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Passive Radar Sensor Technology

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Background Raytheon Deutschland

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Space and Airborne Systems

Raytheon Deutschland is the Design Authority for the **passive** working
Emitter Location System (ELS) deployed with German & Italian Air Force ECR Tornado.
We designed, developed and built a **Digital Receiver** to replace the analog ECR ELS
– free of ITAR constraints!

Passive Sensing Technology

Basic design considerations

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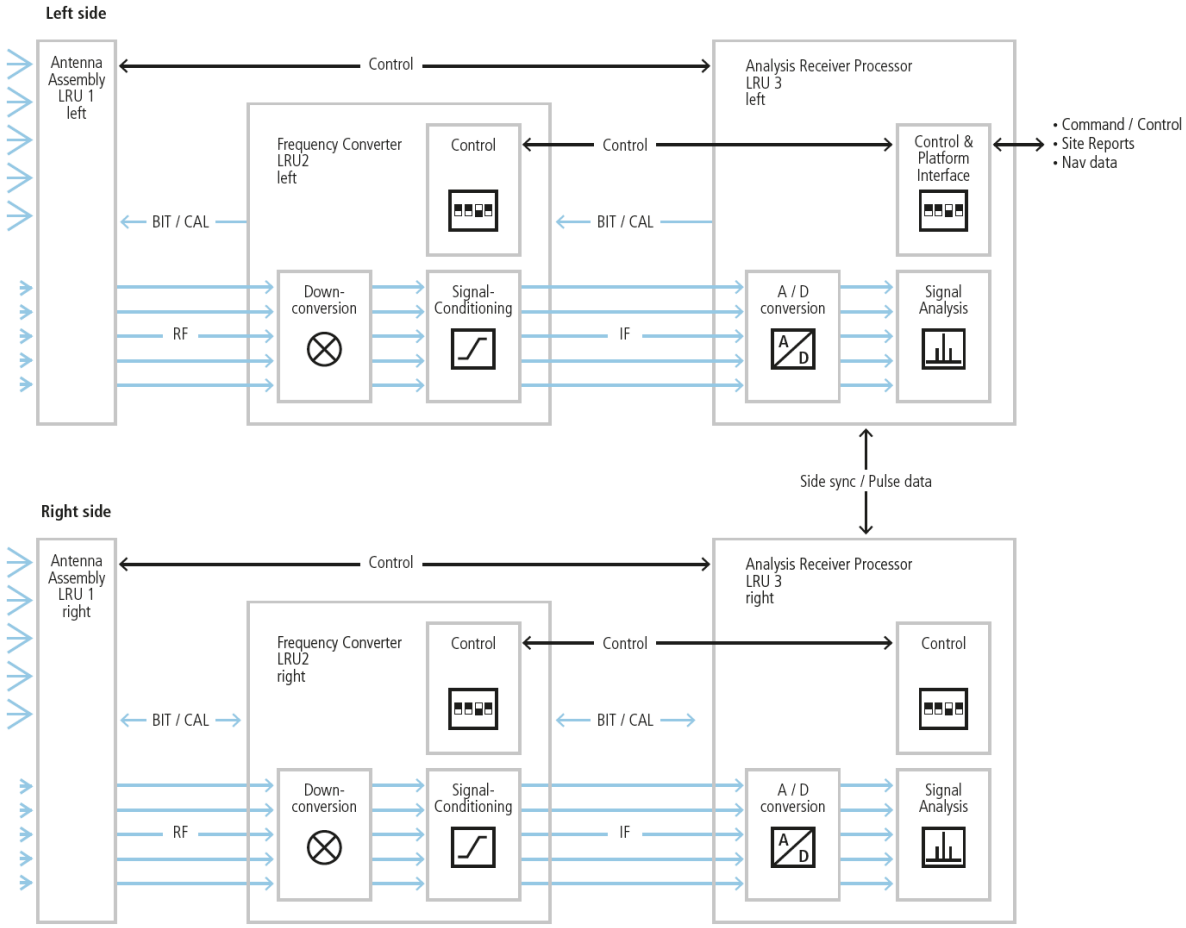
- Two sided system with identical hardware
- Use of interferometer antennas
- 5 channel input
- Standard size modules and COTS hardware where possible
- Easy to adapt system design for different applications
- „Software Defined Receiver“ to allow flexibility



Passive sensor hardware modules

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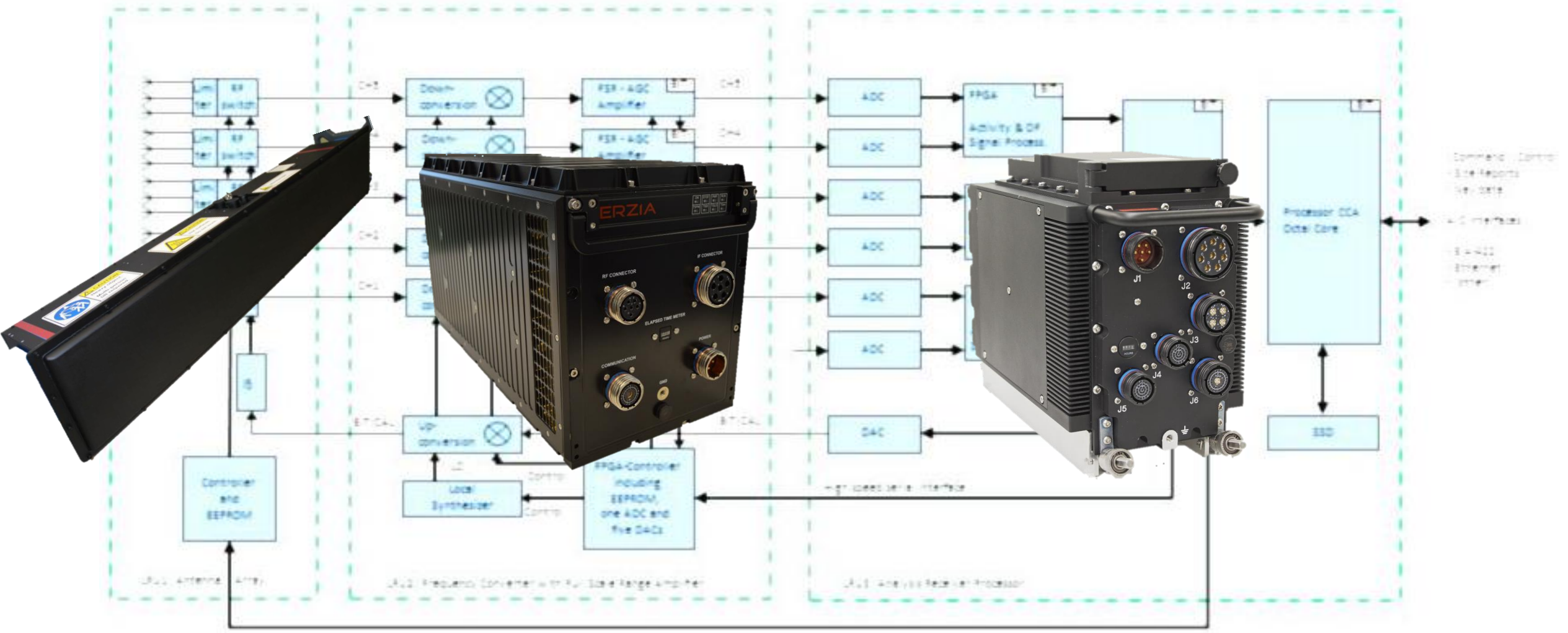

~1,4m Length
(1-26 GHz)

¾ ATR

½ ATR

Passive sensor concept

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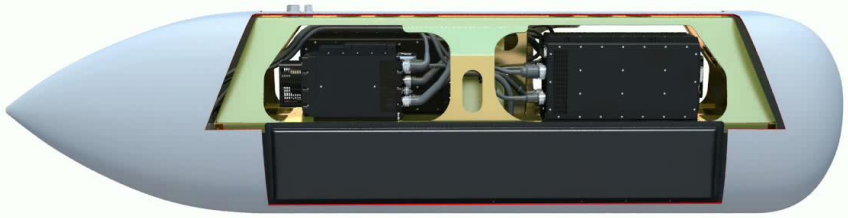

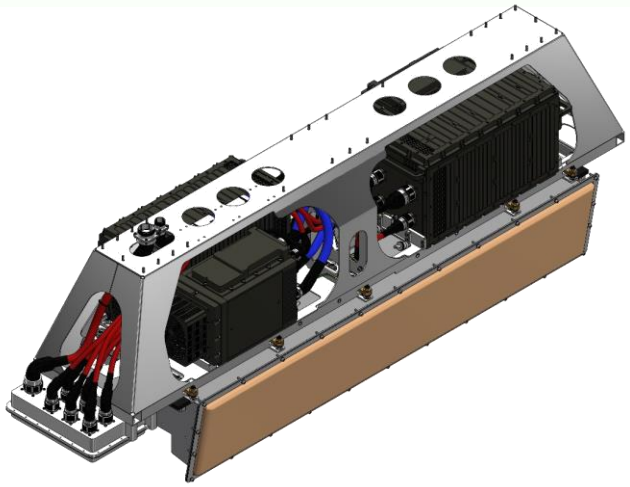

Scalable digital ELINT- / ESM-System for passive radar monitoring
- Data collection
- Tactical-operational missions

HF coverage:	UHF – Ku Band (optional Ka)
HF channels:	Application-specific
Excellent sensitivity:	Detection of low power emitters outside hostile threats

Flexible (Interferometer-) antenna configuration

High precise direction finding system, fast geolocation with “Multiship Ranging” (datalink required).
The system provides fast target information as well as precise EOB information in a highly condensed spectrum.

Mission range depends on:
- Antenna elevation (radar horizon)
- Emitter power
- Emitter frequency

Utilization of existing platform infrastructure (INS, SatCom, etc.) where possible

Proven Technology based on over 25 years of emitter location experience

Advanced Radar Detection System (ARDS)

Performance Figures

General ARDS performance figures – 1

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- Digital ELINT / ESM System
  - ELINT-Sensor to collect basic emitter data / information
  - ESM-System for tactical-operational use of collected data
- Strategic, tactical and technical ELINT
- Signal classification, extended operational picture with radar emitters
  - Detection of LPI, frequency agile signals, finger-printing, auto-correlation, etc.
- Assignment of other systems / effectors (e.g. jammers or weapons)
  - Multi-Ship-Ranging based on data link (e.g. L16) as contribution for a Joint ISR
- „Software Defined Receiver“ Technology
  - Free definable data-products (e.g. formats, interfaces)
  - Data provisioning as (additional) layer for a comprehensive operational picture

General ARDS performance figures – 2

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- Free antenna design
  - Depending on frequencies to be covered
  - Integration down-conversion into antenna housing
- Platform independent design (manned, unmanned)
- In-Flight-Update of libraries, operation modes, etc.
  - Firm- / Software-Update during flight (increase overall performance during long-term missions)
- Very high degree of automation
  - Autonomous dwell through entire spectrum as long as no other commands are given
    → Return to standard search pattern after certain idle time
- Support of (live-) display and recording for post mission analysis and generation of threat libraries
- Recording includes, but is not limited to
  - I/Q data, pulses, beams, systems

Further use of recorded data

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- Designed as system to be operated with no man in the loop
- Collection of data always active
  - Display of mission critical / required information
  - Recording of all other collected information
- Download via datalink or ground station (post mission)
  - Change of solid state disc
- Detailed post mission data analysis
  - Generation of libraries, update to known threats, etc.

ARDS – Flight test September 2018

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Flight test results

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- Aerodynamics / Mechanics
  - All simulations could be proven during flight
  - Stable design of the pod with mission payload
    - Effective „In-Flight-Calibration“ of the pod-position relative to carrier

- Communication
  - Stable use of assigned datalink capacity
  - Reliable transmission of information and display on ground station

- Performance
  - Exact geo-location and identification of emitters
  - Very precise detection and analysis of emitter parameters (frequency, PRI, pulse width)
  - Very high sensitivity under real world conditions as predicted from lab tests
  - Very low error rate

Proven performance with existing hardware

Passive sensor applications

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- Jets
  - Fighter jet
    - Use in a podded version or “internal”
    - High degree of automation, but recommendation for twin-seater
  - Business Jet
    - Use with fuselage conformal antenna assembly and internal installation of analysis LRUs
- Unmanned Systems
  - HALE / MALE UAS with internal or podded antenna configuration
  - “Distributed System” with centralized tasking
- Naval missions
- Datalink use fully implemented

ARDS – „Ready to fly“

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Yes, we scan!