SCIENCE AND TECHNOLOGY ORGANISATION
Sensors and Electronics Technology Panel
SET-298 / RSM SPECIALISTS' MEETING
on Electronic Attack and Protection for Modern Active/Passive Netted Radars

COMINT

Solutions developed for modern PET/PCL Passive Netted Radars

– features, EA immunity and the Passive Radar System protection capability

Roman Jażdżewski
Senior System Designer
roman.jazdzewski@amt.pl
https://amt-sigint.pl/

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COMINT (Communication Intelligence)

Monitoring and exploration of all electromagnetic signals used to send information. COMINT systems perform:

- **Emission activity detection;**
- **Signal analysis and recognition;**
- **Information interception;**
- **Direction Finding & emitter gelocation**

of targeted communication emissions in order to support other systems in decision-making.

COMINT emiter geolocation methods

- **AOA (Angle of Arrival) – angle based (Direction Finding)**
- **TDOA (Time Difference of Arrival) – distance based (propagation delays)**
- **FDOA (Frequency Difference of Arrival) – velocity based (Doppler effect)**
- **SSD (Signal Strength Difference) – signal property (path loss)**
- **Hybrid**

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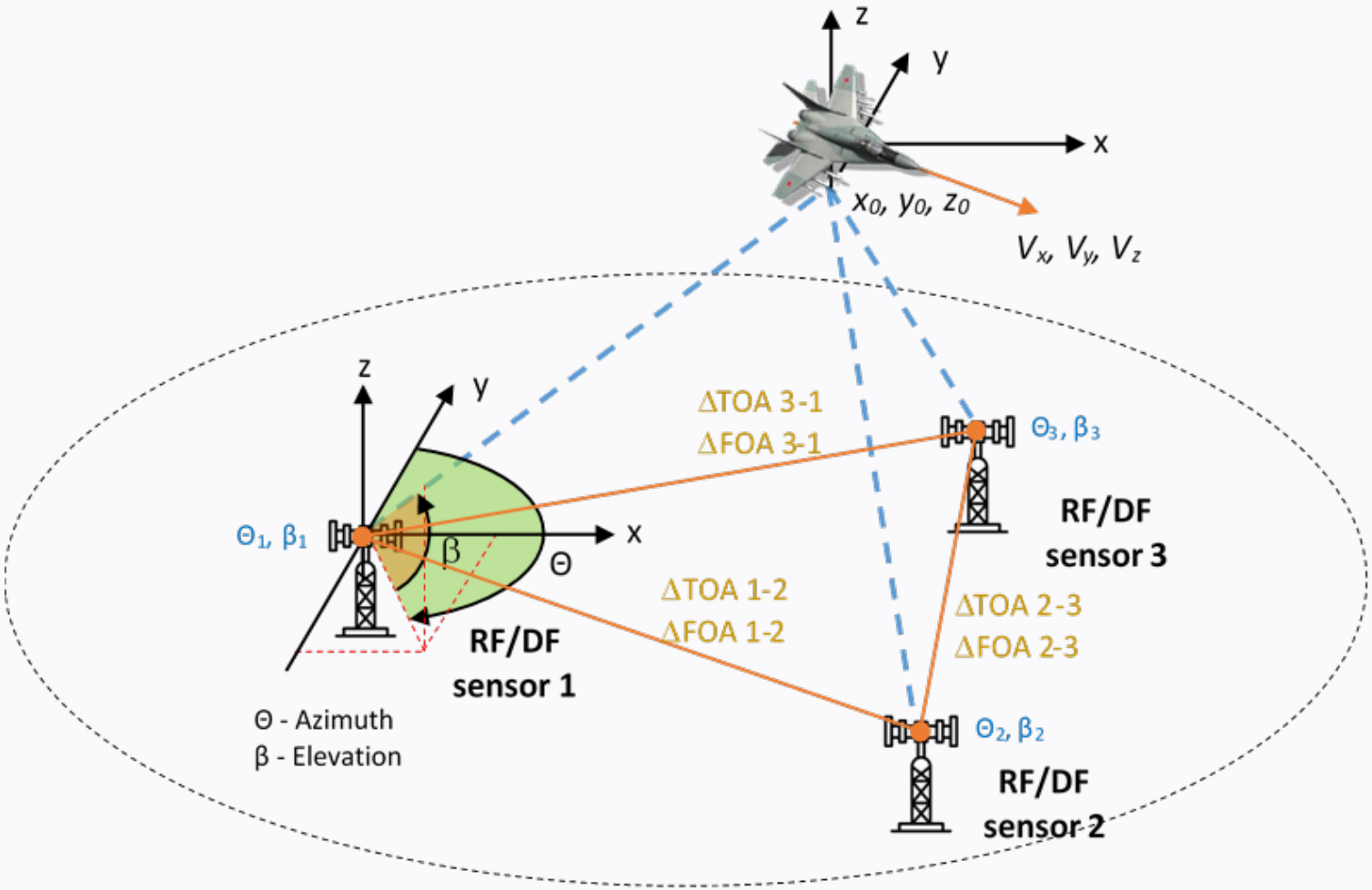

Ground COMINT system network for the Air Defence - representative deployment of RF/DF sensors

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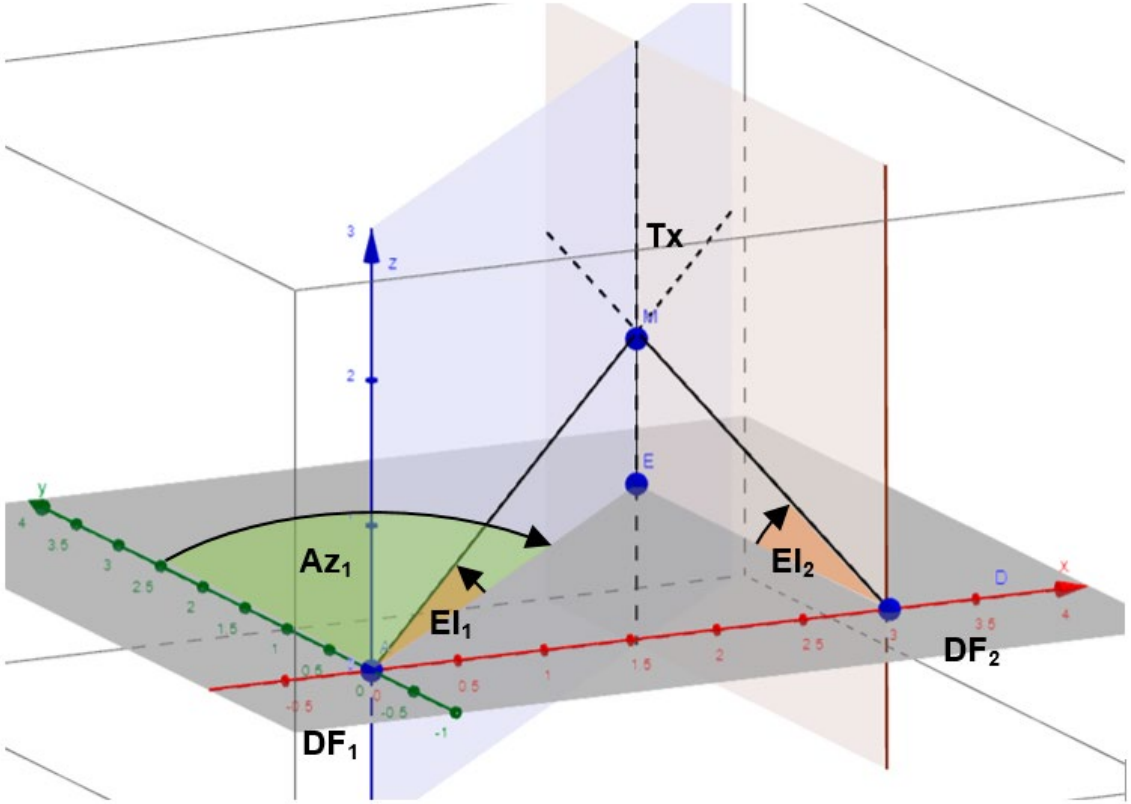

Illustration of the Direction Finding and the AOA principle transmitter geolocation in the 3D space by two Direction Finders

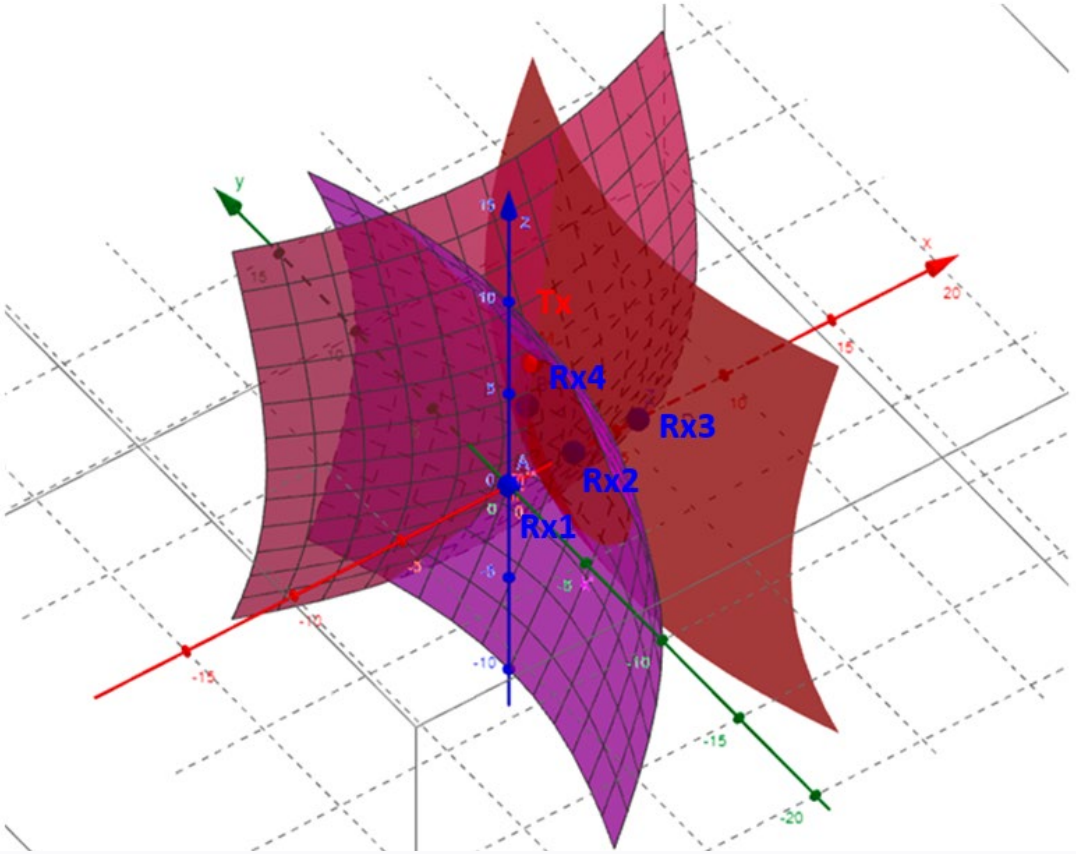

Illustration of the TDOA principle transmitter geolocation in the 3D space by a set of 4 Rx sensors

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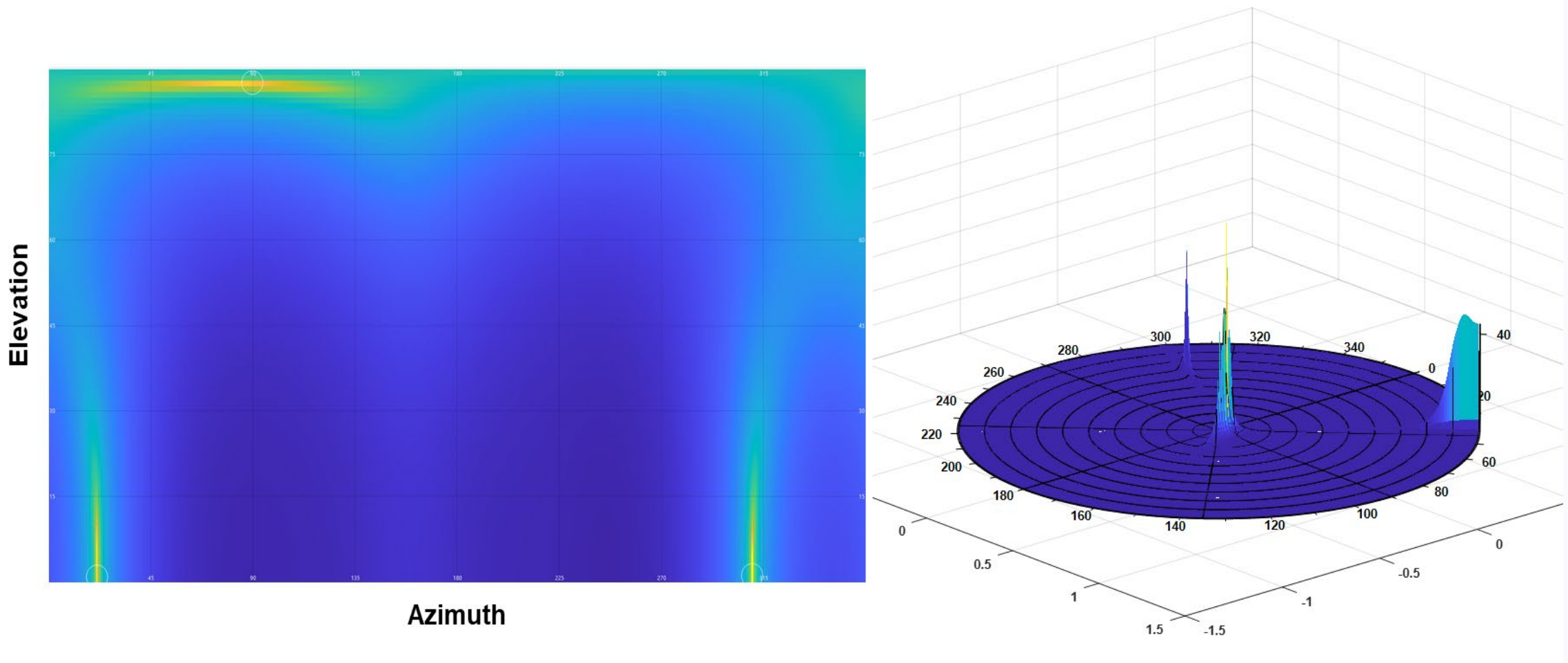

Super-resolution Direction Finding MUSIC algorithm (azimuth and elevation), rectangular and polar results representation for 3 emitters

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Rx - Receiver
Tx 1..3 - Occasional Transmitters
O - Recognized Object

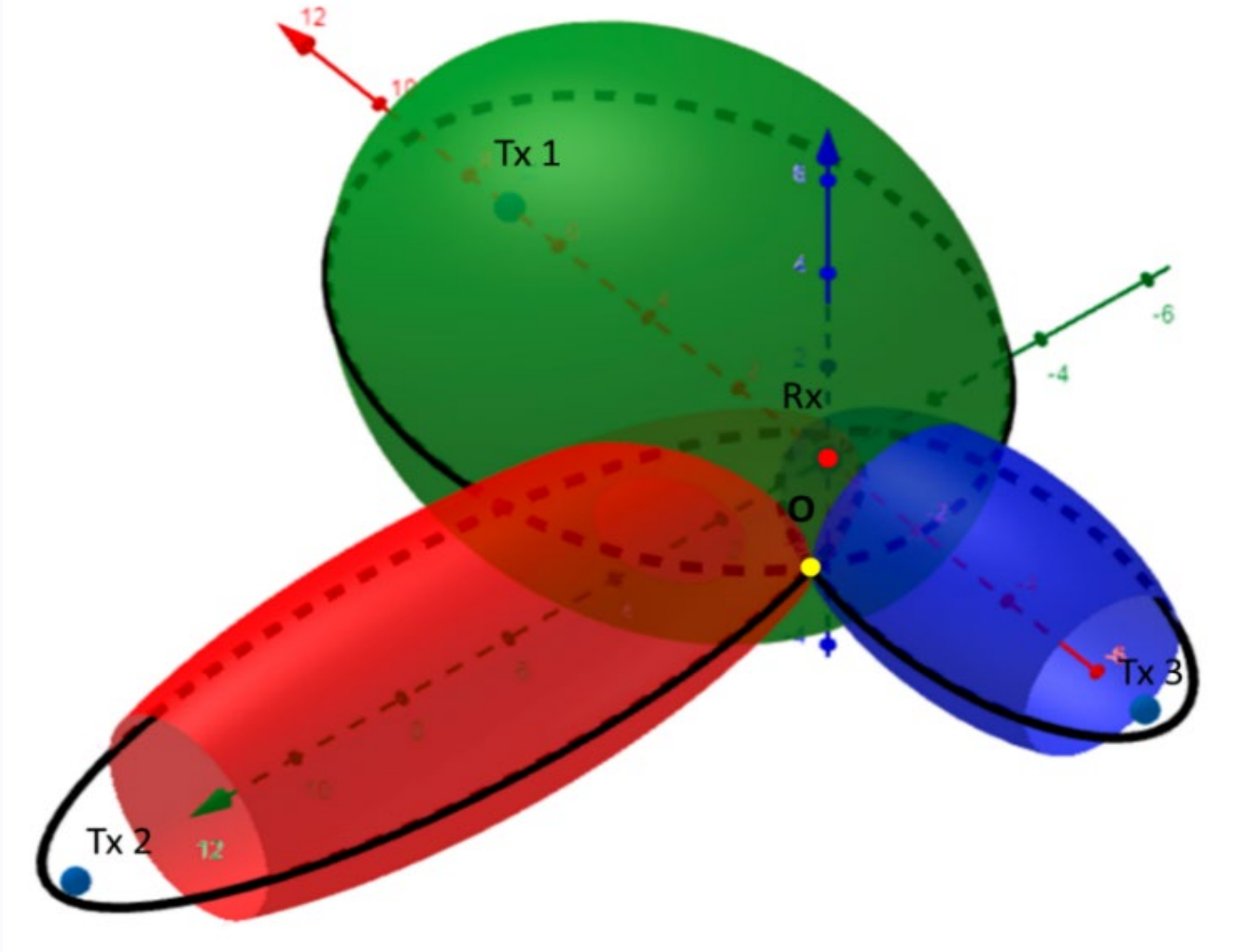

Illustration of the TSOA (PCL) geolocation principle in the 3D space

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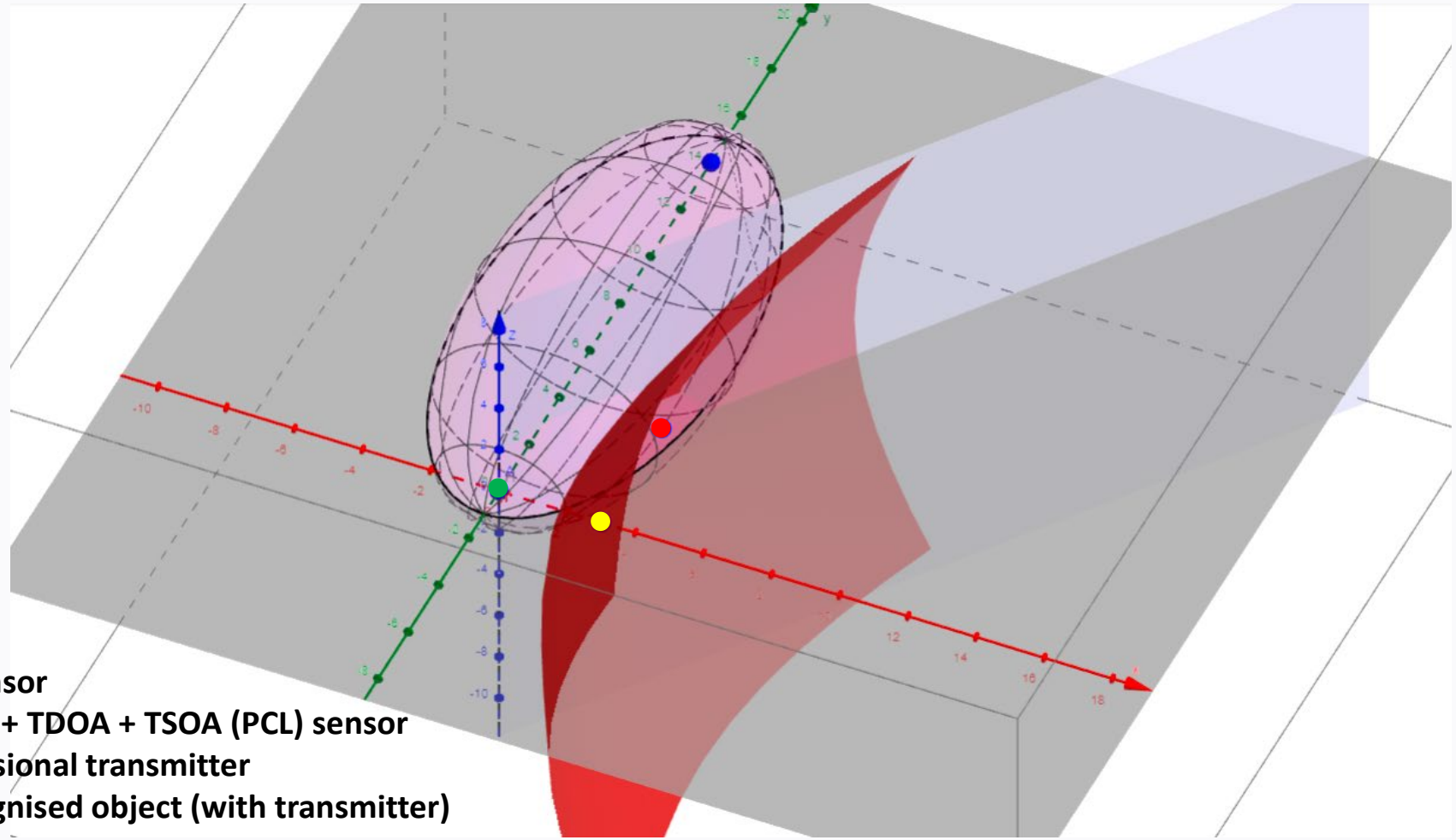

- TDOA sensor
- AOA (DF) + TDOA + TSOA (PCL) sensor
- Tx - occasional transmitter
- O - recognised object (with transmitter)

Hybrid PET/COMINT (AOA+TDOA) + PCL (TSOA) target geolocation graphical illustration

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Minimum number of the PET (AOA, TDOA, FDOA) and PCL (TSOA) sensors and occasional transmitters (PCL) necessary to reduce the set of potential target locations to a finite number, for 2D or 3D hybrid geolocation

System	Item	Geolocation method		No. of Receivers (sensors)																	
				2D geolocation								3D geolocation									
PET	1.1	AOA (Azimuth only)		2				1	1		1						1			1	
	1.2	AOA (Azimuth + Elevation)										2				1	1				1
	1.3	TDOA only			3			2					4			2					3
	1.4	FDOA only				5			4					7							
PCL	2.1	TSOA	Receiver							1	1							1	3	1	1	1
	2.2		Occasional transmitter							2	1							3	1	2	1	1

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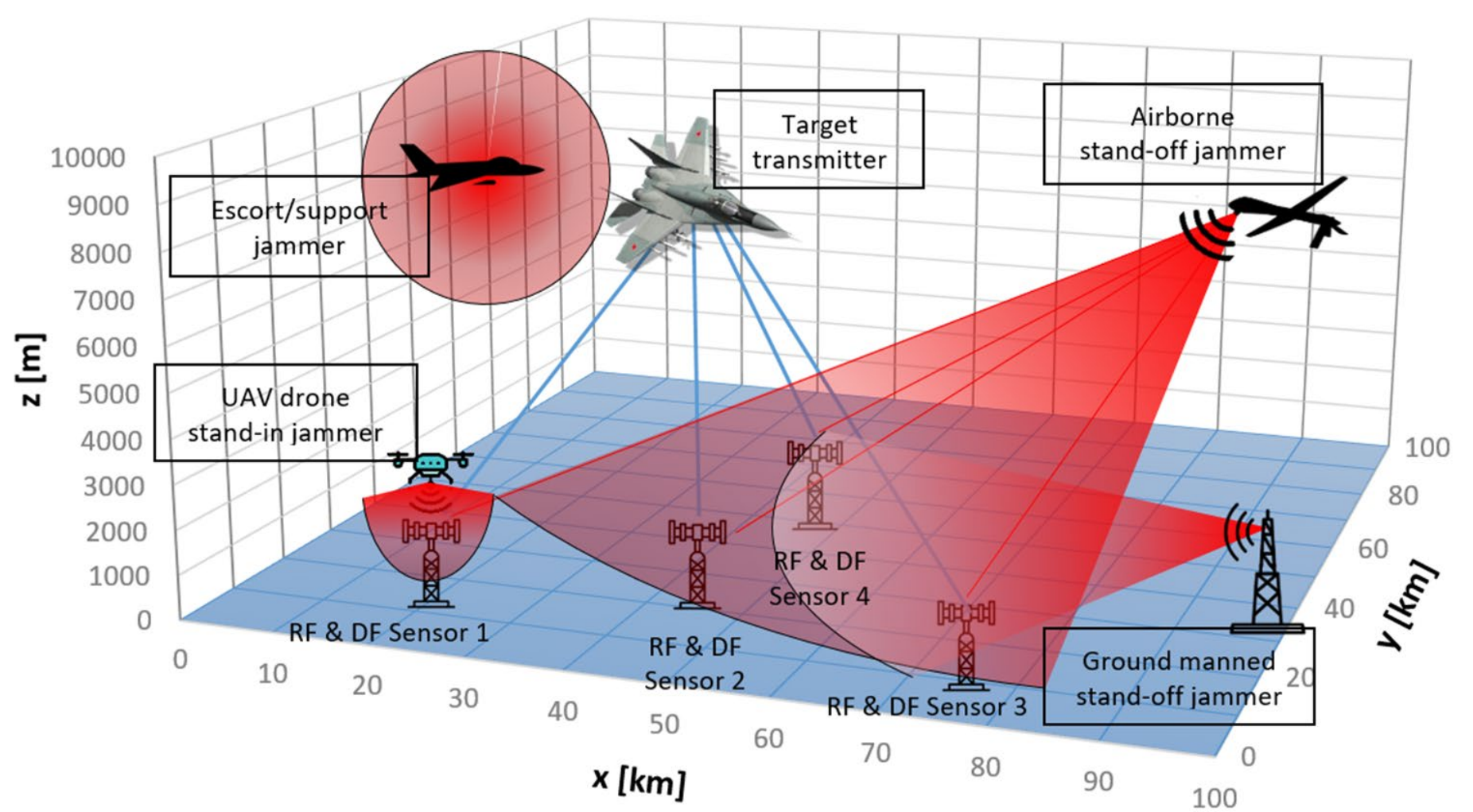

Jamming scenarios of the PET/COMINT system

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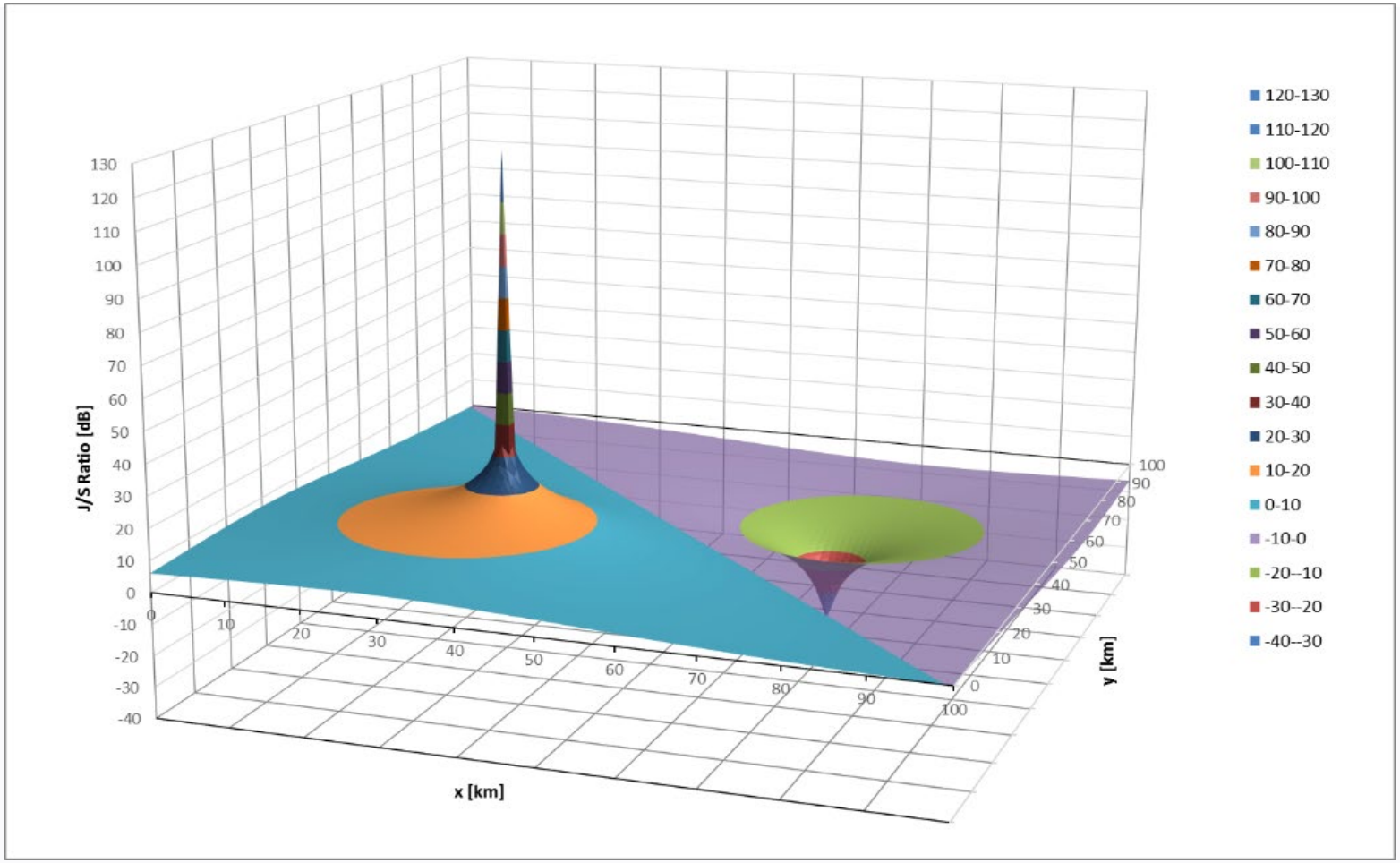

Estimated J/S power ratio, acc. to the Free Space propagation model, in the 2D space, for the jammer (33, 33) and the target transmitter (66, 66), operating with the same EIRP powers, bandwidths and frequencies (1000 MHz)

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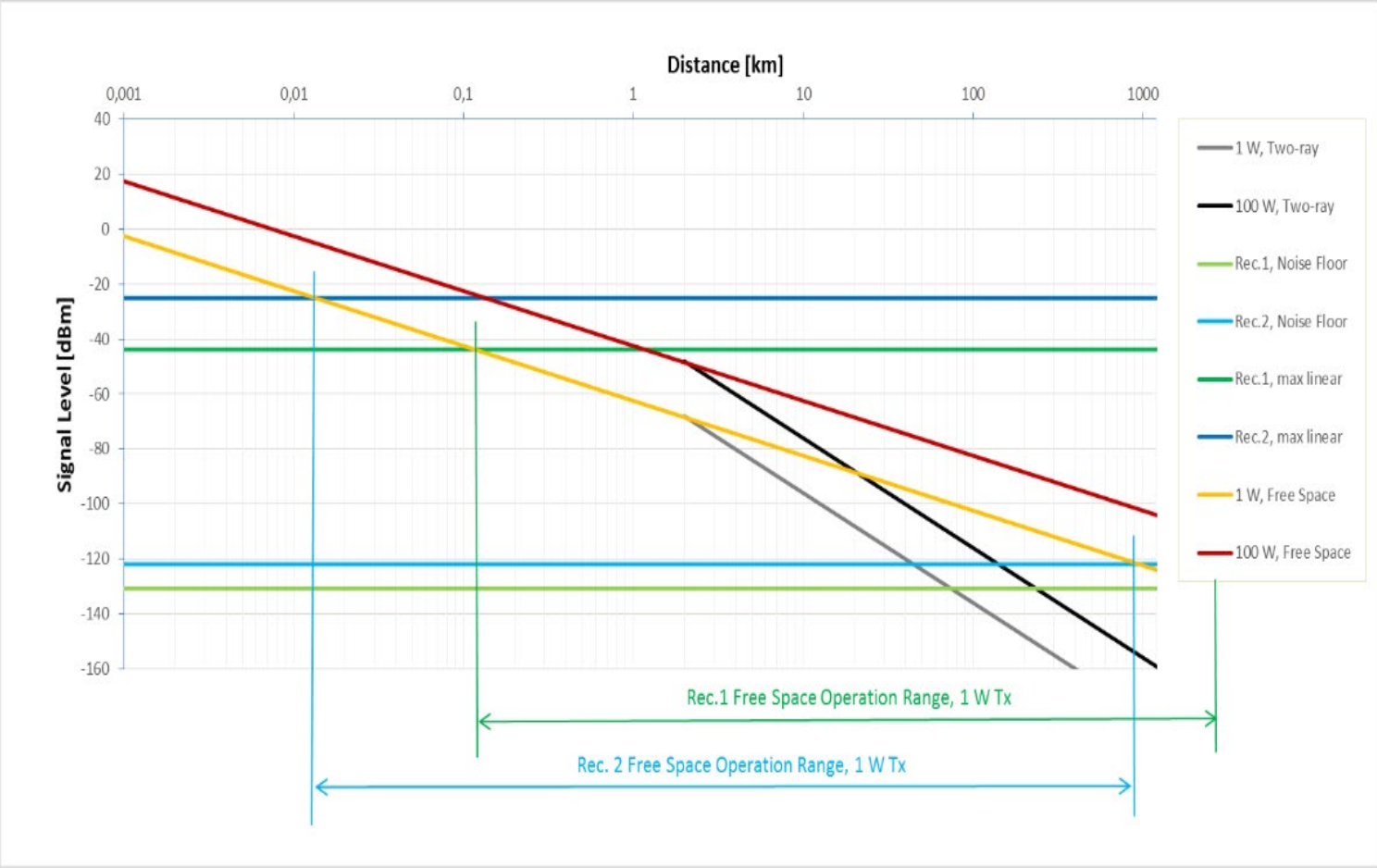

Received signal power level, for various distances from transmitters (1W and 100W, 1000MHz frequency), acc. to the: 'Free Space' propagation model (hT, hR not defined), and 'Two-ray' propagation model (hT=10m, hR=5m, FZ=2km)

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Wideband Direction Finder AMT 'CRUX'

https://amt-sigint.pl/

Fundusze Europejskie Inteligentny Rozwój

Unia Europejska Europejski Fundusz Rozwoju Regionalnego

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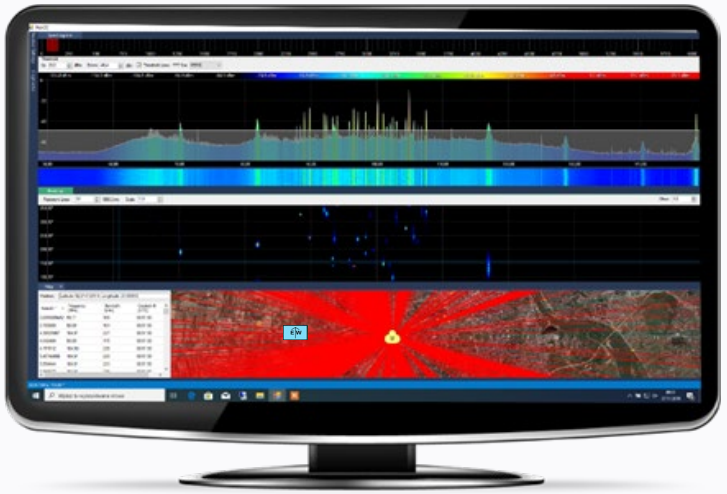
LIDER BEZPIECZEŃSTWA PAŃSTWA 2021
Nagroda w kategorii INNOWACYJNY PRODUKT



Widedband VUHF Radio Direction Finder AMT 'CRUX' set with an example results visualisation

Conclusions

1. Main advantages of the COMINT with the PET/PCL passive radar integration:
   - target final location accuracy enhancement;
   - information interception;
   - signal/target recognition.
2. Stand-in jamming, causing that only selected RF/DF COMINT sensors are excluded from operation, is most probable jamming scenario.
3. AOA is the most universal method for transmitters geolocation. The AOA 3D geolocation, using Direction Finders with the azimuth and elevation estimation capability, requires the smallest number of operating sensors and is most resistant for jamming.
4. COMINT sensors, Superresolution DF in particular, can detect communication jammers affecting the PCL radars.
5. COMINT systems, play very important role as an fundamental part of the PET/PCL integrated passive radars.

Thank you for attention

Roman Jażdżewski
Senior System Designer
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