

# MICROSYSTEMS TO ENABLE LOW SWAP, VISION ANALYTICS FOR EXPLOITATION OF HIGH VOLUME IMAGERY DATA, UNDERWATER SENSORS

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# Areas of Interest for Defence Innovative Research Project (DIRP) Call 2016

## Microsystems to enable low SWaP

- 2016-10: Next Generation Digital Wideband Receivers
- 2016-11: Next Generation RF/Microwave Receivers
- 2016-12: Highly Reliable Electronics in Space Environment

*by Dr. John Poh <Poh\_Chung\_Hang\_John@defence.gov.sg>*

## Vision Analytics for exploitation of high volume imagery data

- 2016-13: Image/Video Processing for Wide Area Sensors
- 2016-14: Intelligent Vision Analytics

*by Mr. Lim Boon Wah <Lim\_Boon\_Wah@defence.gov.sg>*

## Underwater Sensors

- 2016-15: Sea-Deployed IED Detection
- 2016-16: Underwater Energy Harvesting

*By Mr. Vincent Toh <Toh\_Wei\_Siong\_Vincent@defence.gov.sg>*



# Overview

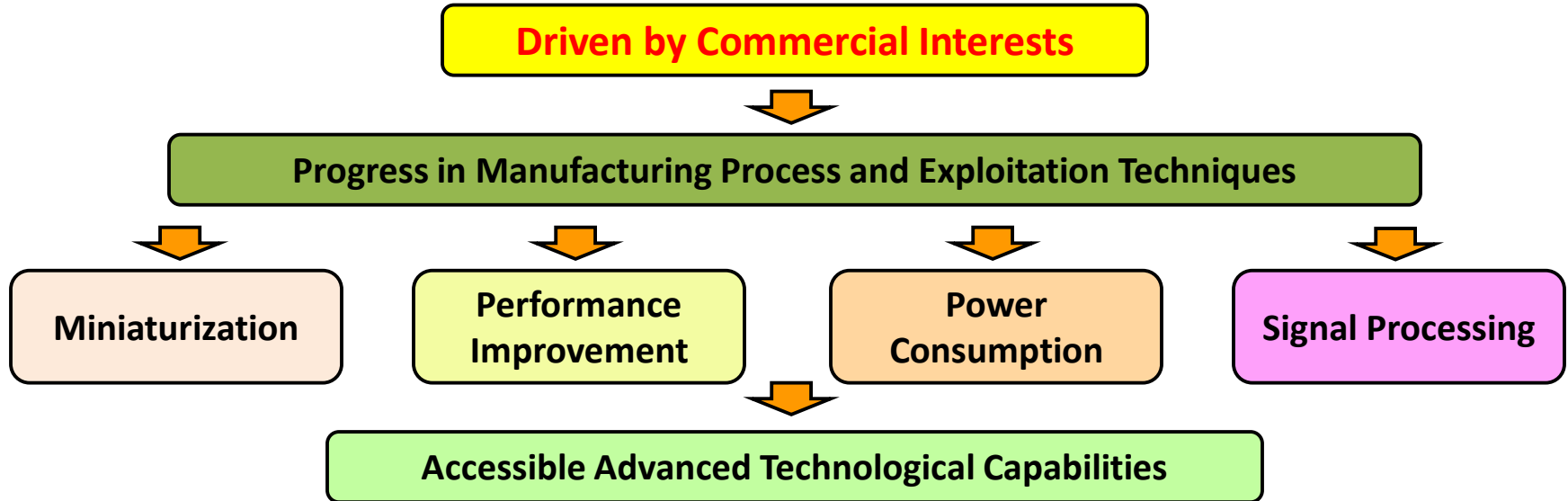
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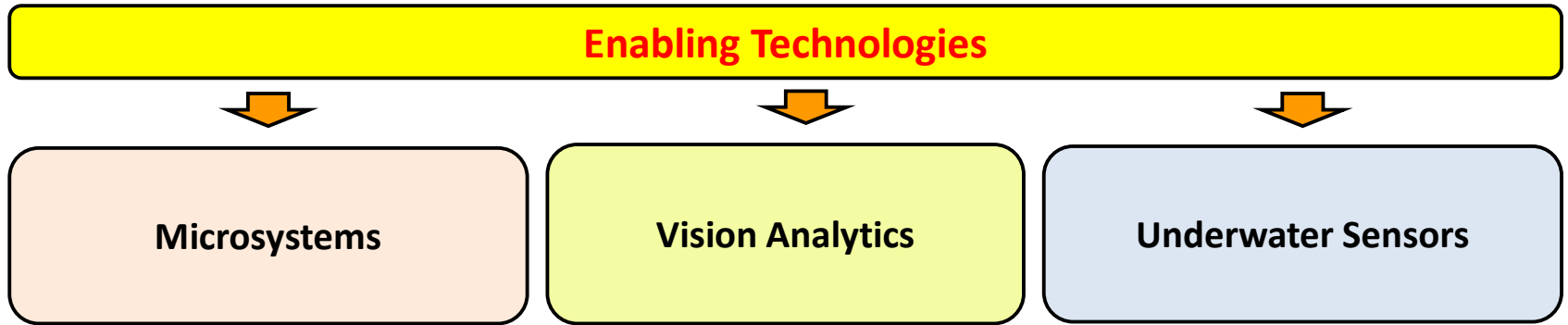
# Introduction

- Enabling technologies such as Microsystems and EO/IR Sensors are at the heart of any advanced systems.



# Enabling Technologies of Interest

- FSTD recognizes the enormous challenges and opportunities in this new technology landscape.
- We seek to leverage and transcend current COTS landscape to deliver next generation defence capabilities.



# Microsystems to enable low SWaP

**Dr. John Poh**

Programme Manager (Electronic Systems)



# Interests

- FSTD is interested in exploitation of **advanced electronics and photonics** to enable new application areas or significant performance improvement of existing systems for defence.
- The microsystems technology research includes the following:

Advanced RF/Microwave  
Electronics

Advanced Digital & Mixed  
Signal Electronics

Highly Reliable Space  
Electronics

Opto-Electronics and  
Photonics

- FSTD invites innovative ideas that:
  - a. **Focus on defence applications**
  - b. **Add significant performance improvement**

# 2016-10: Next Generation Digital Wideband Receivers

- FSTD is interested in novel technologies that can support the development of **next generation digital wideband receivers** that are able to fulfil the future demands on bandwidth, dynamic range, sensitivity, multi-functionality, robustness, weight and form factor for **electronic systems** and **radar applications**.
- **This call is for the following key areas:**
  - a. High speed/resolution **analog-to-digital converter and digital-to-analog converter**
  - b. Wideband **track-and-hold amplifier**
  - c. Ultra-low phase noise **oscillator** and ultra-stable **clock**
  - d. Advanced **microwave photonic** architectures and **optoelectronic devices**



# 2016-11: Next Generation RF/Microwave Circuits

- FSTD is interested in **advanced RF/Microwave technologies** that would enable next generation of **RF transmit/receive modules** and **RF front-ends**, which could be used in sensors, with revolutionary performance and functionality .
- **This call is for the following key areas:**
  - a. Advanced **RF/microwave packaging** that leads to **miniaturization**
  - b. **Reconfigurable and tunable** RF/microwave circuits for **adaptive systems** operating under varying operational and environmental conditions

# 2016-12: Highly Reliable Electronics in Space Environment

- FSTD is interested in the development of **radiation hardened/tolerant electronics** that are capable of operating and surviving in the **extreme temperature** and **radiation environments**.
- **This call is for the following key areas:**
  - a. Low power, highly efficient, radiation-hardened **processor and data converter technologies**
  - b. Innovative radiation hardened volatile and non-volatile **memory technologies**
  - c. **Packaging technology** capable of surviving frequent thermal cycles and tolerant of the **extreme temperature**.

# Vision Analytics For Exploitation of High Volume Imagery Data

Mr. Lim Boon Wah

Project Manager (Radar Systems)



# Interests

- **Wide-area EO/IR image exploitation** is challenging due to:
  - High volume of image data,
  - Bandwidth limitation, and
  - Urban operational environment.
- Understanding of these **wide-area images** will require:
  - On-board processing,
  - Timely processing for large image volume, and
  - Intelligent analytics for interpretation.
- FSTD is interested in **advanced concepts and techniques** in

Advanced image / video  
processing

Intelligent vision analytics

# 2016-13: Image/Video Processing for Wide Area Sensors (WAS)

- Applications for **WAS** on **air platforms** have grown in recent years for **defence surveillance**.
- **This call is for the following key areas:**
  - a. Develop **intelligence** to correlate visual events from air-borne wide area persistent EO and/or IR sensors.
    - **Event detections** that are of 'operational significance' such as locating military vehicle convoy, border intrusion and backtracking of such activities across time and space.
    - Robust performance in **urban environment** where problems such as building occlusions are likely.
  - b. Develop processing concepts that enables **real-time analysis using limited compute resource**.
    - **High volume** of image/video imagery.
    - **COTS-based, mobile** compute hardware architecture.



# 2016-14: Intelligent Vision Analytics

- During military and homeland security operations, **large volume** of sensor data are collected through vision sensors on satellite, unmanned aircrafts and ground-based cameras. Analysts are overwhelmed with high volume of raw imagery or video, leaving substantial information unexplored. **Intelligent vision analytics** could reduce this volume of data by performing analysis to flag out key events and anomalies to **focus analysts on higher level analysis**.
- **This call is for the following key areas:**
  - a. Leverage on 'big data' techniques to manage, **interpret** and **correlate** large amount of unstructured image and video data and **predict intents** that are relevance to **military operations**,
  - b. **Cross-apply** techniques to a variety of **vision** sensors on satellite, unmanned aircrafts and land surveillance systems.

# Underwater Sensors

**Mr. Toh Wei Siong Vincent**

**Project Manager (Maritime Systems)**

# 2016-15: Sea-Deployed IED Detection

- In a busy straits environment, sea-deployed IED with enough explosive can inflict significant damage to commercial vessels and loss of lives. Although the detection of such IEDs can be performed by conventional specialized manned vessels, it is manpower intensive approach.
- **This call is for the following areas:**
  - a. Sensor development (passive/active/combination of both)
  - b. Signal processing for **expeditious** detection and **accurate** localisation
  - c. Alternative novel approaches





# 2016-16: Underwater Energy Harvesting

- One of the key enabling technology to successfully employ unattended underwater sensors and unmanned underwater vehicles in a battlespace is power energy. Although battery technologies is will continue to advance due to the expected proliferation of electric vehicles, size will be a constraint.
- **This call is for the following:**
  - a. Underwater energy harvester that is **compact, customised** to exploit local environment and **high yield**.
  - b. Technologies that yield incremental enhancement of conventional battery designs, wave-glider designs will not be considered.

