MORE Presentation September 2023



MILITARY OPTICAL RF EQUIPMENT Ltd.

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Confidentiality statement:

This presentation is intended solely for the person to whom it was addressed, and may contain confidential or legally privileged information. Access to this data by anyone else is unauthorized.

- ✓ Israeli company operating in defense and homeland security markets
- ✓ Unique portfolio of Electronic Warfare and Signal Intelligence products
- Our products were successfully demonstrated in various operational scenarios
- ✓ Customers include IMOD and the US Department of Defense

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Our unique proposition

- ✓ Low SWaP tactical Integrated SIGINT and EW Payloads
- ✓ Unique Electronic Attack CONOP based on integrated DRFM and ORFM* technique generator
- \checkmark Payloads can be installed on UAV groups 2 and 3
- ✓ Increased Line of Sight operation enables much earlier enemy threats detection and mitigation
- Close support and protection for Naval and Ground forces (On and Off Board installation)
- * Optical RF Memory

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MORE in details

- ✓ Small Business Company
- ✓ Located in Petah Tikva Israel
- ✓ Two equal owners: EIM Group, Roman Rabinovich
- ✓ Significant investment by the Israeli MOD
- ✓ MORE provides long-term direct support across the IMOD on the demonstration of SIGINT and EW's unique capabilities which expose MORE to the modern EMOE challenges

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Operational Assets

- Deep understanding of Electromagnetic Operational Environment(EMOE) challenges
- ✓ Deep understanding of modern EW threats (RADARs)
- Unique proved CONOPs and systems against modern EW threats installed on operational platforms (will be disclosed under higher classification)
- Field-proven deployed to a couple of customers of Aerial SIGINT payloads operates in challenging high-density emitters environment(including heavy multi-path areas)

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Technological Assets

- ✓ SIGINT and EW System design and manufacturing
- ✓ RF Receiver and Transmitter Front Ends design and layout (layout is carried out by outsourcing contractor)
- RF over Fiber (RF to Optics and Optics to RF modules) design and manufacturing
- ✓ Optical Processing
- Mixed Signal board design and layout(layout is carried out by outsourcing contractor)

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Technological Assets

- ✓ FPGA Real-Time Processing Algorithm Design and Implementation (Applied Mathematics)
- ✓ Real-time processing includes:
- FFT providing streaming PDW
- Cross-Correlation for higher sensitivity and time accuracy for LBDTOA applications
- ✓ Emitters De Interleaving algorithms
- ✓ Platform integration including INS information from the platform and transmitting the results to the ground station

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Technological Assets

- ✓ Embedded Firmware Design and Implementation (ARM)
- ✓ Graphical User Interface Design and Implementation



Technological Assets

- Mechanical Design (outsourcing contractor supervised by MORE's mechanical designer)
- ✓ Designed ruggedized mechanical system enclosure to meet MIL-STD – 810
- Mechanical enclosure manufacturing is carried out by outsourcing contractor



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Field Test Demonstration Deployment

- \checkmark Wide experience in system demonstration
- ✓ Supporting operational models
- ✓ Proved EW system integration in small platforms
- ✓ Aerial, Naval, and Ground applications

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MORE's Products

- Multi-mission integrated Electronic Intelligence and Electronic Warfare systems
- ✓ "Light Suite"





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✓ "Compact Suite"

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MORE's Products

Advanced RWR/ESM/ELINT small form factor Receiver

✓ "Light Shield"

✓ "Wet Eyes"





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MORE's Products

Advanced RWR/ESM/ELINT small form factor Receiver

✓ "Tactical Sense"



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What our customers/partners think of MORE



- Next Generation Jamming (that generation after the DRFM...)
- Photonics core !
- Extremely wideband...
- May stay an ISR-DEU (Fraunhofer) endeavour "only", due to security reasons





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Challenges in the Modern Electromagnetic Operational Environment(EMOE)

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- EMOE becomes a dense and dynamic mixture of signals distributed over a wide frequency range and geolocations
- EMOE emitters including Radars and communications characterized by complex waveforms (FMCW, Barker, hopers, low power, etc)
- Threats(Radars) can be installed on various platforms and can be used in different operational scenarios

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"Light Shield" De interleaving output



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- ✓ Modern threats reduce jamming effectiveness:
 - Waveform agility (modulated frequency, phase, amplitude etc.)
 - High Range & Doppler resolution
 - Matched Range-Doppler for true targets identification
 - Phased array based electronic lobe stirring (allowing TWS)
 - Advanced SLC

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- ✓ The trend of upgrading legacy sensors with solid-state technology and DSP capabilities transforms them into advanced ones
- ✓ As a result, the electromagnetic battlefield becomes dense with complex threats spread all over the RF spectrum while utilizing sensor fusion techniques to maximize their effectiveness
- ✓ Ground Surveillance Radars limit the maneuvering capabilities of ground forces

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- ✓ Naval platforms Multi Band(L,S,X) and Multi Mission Radars
- ✓ Deceiving all Radars would be a quite challenging mission...



- ELM -2226 specifications(ELTA)
- ✓ LFMCW Solid State Radar
- ✓ Output power: 5W
- ✓ Detection Range (sea state 3)
- Rubber boat >20km
- Patrol Craft >60km
- ✓ Classification by acute range signature
- Inverse Synthetic Aperture Radar (ISAR)
 classification





Preparties Address Contraction Contraction Address Add



- "Surface Scout" specifications (Thales)
- ✓ FMCW Solid State Radar
- ✓ LPI mode operation
- ✓ Output power : 10mw 5W
- \checkmark Range cell size : down to 3 meter



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- "Surface Scout" false target challenge
- ✓ How would the SEALION (CCH) appears on "Surface Scout" Range map ?
- In order to create SEALION profile that looks like a false target 8 range bin should be occupied



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Our Approach to EW

- ✓ Robust solutions
 - Advanced & Legacy threats
 - Diverse scenarios
 - Customers do not share enough details regarding their operational needs
- ✓ Intelligence
 - Hard to get & expensive
 - Always changing
- ✓ Simplicity
 - Technological
 - Operational
- ✓ Small SWaP

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MORE's Unique Electronic Attack Section

- EA section, equipped with innovative Optical RF
 Memory(ORFM) and DRFM technology, are capable
 of generating advanced EW techniques
- ✓ EA section ,enables variety of operational scenarios, starting with low footprint deception of specific threats and selectively increasing impact up to intensive engagement of the entire arena

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ORFM EW system operational advantages

- ✓ Ultra high immediate BW in a single channel
- Range, amplitude and phase modulations while maintaining Range-Doppler matching
- ✓ No RF up/down conversions , sampling or quantization
- ✓ Ultra-low latency ideal for self defense applications

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ORFM EW system operational advantages

- RF-photonic design allows operation in ultra-wide instantaneous bandwidth and generation of sophisticated multi-target scenarios without being dependent on detection of the radars' signals
- The threats that we cover vary from legacy radars to modern state-of-the-art imaging, multi-sensor and LPI systems operating in various spectral bands while utilizing complex wave-forms

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ORFM capabilities

- ✓ Creation of false targets to all Radars simultaneously
- Targets maybe consider as a "corner reflector"
 (agnostic to the Radar Frequency and Waveforms)



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Products

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"Light Suite"

- ✓ EA section, equipped with innovative RF-Photonics and DRFM technology
- ✓ Situational awareness and real-time creation of Electronic
 Order of Battle
- ✓ "Light Suite's" initial batch would be supplied to a customer on Q4/23

✓ Proven in operational models in a real combat environment A MEMBER OF E M GROUP
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"Light Suite" ES and ELINT Section

RWR/ESM/ELINT capabilities

- ✓ Operational Frequency Range: 0.1GHz 18GHz
- ✓ Instantaneous bandwidth: 1.25GHz (per channel)
- High Sensitivity < The system incorporates both realtime FFT and Correlation techniques for higher sensitivity and time resolution
- ✓ Selective threats Raw Data recording for advanced processing capabilities

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"Light Suite" EA section

Electronic Attack capabilities

The following techniques can be implemented with or

without the detection of the threats:

✓ CRVGPO

- ✓ Range Doppler Bin Masking
- ✓ False Targets
- ✓ Phase Modulation
- ✓ Amplitude Modulation

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"Light Suite" ES section operational approval

Operational setup

- ✓ Live fire of the "Gabriel" "Israeli Airspace Industries" Anti-Ship Missile on INS ship
- ✓ Missile detection by the "Light Suite's" ES section
- ✓ Chaff activation by the "Light Suite" ES section

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"Light Suite" ES section operational approval



"Light Suite" ES section operational approval





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- ✓ Multi-mission integrated Electronic Signal Intelligence
 - and Electronic Warfare system
- Low SWaP designed for small platforms installations
 (UAS 3)
- Electronic Attack(EA) section, equipped with innovative
 ORFM and DRFM technology
- ✓ Operational scenarios including "On Board" and "Off Board" self-defense and "Stand In" applications - UNCLASSIFIED -

- ✓ Ideal solution for Air Lunched Effect (ALE) concept
- Situational awareness and real-time creation of Electronic Order of Battle
- Capable engaging multispectral Integrated Air Defense
 System simultaneously
- Naval "Off Board" applications can be very useful by both improving the threat detection range of the threat and increasing the jamming efficiency
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"Compact Suite" ES and ELINT Section

RWR/ESM/ELINT capabilities

- ✓ Operational Frequency Range : 0.1GHz 18GHz
- ✓ Instantaneous bandwidth : 1.25GHz
- ✓ High Sensitivity
- The system incorporates both real time FFT and Correlation techniques for higher sensitivity and time resolution
- ✓ Hostile emitter's directions and geo locations is provided in real time during the mission(Swarm)

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Electronic Attack Capabilities

- ✓ CRVGPO
- ✓ Range Doppler Bin masking
- ✓ False Targets
- ✓ Phase Modulation
- ✓ Amplitude Modulation

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"Tactical Sense"

- ✓ Advanced SIGINT small form factor Receiver
- Provides the capability of electromagnetic activity surveillance for intelligence purposes
- Capabilities of building of the battlefield situational awareness of the hostile sensors that can threaten the platform or friendly forces
- ✓ Naval patrol ISR platform for beyond Line Of Sight missions
- ✓ Naval force escort operation enables to detect the lethal threats much earlier stages providing critical time for activation of counter measures and maneuvers

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"Tactical Sense"





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"Tactical Sense"

- ✓ The systems provides full hostile emitters activities description
- ✓ The description includes all relevant parameters and internal modulation scheme
- ✓ Hostile emitter's directions and geo locations is provided in real time during the mission

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- ✓ Frequency Bands: 0.05GHz 18GHz
- ✓ High sensitivity < -85dbm@800ns integration time
- ✓ High Instantaneous Bandwidth: 1.25GHz
- ✓ DF and Geolocation capabilities(Swarm operation)
- ✓ PDW and Raw Data recording for advanced processing capabilities
- ✓ Advanced signal processing algorithms and hardware

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"Tactical Sense " Signal Flow



"Tactical Sense " demonstration



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"Tactical Sense" output



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