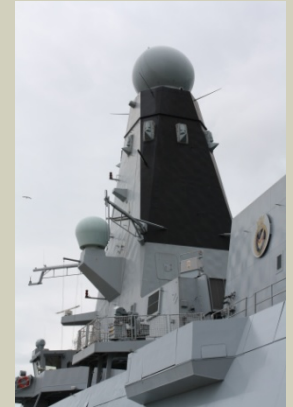


MicroESM – Developing the World’s Smallest Fully Functional Radar ESM

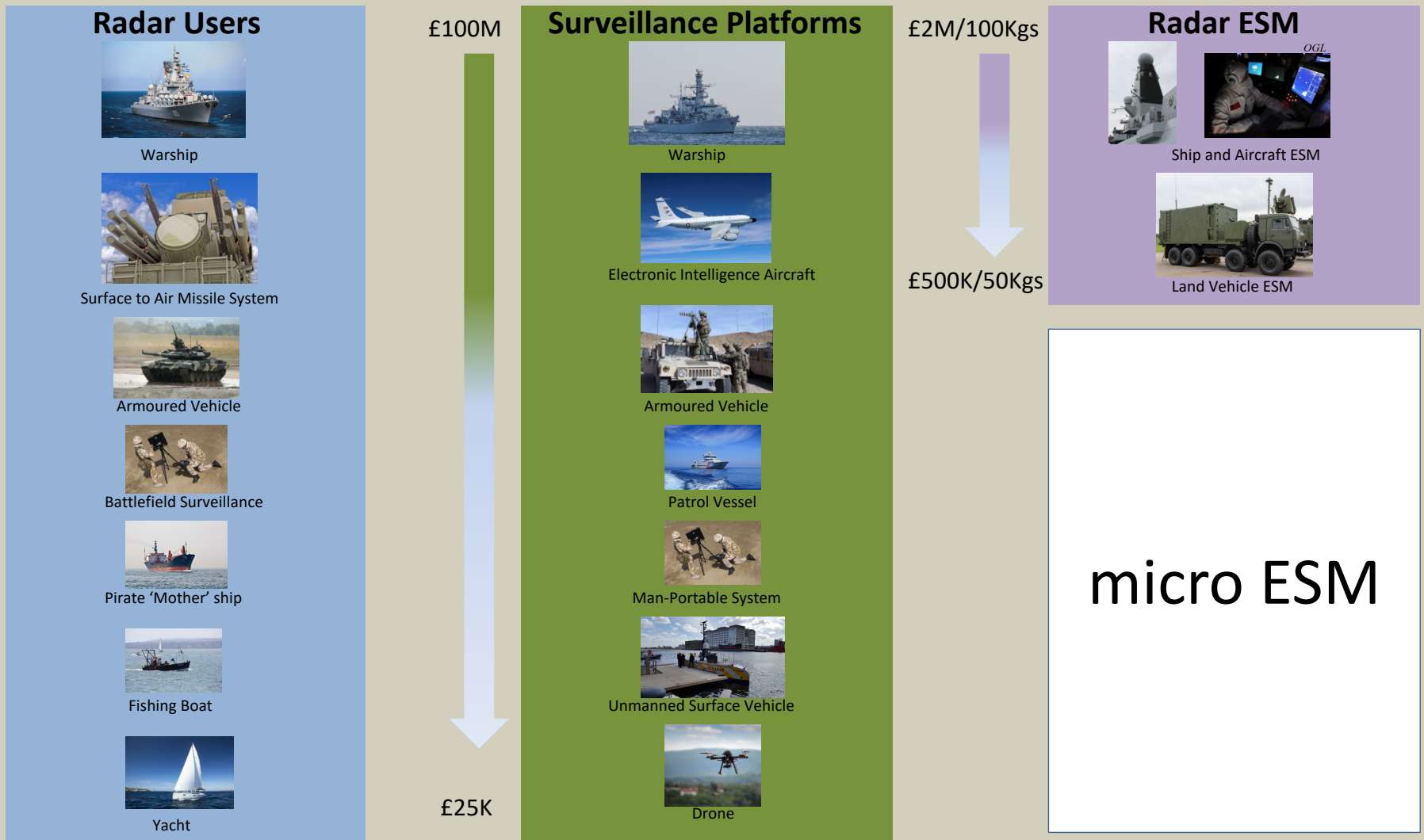
Presented by: Jon Roe, CEO, ESROE LIMITED

Monitoring radar signals

- The detection and identification of radar signals has traditionally been the domain of military radar ESM equipment
- Military ESM equipment is typically very expensive and often very bulky
- This limits the availability of ESM to the warfighter



Radar ESM – Capability Gap



micro ESM

- Size: < 6 Litre
- Weight: < 2 Kilo
- Power: < 50 Watt
- Automatic
- Networkable
- Low cost

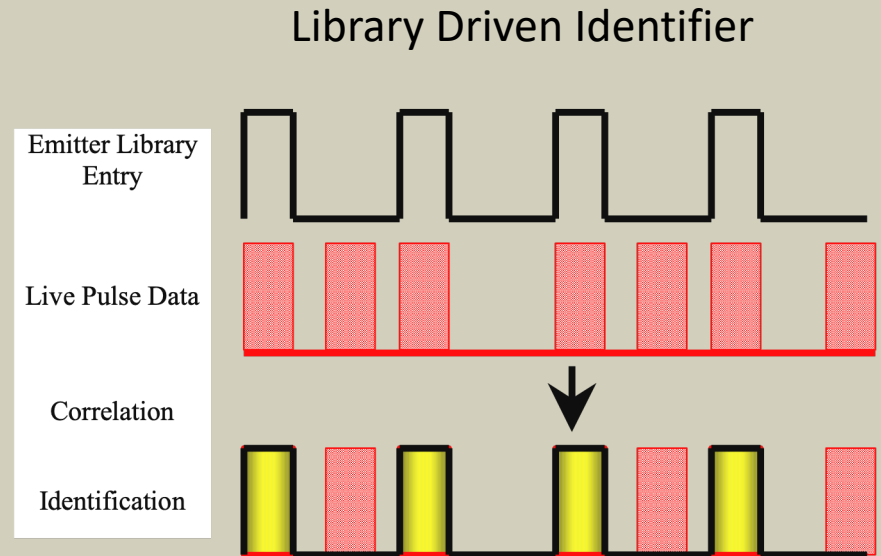


Development of a micro ESM

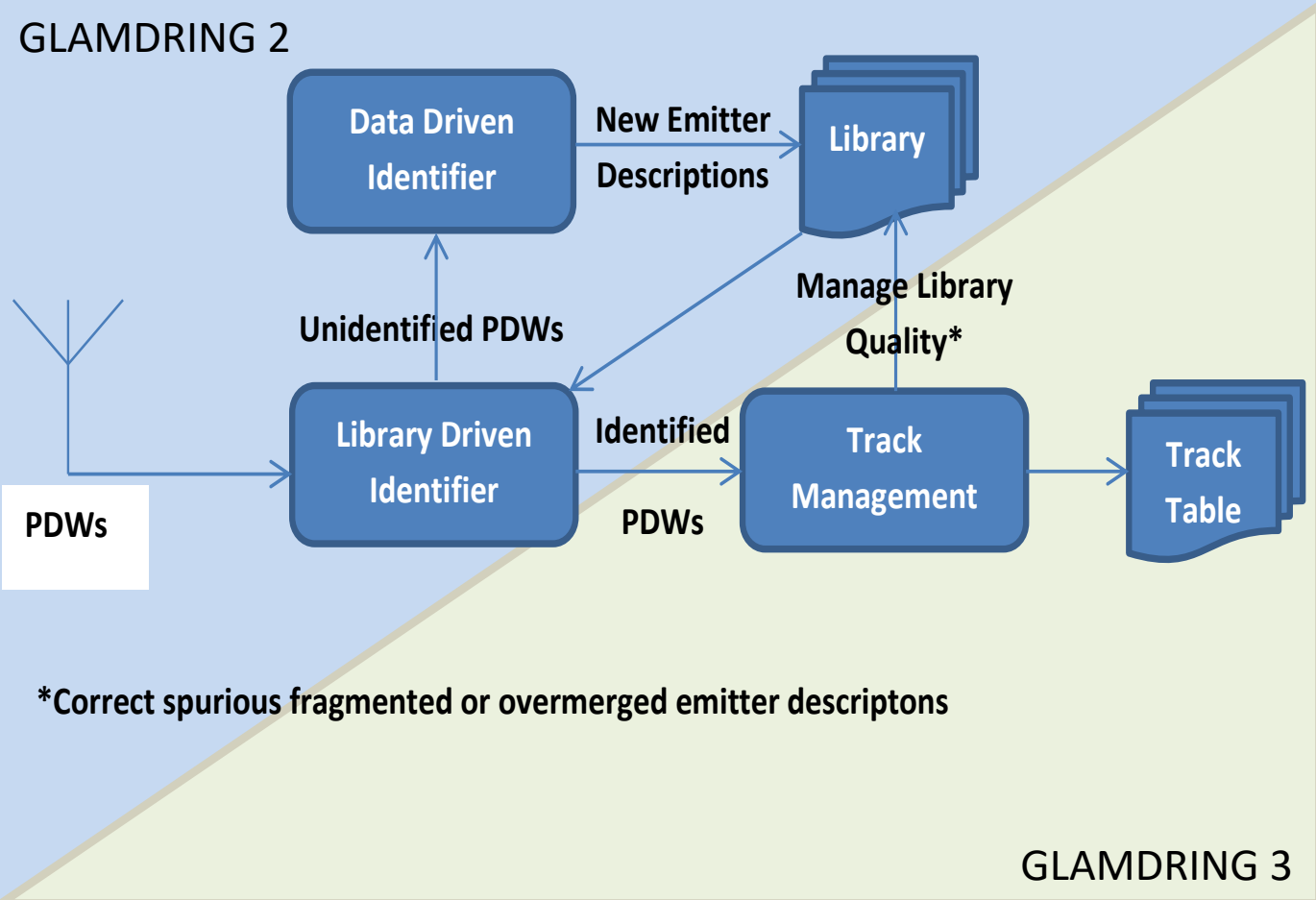
- Development of an ESM system that fits the requirements for a 'micro ESM' requires that suitable size, weight and power (SWAP) solutions are found for the following:
 - Antennas
 - Receivers
 - Processing software
 - Processing platform
 - System enclosure
 - Display
- A COTS (Commercial off the shelf) has to be followed to keep costs down.

ESM processing software

- Unique GLAMDRING software
- Uses time of arrival correlation
- Not dependent on RF, pulse width or DoA measurement
- Deinterleaving and identification is a one pass process
- ESM library consists of pulse sequence descriptions of radar waveforms



GLAMDRING



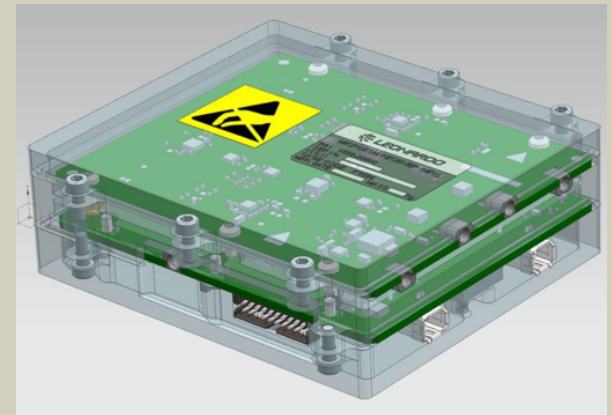
Computing platforms for GLAMDRING

- Key for a micro ESM is a small, low power computing platform for the ESM processing
- The GLAMDRING software is very efficient and can be run on small processor cards such as Raspberry Pi, or small computers such as a smartphone or a tablet



A receiver for micro ESM

- The micro ESM system design requires a small low power receiver module
- ESROE have worked with Leonardo UK to develop the MRx receiver
- The MRx receiver weighs only 518g and consumes less than 20W of power
- The MRx receiver provides 4 detection and measurement channels with an RF input and a digital PDW output over Ethernet or USB



Leonardo MRx receiver

Antennas

- To limit the size of the ESM system small antennas are required
- A spiral antenna gives the wide bandwidth required and can be designed to be small
- ESROE has worked with Cobham Antennas to reduce the weight of an already small off-the-shelf antenna
- The antennas each weigh as little as 64g
- Frequency coverage is 2 – 18 GHz
- Any lower frequency increases the size of the antenna too much for a micro ESM design



System configuration

- Aim was to create one design suitable for widest range of applications
- Key questions:
 - Separate Antenna and receiver modules?
 - Integrated processing
 - Power sources



Rugged enclosure

- Although design was COTS, ruggedness of system has to be credible for military use
- Full range of environmental requirements to be met, without increasing cost, size or weight too much
- Weatherproof, shockproof, vibration resistant, ability to operate in a full range of climactic conditions and very low electromagnetic emissions

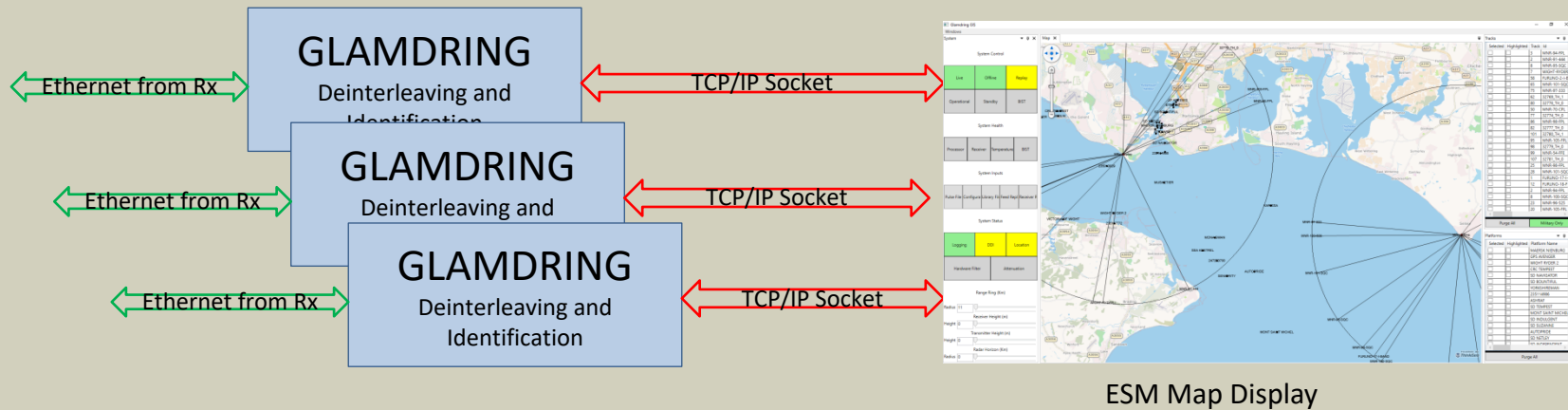


ESM display

- A ruggedised Panasonic ToughPad was chosen as the initial computing platform
- MS Windows 10 was chosen as the operating system
- A map based display was chosen
- A map based Graphical User Interface (GUI) was developed from scratch incorporating a commercial mapping tool
- The GUI was designed to be portable to other environments, particularly Android



Software architecture



ESROE's MicroESM 1t



MicroESM 1t antenna/receiver unit



MicroESM 1t ready to go



MicroESM 1t – full ESM in a case



MicroESM 1t tablet display



MicroESM 1t in a simple vehicle mount configuration

ESROE's MicroESM 1t - Specification

| | | | |
|-----------------------------|-------------------|------------------------------------|--|
| Frequency coverage | <i>2 – 18 GHz</i> | Weight (Antenna/Rx unit) | <i>< 1.5 Kg</i> |
| Frequency resolution | <i>3.5 MHz</i> | Power | <i>< 20 W</i> |
| Azimuth coverage | <i>360°</i> | Operating voltage range | <i>10 – 20 V</i> |
| Bearing measurement | <i>10° rms</i> | Operational battery life | <i>Up to 12 hours (BB2590 battery)</i> |
| Sensitivity | <i>-55 dBm</i> | Environmental Certification | <i>IP 68 DEF STAN 00-35</i> |
| Dynamic range | <i>40 dB</i> | Pulse logging | <i>3 hours</i> |