# **Office of Naval Research**



Presentation to:

#### ICASSP Panel Signal Processing Research in Communications

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## **Office of Naval Research**





# **S&T Investment Categories**

#### **Discovery & Invention (D&I)**

- NRL Base Program
- · Science shortfalls in topics with Naval interest
- Nurturing science opportunity
- High impacts/surprises
- Health of Academic pipeline ideas/workforce
- National Naval Responsibilities
  - Ocean Acoustics
  - Undersea Weaponry
  - Naval Engineering
  - Naval Air (proposed)

#### Innovative Naval Prototypes (INPs)

- EM Gun
- Sea Basing
- TBD

#### **Future Naval Capabilities (FNCs)**

- Time Critical Strike (TCS)
- Organic Mine Countermeasures (OMCM)
- Knowledge Superiority & Assurance (KSA)
- Littoral Antisubmarine
  Warfare (LASW)
- Expeditionary Logistics (ExLog)

- Fleet/Force Protection (FFP)
- Littoral Combat and Power Projection (LCCP)
- Missile Defense (MD)
- Advanced Capability Electric systems (ACES)
- Autonomous Ops (AO)
- Total Ownership Cost (TOC)
- Capable Manpower (CM)
- Warfighter Protection (WP)

#### **Quick Reaction and Other**

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- SwampWorks
- Tech Solutions
- MCWL

#### Other

- Pass-Through to JFCOM
- OSD Directed
- Infrastructure Efforts enabling ONR's mission execution such as IFO, conferences, outreach



### **Naval S&T Investment by Performer**





- Research Issues Fusion
  - Consistent target picture in a multisensor multitarget scenario
  - Error free data communication
  - Processing tracks for highly maneuvering and dense target scenarios
  - Tracking and Identifying breaking up threat missiles
  - Unique one track per target view across networked sensors



- Research Issues in Communications
  - Interference suppression/mitigation
  - Spectral awareness monitoring/control for AJ/EMI
  - Higher bandwidth for tactical comms
  - Greater energy efficient and miniaturized transmitter/receiver
  - Anti-jam, low probability of detection comms
  - Submarine comms at speed and depth
  - Over the horizon connectivity
  - Adaptive, ad-hoc wireless networking
  - Navy architecture evolution to IPv6
  - Coalition networking and inoperability

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### Beyond CDMA and OFDM: Redundant Linear Precoders



**CDMA** 



OFDM and CDMA are successful, widely implemented digital communications techniques.

These techniques are special cases of the new linear-precoders introduced by Giannakis, Xia, and others. This more general approach uses carefully chosen FIR filters for the transmit and receive functions. This approach is capable of simpler, lower order operation, blind identification, and equalization, even with unknown channel characteristics. Coefficients can be optimized to maximize S/N of a given channel.

Capability yields simpler, more effective multiaccess communications and radar systems operating over common frequencies.

