

Where Courage Meets Technology



VECTOR SENSOR FOR HF DIRECTION FINDER

A REVOLUTIONARY WAY TO TACKLE THE HF CHALLENGE



HF is not dead...



Narco - Terrorism



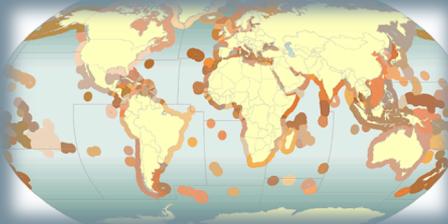
Pirates



Illegal immigration



Urban & jungles area hostile activities



Exclusive Economic Zone (EEZ) protection



Search & Rescue

Why HF?

hf walkie talkie

הגדרות כלים : עוד סרטונים קניות מפות תמונות הכל

2,680,000 תוצאות (0.47 שניות)

ממומן

hf walkie talkie ראו

Product Name	Price (SGD)	Source
1PCS Baofeng UV-5R Walkie	37.74	LightInTheBox
Xiaomi Mijia Walkie Talkie 1s	69.90	..azada Singap...
NOMU T18 IP68 Waterproof	415.14	Shopee
2PCS Walkie Talkie Baofeng	34.31	LightInTheBox
Walkie Talkies Rechargeable	39.99	Amazon.sg
Baofeng BF-8000D Walkie	58.27	sea.banggood....

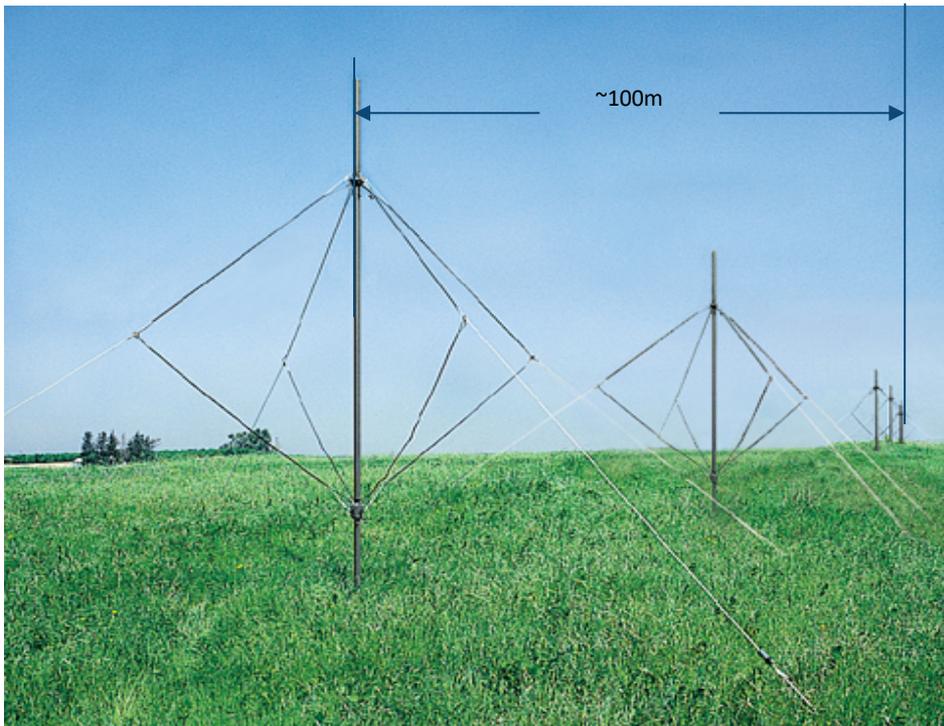
לדף המתורגם walkys < Consumer Electronics < www.alibaba.com

Hf Walkie Talkie - Alibaba

Alibaba.com offers 1491 hf walkie talkie products. About 46% of these are - 1491 products Walkie Talkie, 0% are Mobile Phones. A wide variety of hf walkie talkie ...

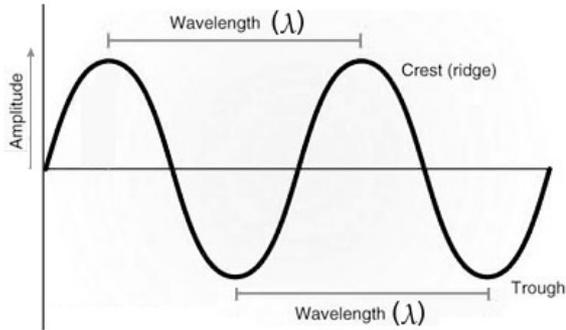
- Accessible
- Cheap
- Physical characteristics
- Advanced generation:
 - Digitized
 - FF\FH
- Hard to Geo-Locate

Conventional HF DF Ground System



And why is that?

A journey to high school physics...



$$c = \lambda \nu$$

speed of light

wavelength
(Greek letter, lambda)

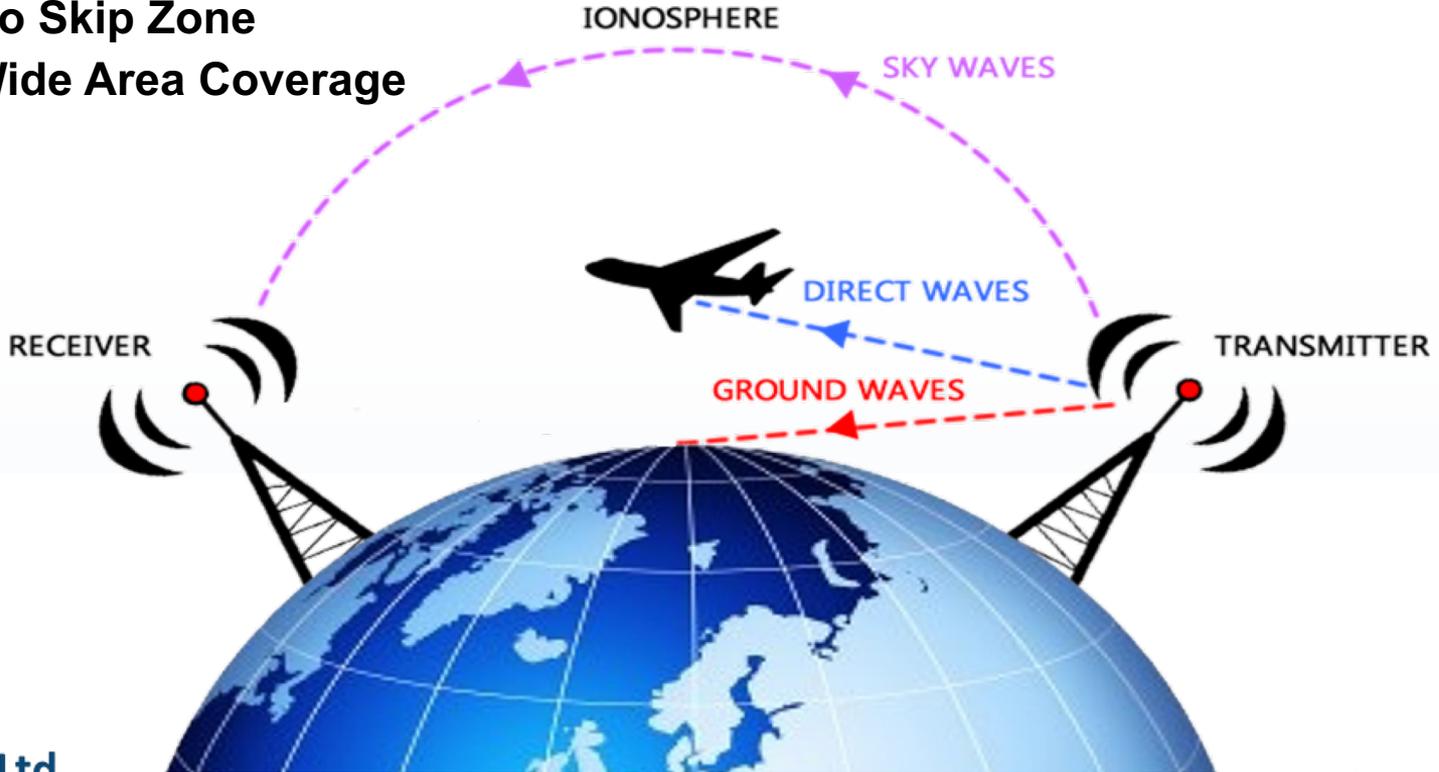
frequency
(Greek letter, nu)

Wavelength for HF vary from 10 to 100 m

Conclusion – interferometer will require multiple antennas over large area

✦ Using Direct Waves:

- ❖ No Skip Zone
- ❖ Wide Area Coverage





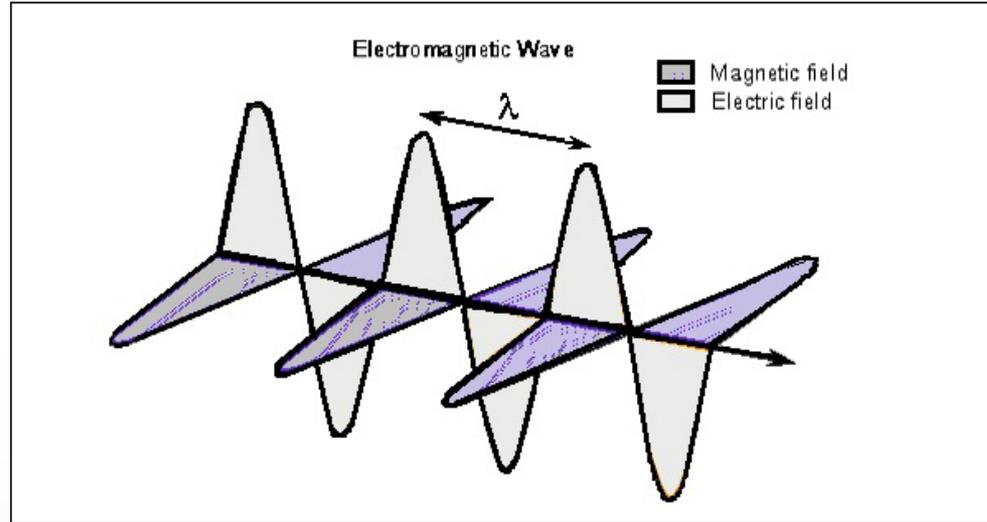
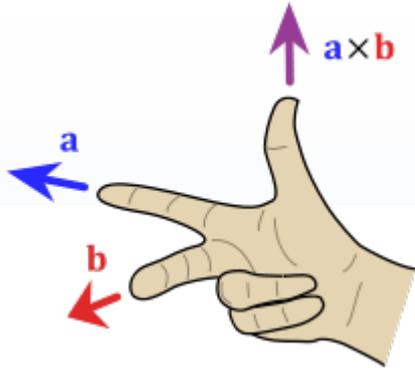
3D Aerial HFDF

New Technology for
Instantaneous Geo-Location



Poynting Vector Theorem

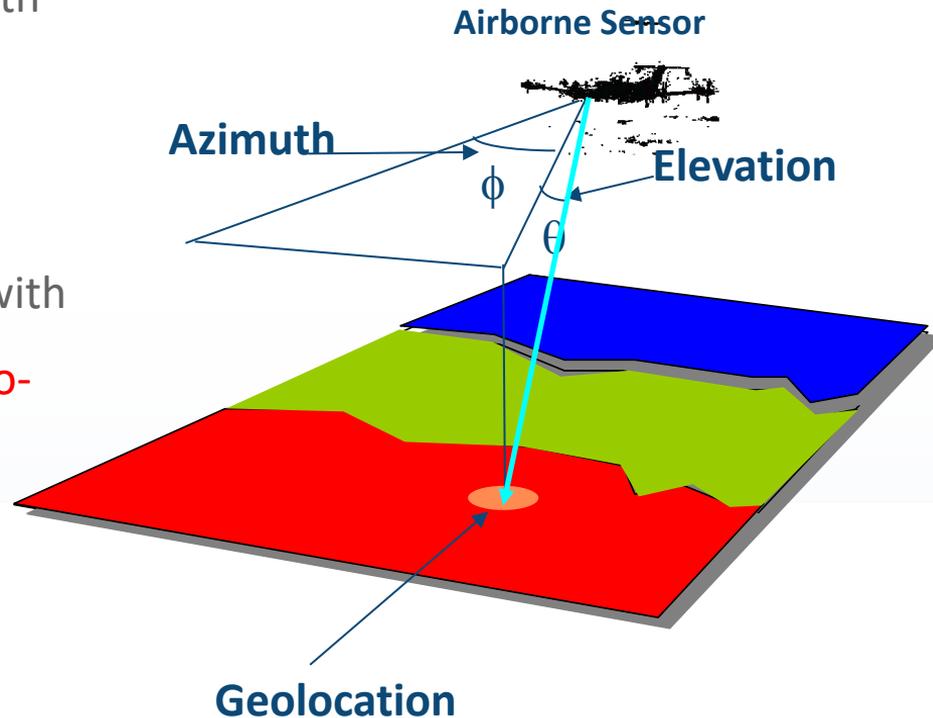
The Principle:
DF using Poynting vector



$$S = E \times H^*$$

Vector Sensor - Basics

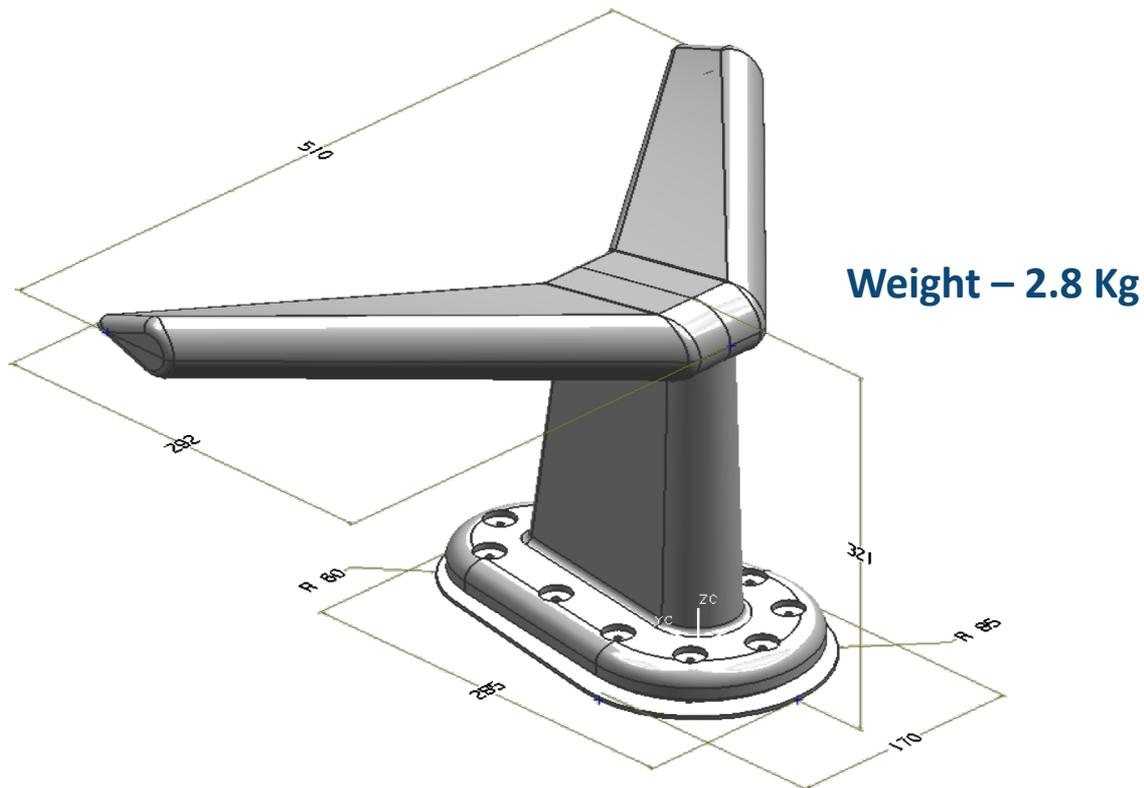
- The DF **estimated direction is a 3D** (i.e. azimuth **and** elevation)
- Vector Sensor Array (VSA) on aerial platform enables the intersection of the 3D direction with a Digital Terrain Map (DTM) establishing a **geo-location from a single platform.**





Airborne Implementation

Compact & Light Weight HF DF Antenna Array





The Airborne VSA HFDF System Units



Antenna Array

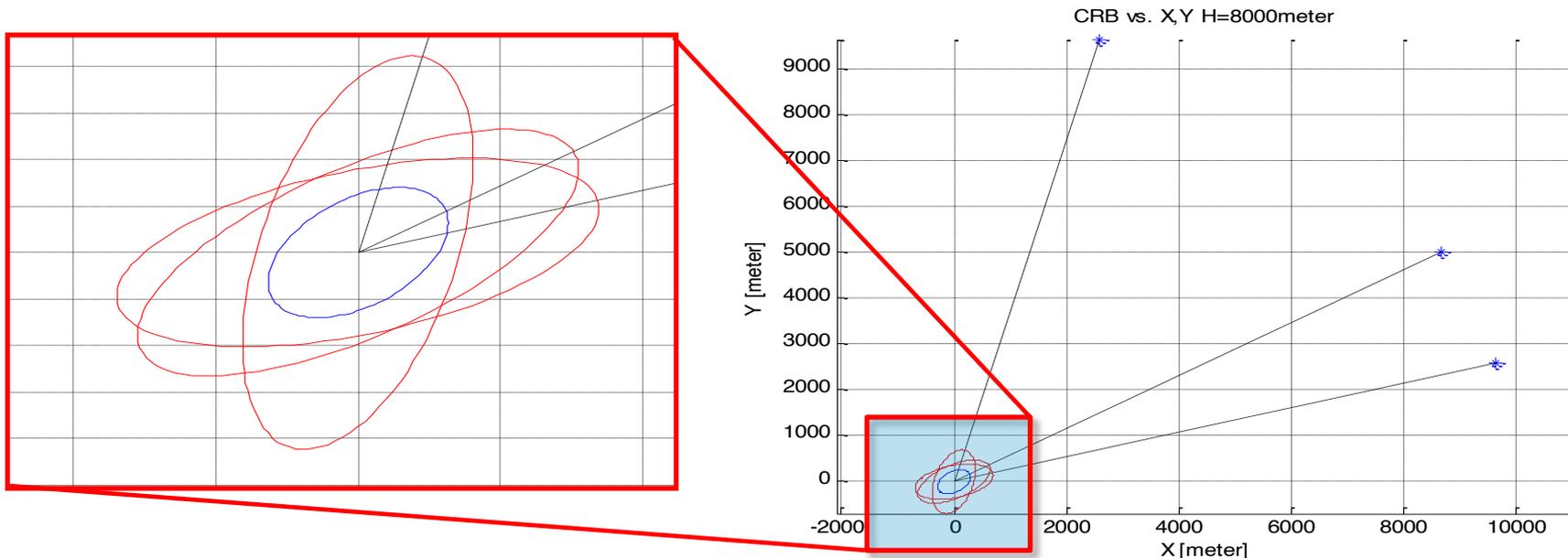


**Multi- Channel COMINT
Sensor
(MCCS)**

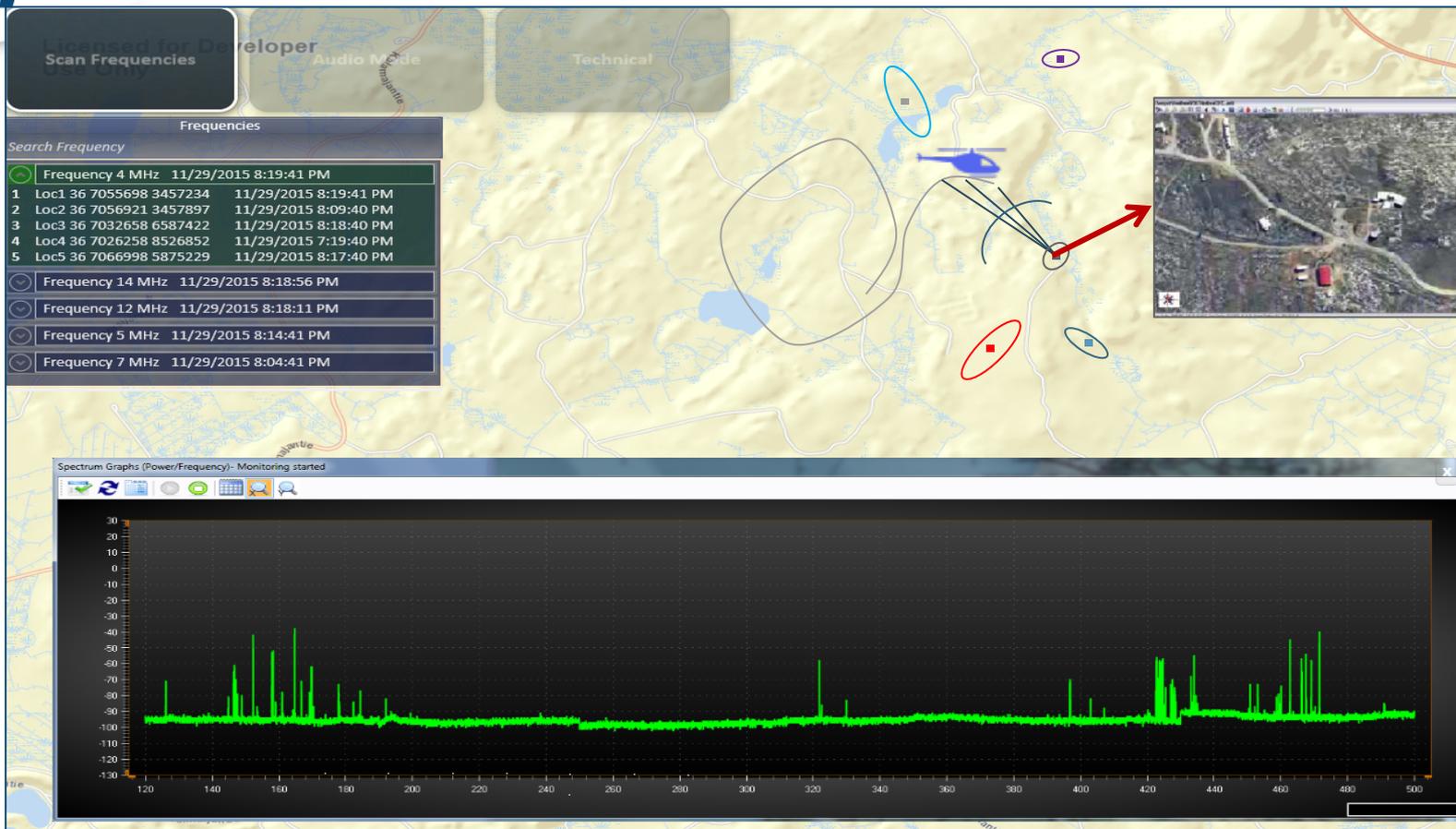
Host & WS

Enhancing The Location Product

- Integration of measurements enhances the location product



HF DF cues the optical sensor – Typical Display



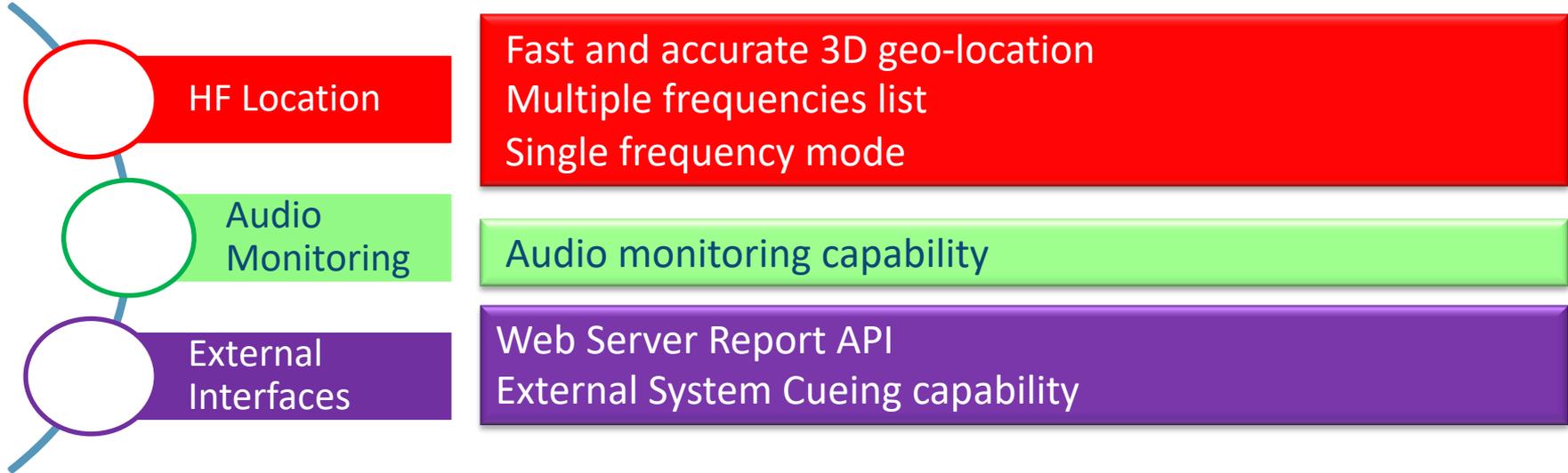


Innovative Airborne 3D HFDF sensor Capabilities

- Physically small compact Vector Sensor antenna (VSA) array
- Instantaneous azimuth (360°) and elevation ($\pm 90^\circ$)
- Instantaneous geo-location utilizing DTM!
- Accuracies better than 2° RMS
- All modulations & polarizations
- No Skip Zone
- Suitable for various manned and unmanned aerial platforms



Complete System Capabilities

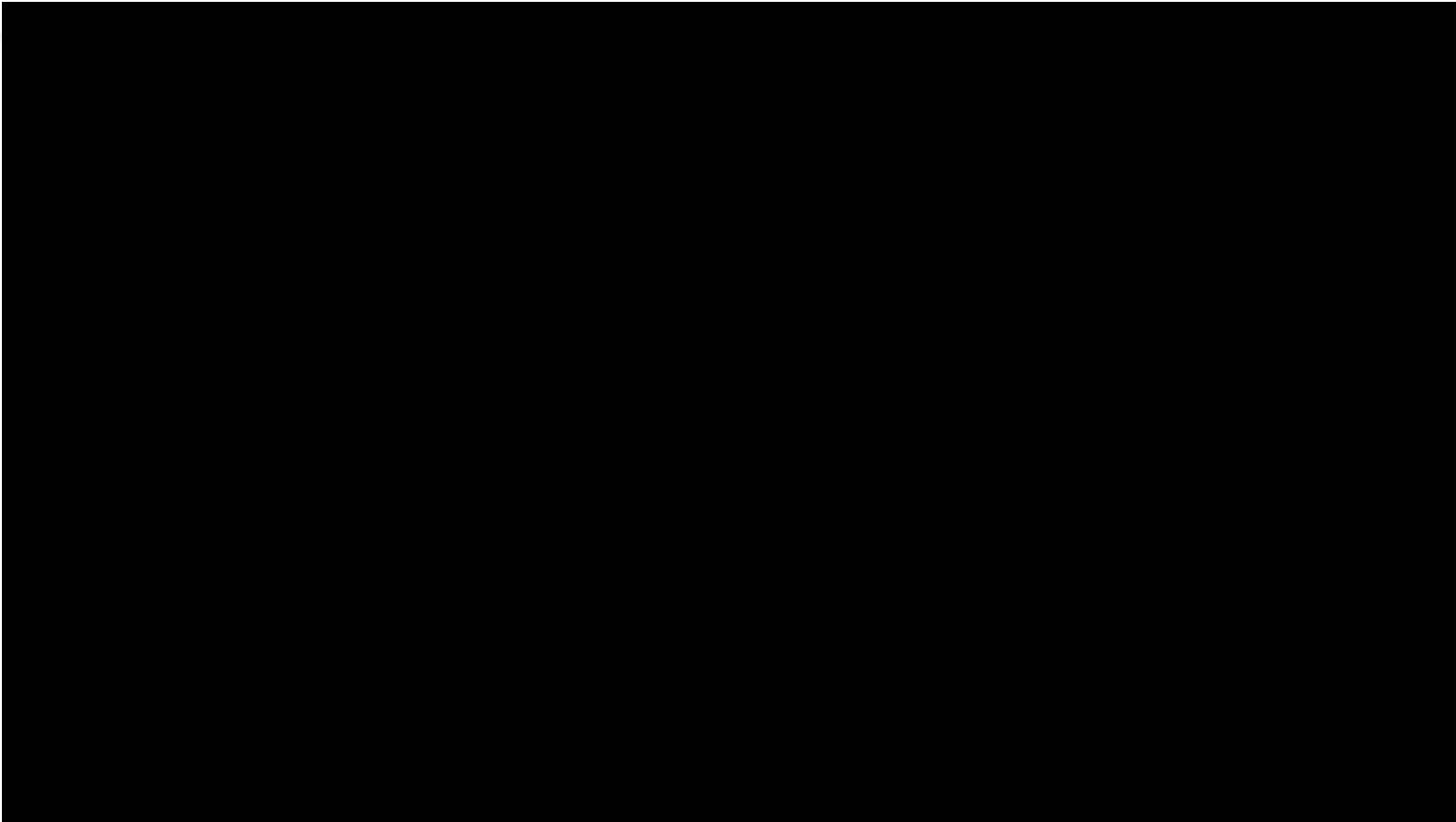




Flight Demonstration

on

HERON 1 UAV





Flight on S-100 VTOL



Example: installation on S-100 VTOL UAS

Integrated HFDF - EO



The AUSTRALIAN ARMY Exercise



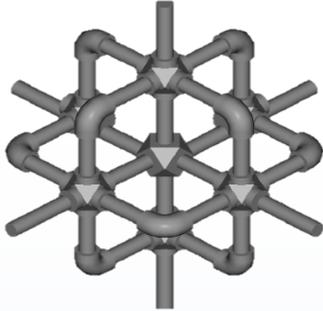
<https://www.uasvision.com/2018/12/14/schiebel-camcopter-s-100-successfully-demonstrates-new-comint-and-imaging-payloads-to-australian-army/>



Ground Based Implementation

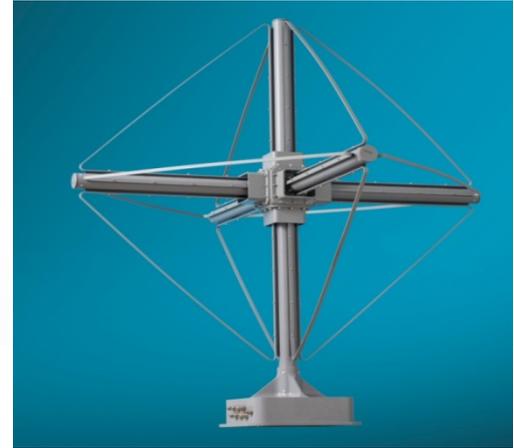
Ground Based Vector Sensor Antenna Array

The Principle:
DF using Poynting vector



$$S = E \times H^*$$

The Implementation



R= 60 cm
H= 120 cm
18 kg

The Ground HF DF implementation

- Distinction between sky-waves and ground waves
- Instantaneous Azimuth, Elevation and polarization
- DF accuracy better than 2° RMS
- Single Site Location (SSL) for sky waves

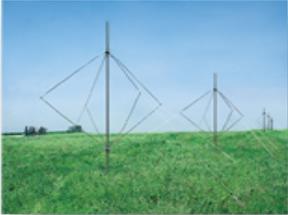
The Principle: DF using Poynting vector

$$\mathbf{S} = \mathbf{E} \times \mathbf{H}^*$$



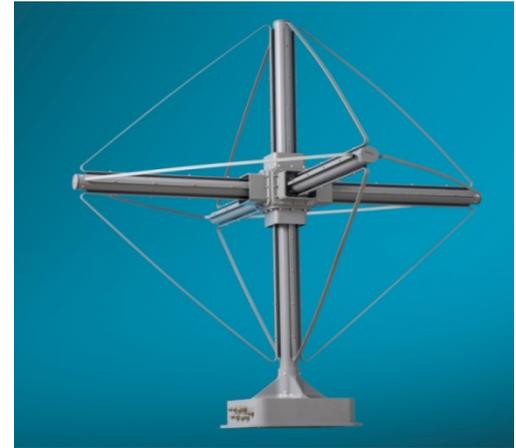
H= 120 cm, R= 60 cm, W= 18 Kg

HF DF Comparison Table

	Typical Fixed HF Df Systems	Typical Mobile HF DF Systems	ELTA's new 3D HFDF Mobile/Fixed Solution
			
Method	Interferometer	Watson Watt	Vector Sensor
Size	10000 m ²	3 m	1.2 m 
Deployment Time	3 hrs	Mobile 	Mobile 
Accuracy@Low Elev.	2° 	5-10° 	2° 
Azimuth Coverage	360° 	360° 	360° 
Elevation Coverage	0-85° 	None	0-90° 
SSL	Yes 	No	Yes 
Instantaneous measurement Ground & NVIS	No	No	Yes 
Frequency Range	2-30 MHz 	2-20 MHz	1.5-30 MHz 

Naval HFDF - The new solution

- ✦ The advantages:
 - ❖ Low signature (**Compact** DF Antenna Array)
 - ❖ The main mast is **“Free”**
 - ❖ Better (**>2 times**) accuracies
- ✦ The principal:
 - ❖ **Vector Sensor antenna**



R= 60 cm
H= 120 cm
18 kg



THANK YOU

www.iai.co.il

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