IMU
- Regulations

UAV on Mars :

- Tethered powered
- georeferenced image (take by the drone)

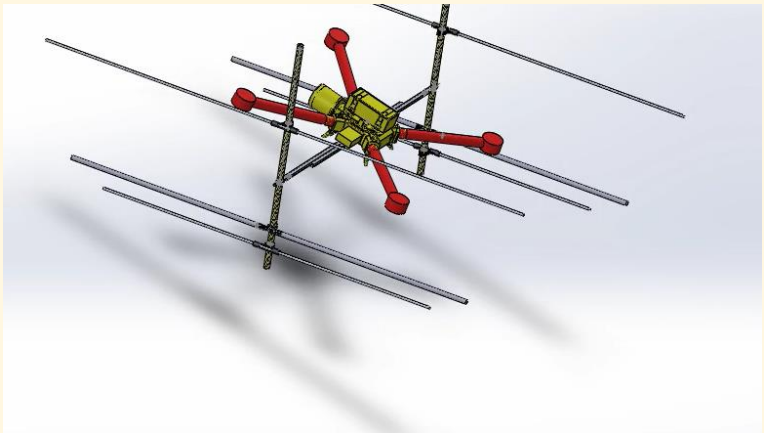
Radar's miniaturization WP3

Antennas size :
2 antennas of about 2m

Go from

TO

Radar weight
About 30 kilos



The smallest and most aerodynamic antennas possible!

Less than 4 kg !

Required specifications

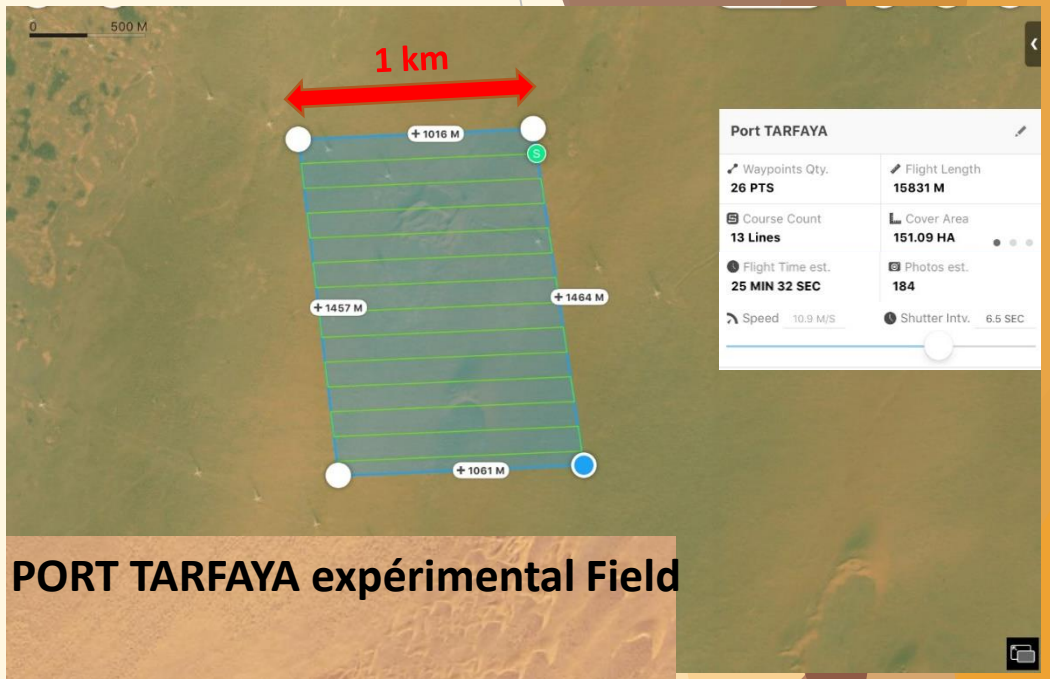
FlyRADAR

Finally,
The perfect drone for the FlyRadar project must:

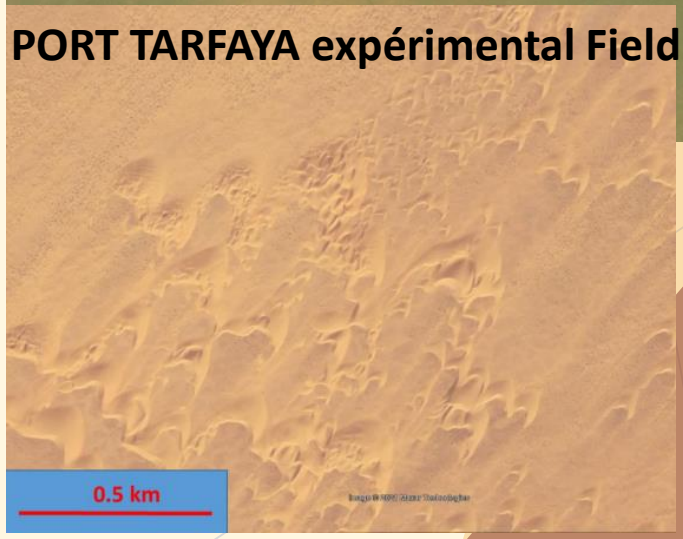
- ✓ Be able to carry 4kg (drone + antennas)
- ✓ Fly for 30 minutes with this payload
- ✓ Fly at an average speed of 10m/s
- ✓ Be able to fly at low altitude
- ✓ Cover 15km linear/flight

- ✓ Operate at temperatures of 50° C
- ✓ Be dustproof
- ✓ Be able to fly in 4 m/s wind

- ✓ Have a good aerodynamic performance (antennas…)
- ✓ have antennas oriented perfectly parallel to the ground (for signal quality)
- ✓ Be able to power the radar
- ✓ Do not interfere with the radar signal



PORT TARFAYA expérimental Field



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First Technical choice

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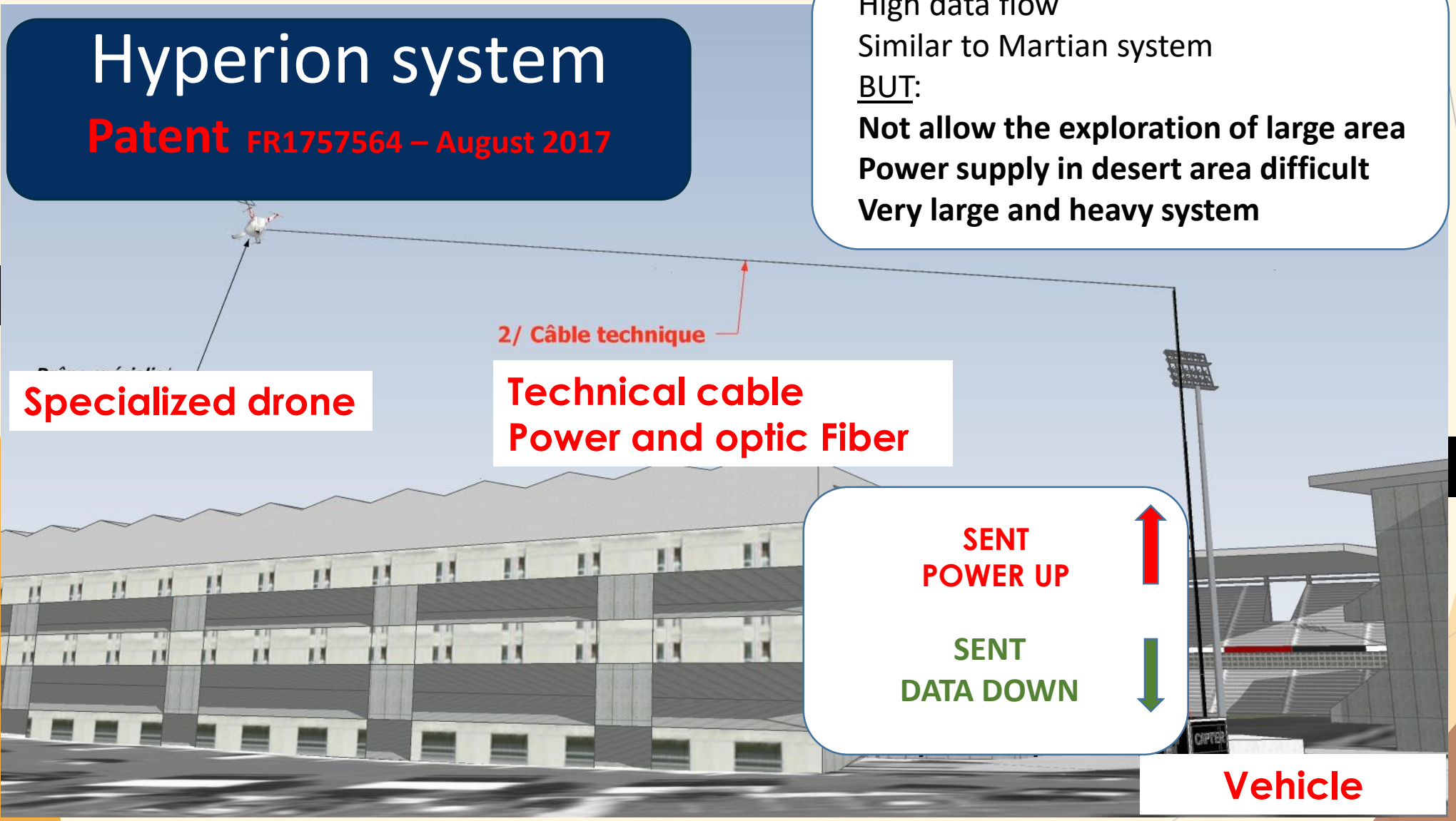
Hyperion system

Patent FR1757564 – August 2017

High data flow
Similar to Martian system
BUT:
Not allow the exploration of large area
Power supply in desert area difficult
Very large and heavy system



Specialized drone

Technical cable
Power and optic Fiber

SENT
POWER UP

SENT
DATA DOWN

Vehicle

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Final Technical choice

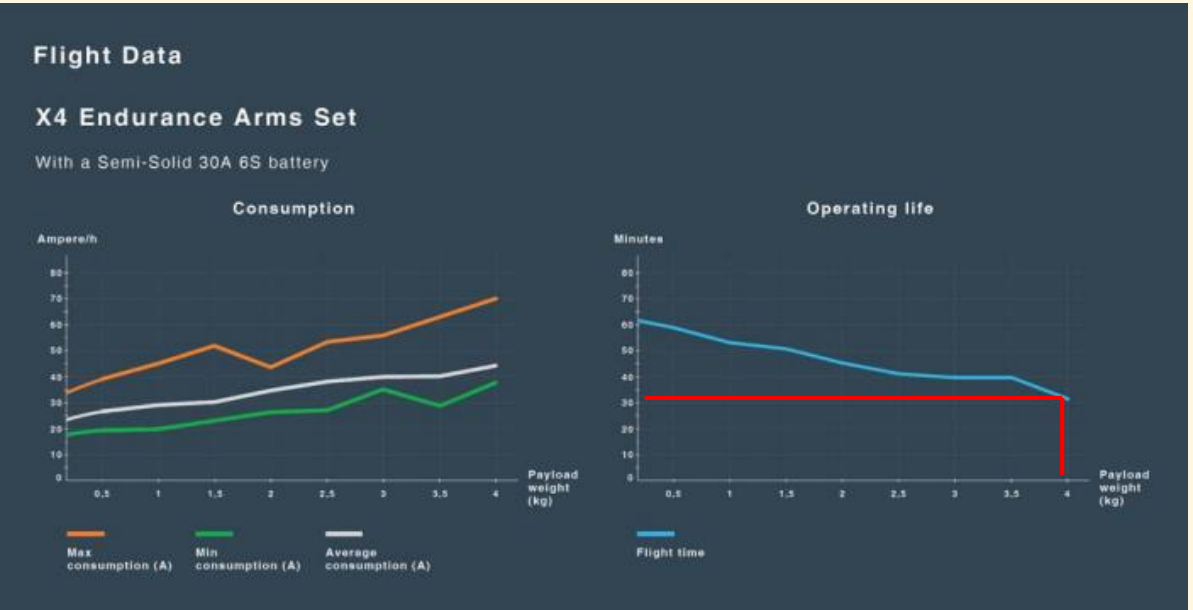
TUNDRA

HEXADRONE

MODULAR | WEATHERPROOF | MULTIPURPOSE

Custom UAV developed by hyperion and hexadrone

- ✓ Air conditioning for electronics
- ✓ Special protective paint
- ✓ Dust and waterproof
- ✓ Adapted autonomy (with endurance arms)



A collaborative design

Interchangeable arms

Modular electronics

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First Tests

Conclusions – still to be done

Conclusions:

- ✓ Autonomy
- ✓ Payload
- ✓ Speed

Still to be done:

- ✓ Autonomy with powered radar
- ✓ Interference between radar /remote control

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THANKS FOR YOUR ATTENTION

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