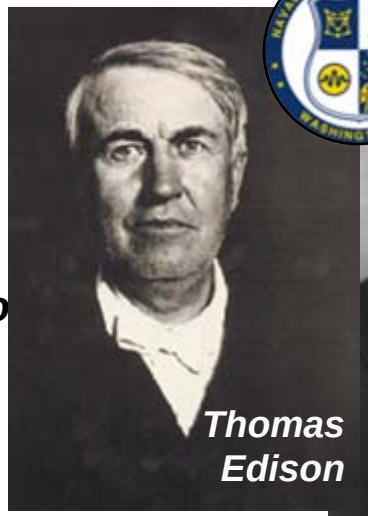
Marine Corps Systems Command **-Advanced Planning Brief to Industry**

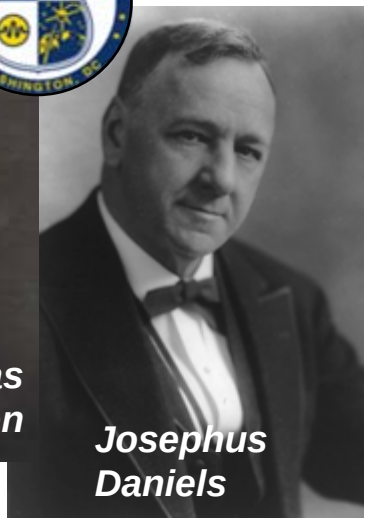
Mr. George Solhan
Deputy Chief of Naval Research,
Expeditionary Maneuver Warfare and
Combating Terrorism (ONR 30)

7 April 2010

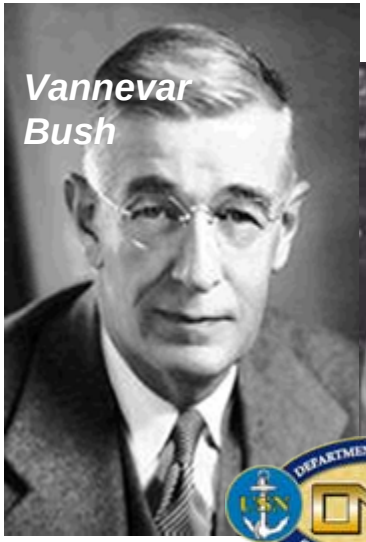
Naval Research: A Statutory Mission

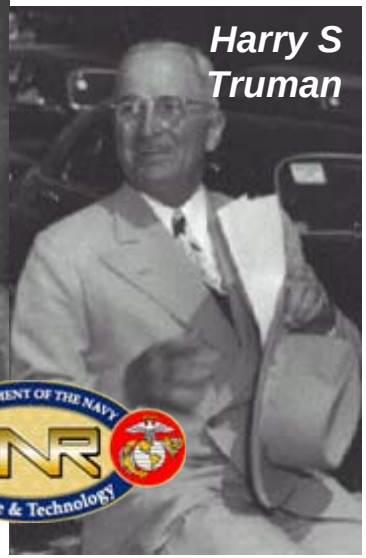
Naval Research Laboratory *(Appropriations Act, 1916)*:
"[Conduct] exploratory and research work…necessary… for the benefit of Government service, including the construction, equipment, and operation of a laboratory…."





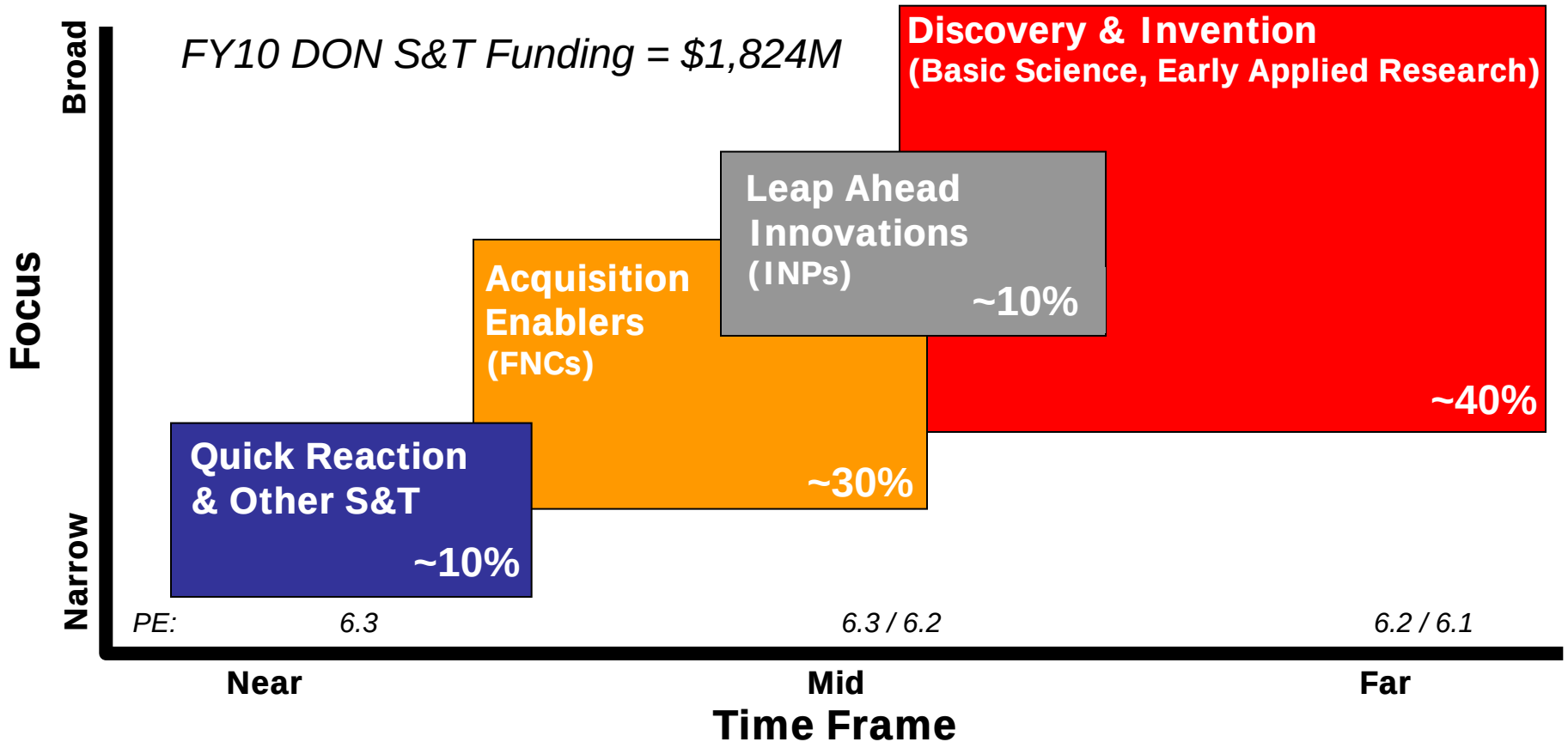
Office of Naval Research *(Public Law 588, 1946)*:
"… plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the reservation of national security…. "





Transitioning S&T *(Defense Authorization Act, 2001)*:
"…manage the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation."

S&T Focused on Naval Needs



Quick Reaction (10%)
- Tech Solutions
- Experimentation
- MC S&T (MCWL, JNLW, etc.)

Acquisition Enablers (36%)
- Future Naval Capabilities
- Warfighter Protection
- Capable Manpower
- LO/CLO

Leap-Ahead Innovations (12%)
- Innovative Naval Prototypes
- NSPs
- Swampworks

Discovery & Invention (42%)
- Basic & Early Applied Research
- National Naval Responsibilities
- Education Outreach HBCU/MI

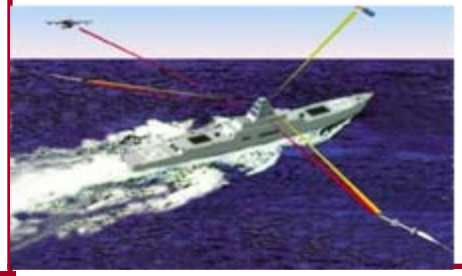
ONR S&T Departments

Code 30

Expeditionary Maneuver
Warfare & Combating Terrorism

Code 31

C4ISR



Code 32

Ocean Battlespace Sensing

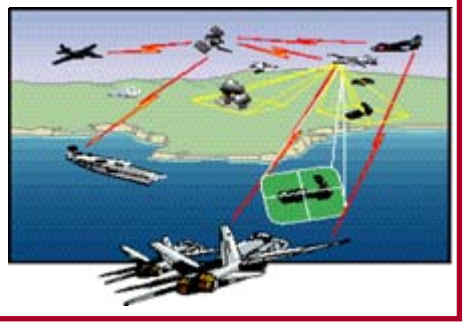
Sea Warfare and Weapons

Code 33

Warfighter Performance

Code 34

Air Warfare and Weapons



Code 35

ONR 30 Organization

Expeditionary Maneuver Warfare and Combating Terrorism S&T

Human, Social, Cultural, and Behavioral Sciences (HSCB)

Hybrid Complex Warfare Sciences Division (301)

- Basic Research
- Counter IED

Applications Division (302)

- FITE JCTD

Combating Terrorism & Integration Division (303)

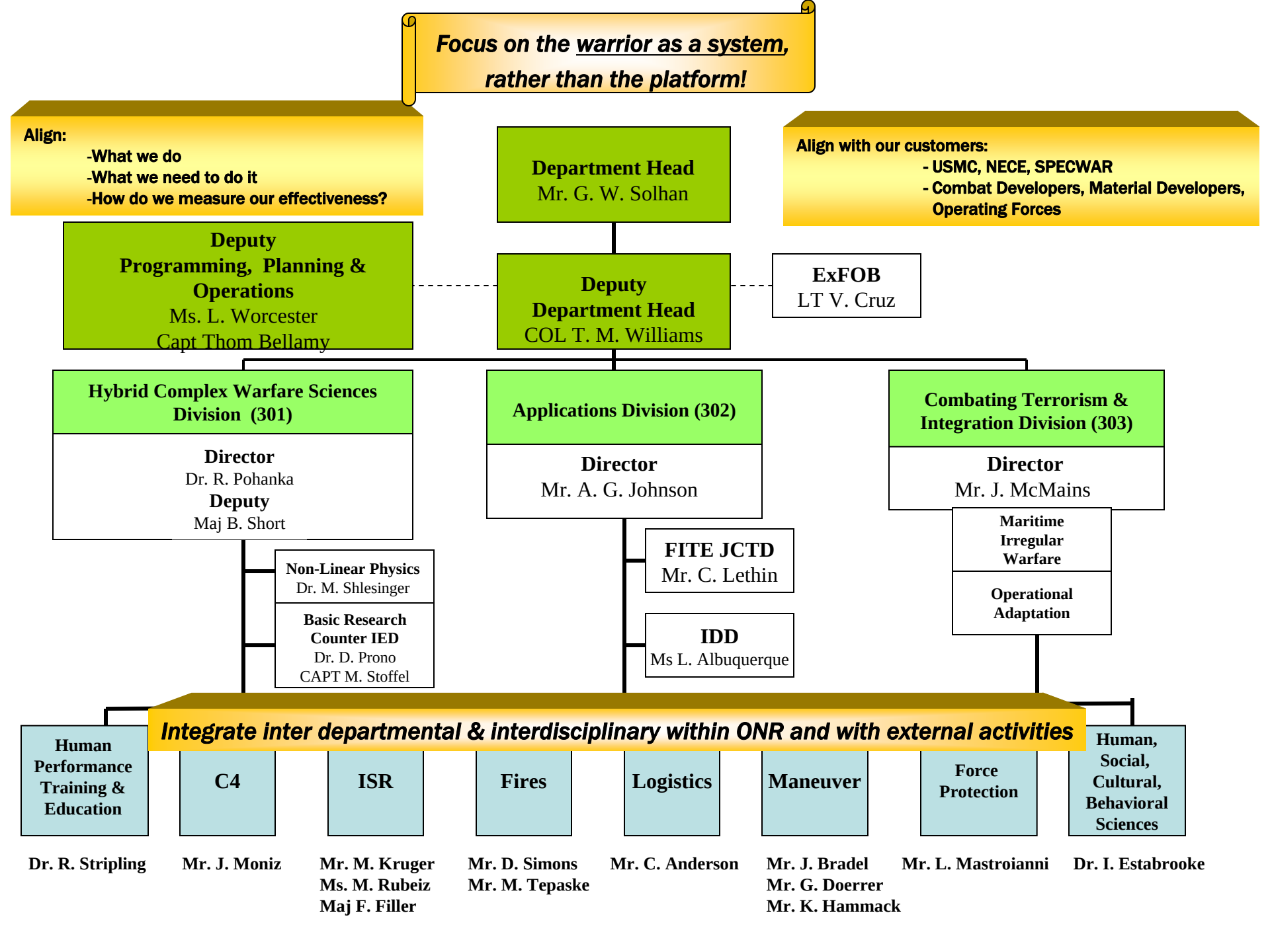
- Maritime Irregular Warfare
- Operational Adaptation + HSCB

FY2011 R2 Activity Areas & ONR Code 30 Thrust Areas

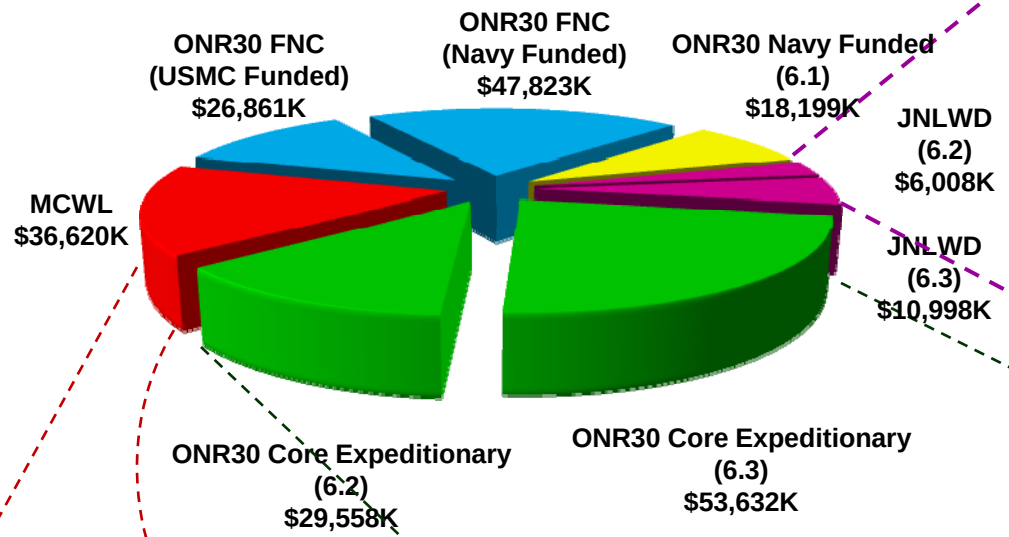
HPT&E* Thrust	C4 Thrust	ISR Thrust	Fires Thrust	Logistics Thrust	Maneuver Thrust	Force Protection Thrust
✓ Enhanced Physical Readiness	✓ Network Centric Warfare -Interoperability	✓ Persistent ISR	✓ Targeting & Engagement	✓ Asset Visibility	✓ Survivability	✓ Detection
✓ Mental Resilience & Cognitive Agility	✓ Over-The-Horizon Comms & Gateways	✓ Knowledge Generation	✓ Advanced Ammo	✓ Logistics Transport	✓ Advanced Mobility	✓ Neutralization
✓ Expertise Development	✓ Small Unit Technologies	✓ ISR - C2 (Actionable Intelligence)	✓ Advanced Weapons	✓ Operational Self-Sufficiency	✓ Maneuver Enablers	✓ Mitigation
		✓ Biometrics		✓ Maintenance Reduction		
		✓ Tag, Track & Locate		✓ Infrastructure		

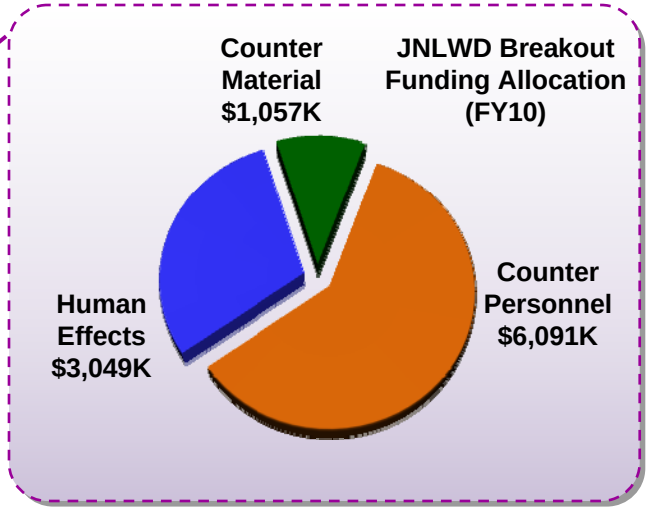
ONR Code 30 Technology Investment Areas – Focused Thrust Level S&T Investments

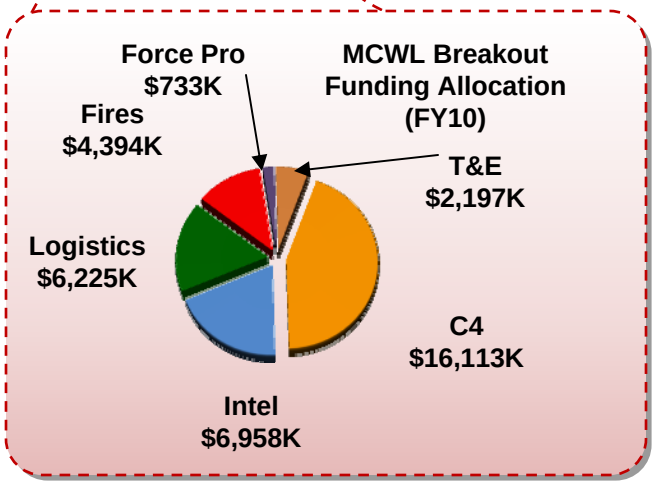
* HUMAN PERFORMANCE, TRAINING & EDUCATION

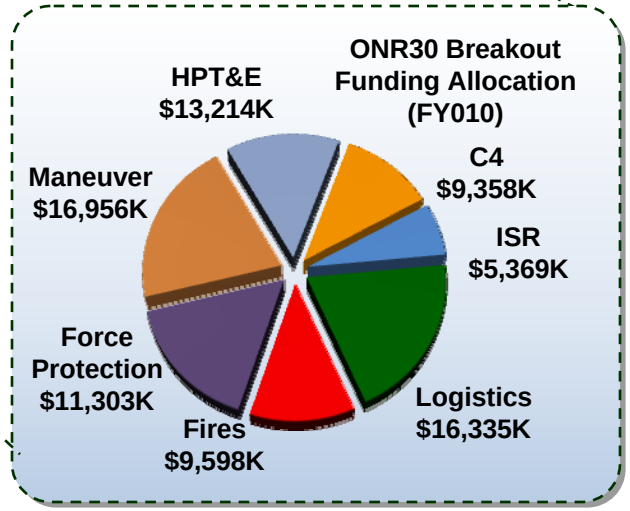

Focus on the warrior as a system, rather than the platform!
Align:
-What we do
-What we need to do it
-How do we measure our effectiveness?
Department Head
Mr. G. W. Solhan
Align with our customers:
- USMC, NECE, SPECWAR
- Combat Developers, Material Developers, Operating Forces
Deputy
Programming, Planning & Operations
Ms. L. Worcester
Capt Thom Bellamy
Deputy
Department Head
COL T. M. Williams
ExFOB
LT V. Cruz
Hybrid Complex Warfare Sciences Division (301)
Director
Dr. R. Pohanka
Deputy
Maj B. Short
Applications Division (302)
Director
Mr. A. G. Johnson
Combating Terrorism & Integration Division (303)
Director
Mr. J. McMains
Non-Linear Physics
Dr. M. Shlesinger
Basic Research
Counter IED
Dr. D. Prono
CAPT M. Stoffel
FITE JCTD
Mr. C. Lethin
IDD
Ms L. Albuquerque
Maritime Irregular Warfare
Operational Adaptation
Integrate inter departmental & interdisciplinary within ONR and with external activities
Human Performance Training & Education
Dr. R. Stripling
C4
Mr. J. Moniz
ISR
Mr. M. Kruger
Ms. M. Rubeiz
Maj F. Filler
Fires
Mr. D. Simons
Mr. M. Tepaske
Logistics
Mr. C. Anderson
Maneuver
Mr. J. Bradel
Mr. G. Doerrer
Mr. K. Hammack
Force Protection
Mr. L. Mastroianni
Human, Social, Cultural, Behavioral Sciences
Dr. I. Estabrooke

FY10 Marine Corps Funding Allocation

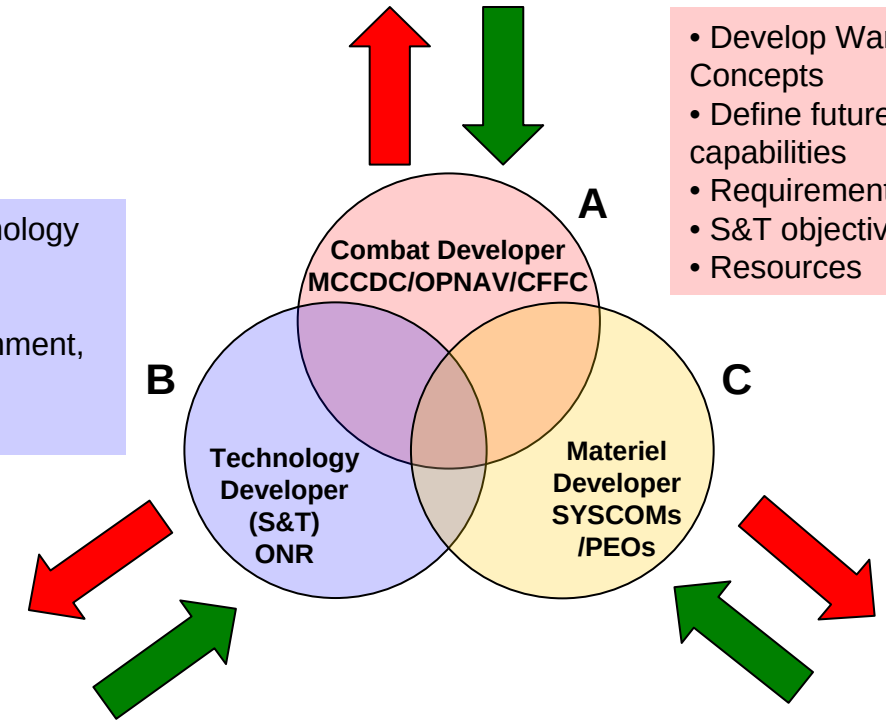








The “The Three Circles”



• Develop Warfighting Concepts
• Define future capabilities
• Requirements
• S&T objectives (STOs)
• Resources

• Plan and execute technology discovery, invention and exploitation
• Collaborate with government, industry and academia
•Technology Transition

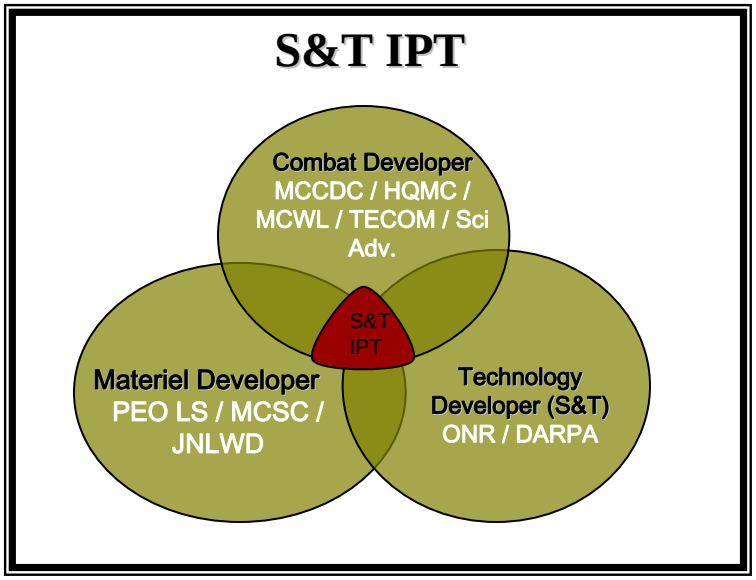
• Program Research and Development
• Procurement
• Fielding
• Operation and Sustainment

Centripetal Forces
- Vision/Planning
- Communication
- Technology Roadmaps
- S&T Objectives
- Technology transition agreements
- Experimentation

Centrifugal Forces
- Budgets
- Schedule
- Risk
- Congress
- Operational Tempo
- Staffing/Turnover
- Industry

A	**Concept**	**Capability Futures**	**Gaps**	**Requirements**			
B		**Capability Futures**	**Gaps**	**Requirements**	**Technology**		
C				**Requirements**	**Technology**	**R&D Production**	**Capability**

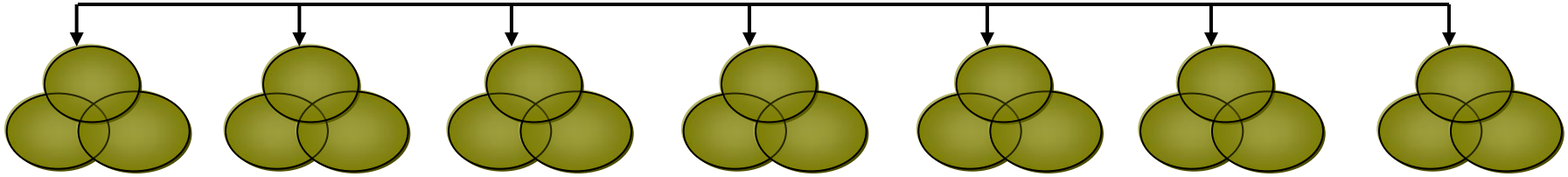
S&T IPT & FWG Organizational Construct



Core Membership – key stakeholders

Technology Dev: *Mr. George Solhan – Chairman*
Executive Sec to EA S&T: *Mr. Jim Lasswell*
Technology Dev: *Mr. Paul Gido - ACNR*
Combat Dev: *Mr. Len Blasiol*
Material Dev: *Mr. David Ungar, Mr Mike Halloran*
Additional Core: *TBD to match charter construct*

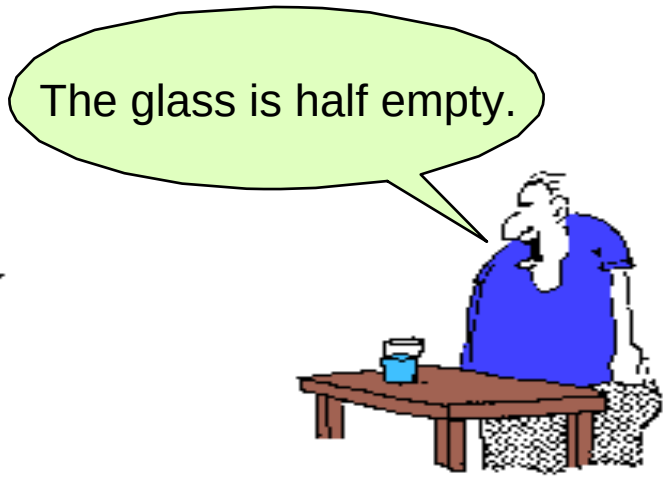
Functional Working Groups (FWG)



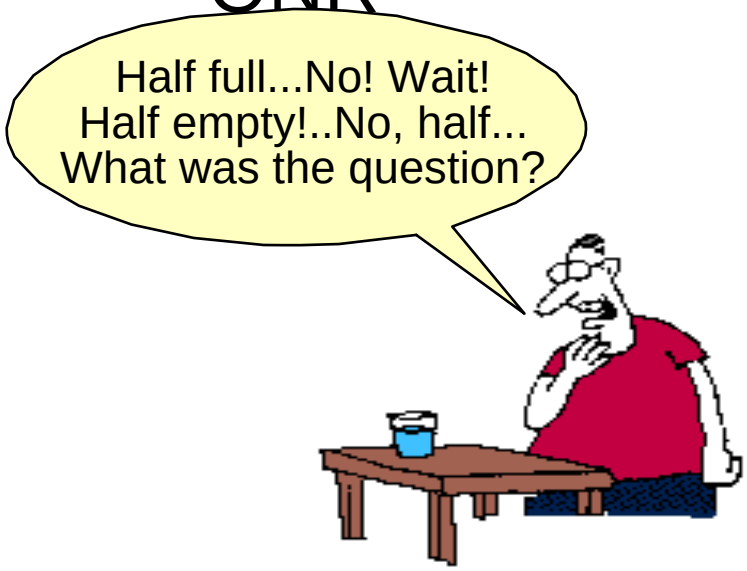
HPT&E/ Training	C4	ISR	Fires	Logistics	Maneuver	FP
Maj Kibel	LtCol Manaco	Maj Scheidler	Maj Cunningham	Paul Neubert	Maj Walters	John Montemayor
Roy Stripling	John Moniz	Martin Kruger	Dan Simons	Cliff Anderson	Jeff Bradel	Lee Mastroianni
Martin Bushika	Chris Zaffram	Marty Jackson	Craig Melton	Scott Story	Scott Story	George Gibbs
Rich St. Amour	Fran Bonner	Rick Shrewsbury	Joe Lipinski	Gloria Tuck	Craig Harvey	George Gibbs
Dan Wright	Mac McKinney	Maj Sadler	Jim Haig	Dan Wright	Greg Kesselring	Greg Kesselring

Combat Developer **Technology Developer (S&T)** **Material Developer**

ONR



SYSCOM



MCCDC/OPNAV

Fleet/MARFOR

Aligning to Strategic Guidance

SECNAV Priorities

- Taking care of our Sailors, Marines, Civilians, and their Families
- Treating energy in DON as an issue of national security
- Creating acquisitions excellence
- Optimizing unmanned systems

CNO Priorities

- Build the Future Force
- Maintain Warfighting Readiness
- Develop & Support Our Sailors, Civilians and Families

Commandant Guidance

- Achieve victory in the War
- Right-size our Corps
- Provide a fully prepared naval force
- Be most ready when the Nation is least ready
- Improve the quality of life for our Marines and our families
- Rededicate ourselves to our Core Values and warrior ethos
- Posture the Marine Corps for the future

CNR 2010 Priorities

1. Focus on S&T areas that provide the biggest payoff for our future
2. Be innovative in our thinking and business processes
3. Improve our ability to transition S&T into acquisition programs
4. Improve strategic communication and engagement with stakeholders

S&T Priorities

1. Focus on S&T areas that provide the biggest payoff for our future
2. Be innovative in our thinking and business processes
3. Improve our ability to transition S&T into acquisition programs
4. Improve strategic communication and engagement with stakeholders

S&T areas with biggest payoff:

- ***Autonomous Systems***
- Hypersonics and Directed Energy
- Warfighter Performance
- Information Dominance
- ***Expeditionary & Irregular Warfare***
- Total Ownership Costs

- SECNAV High Interest:
  - Power & Energy
  - STEM

Autonomous Systems: State-of-the Art

Current state of technology:

Navigation behaviors employing GPS based Route Network Definition Files (RNDF) and costly, multi-modal sensor suites

- Simple behaviors employing rule-based system
- Rule-based systems are not robust enough for complex environments when encountering uncertainty, imprecision, contradiction, and incompleteness
- Typical sensor suite and CPU cost often exceed $250K, bulky, power hungry
  - Limited environmental context and understanding outside of a pre-planned, structured environment
  - Sensor suite and CPU alone render capability un-affordable

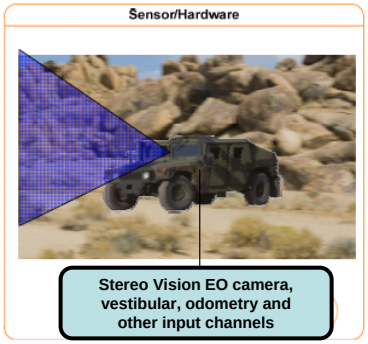
S&T challenges:

1. ***Affordable Logic/Software***
2. ***Affordable Sensor Suites***
3. ***Advanced Autonomy Algorithms***
4. Small unit mobility/maneuverability in extremely complex terrain
5. Dense power and energy devices/sources
6. Fuel independence/energy self-sufficiency for extended ranges

DARPA Urban Challenge

Advanced perception system and algorithms to reduce number of sensors and to allow operations in unstructured environments

Future Tactical System in Unstructured Environments



Remote Control Versus Autonomy

Remote Control

Operator continuously, visually controls the platform via tether or radio. UMS takes no initiative.

Tele-operation

Operator, using video or other sensor input either directly controls the platform or assigns incremental goals via tether or radio. In this mode, the UMS may take limited initiative in reaching the assigned incremental goals.

Semi-autonomous

Operator and the UMS cooperatively plan and conduct a mission but still requires varying degrees of Human-Machine Interface

Fully autonomous

A mode of operation wherein the UMS is expected to accomplish its mission, within a defined scope, without human intervention. Note that a team of UMSs may be fully autonomous while the individual team members may not be due to the needs to coordinate during the execution of team missions.

NIST Special Publication 1011
Autonomy Levels for Unmanned Systems (ALFUS) Framework
Volume I: Terminology
Version 1.1
September 2004

Why Autonomous Behavior is a Hard Problem

Environmental Complexity

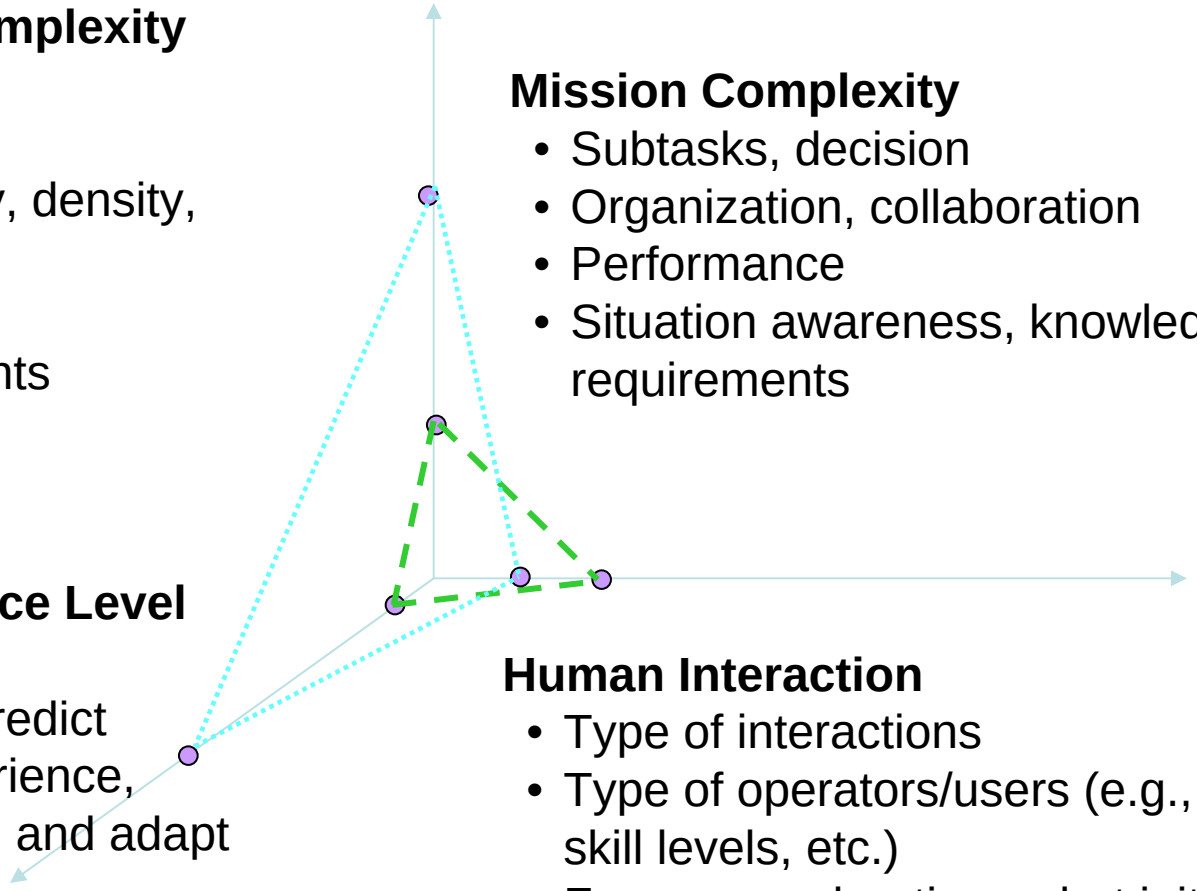
Solution ratios on:

- Terrain variation
- Object frequency, density, intent
- Weather
- Mobility constraints
- Communication dependencies

Machine Intelligence Level

Ability to:

- Reason, Plan, Predict
- Learn from experience, instructions, etc., and adapt to new situations
- Understand the battlespace
- High-level interactions with humans



Mission Complexity

- Subtasks, decision
- Organization, collaboration
- Performance
- Situation awareness, knowledge requirements

Human Interaction

- Type of interactions
- Type of operators/users (e.g., workload, skill levels, etc.)
- Frequency, duration, robot initiated interactions

ONR 30 Unmanned Ground Systems
Areas of Interest

Affordable Sensor Suites and Advanced Perception System

Move away from costly multi-modal sensors suites to low-cost vision based sensors

a. Leverage existing machine vision work performed by DARPA and JPL (LAGR Program)
b. Distributed computing networks to process "at-the-sensor " utilizing FPA, DSP, GPU and reduce the computational burden on the CPU
c. More capable and robust texture analysis algorithms (segmentation, texture, signature)
d. Reasoning algorithms to discriminate between objects and apply context to a near-field spatial scene (rock-bush, puddle-hole, door-window)

Advanced Autonomy Algorithms

Move from point-to-point navigation to autonomous behaviors not reliant on GPS

a. Near-field Tactical Path Planner utilizing a Raster World Model including relative and absolute localization (SLAM)
b. Far-field Advanced Path Planner to include platform master state information and environmental traversability
c. Dynamically generated high-level situation awareness model incorporating information not organic to the vehicle such as threat areas, road and terrain connectivity and traversability, and real-time events and intelligence (Ford Sync System™)
d. Advanced autonomy behaviors which integrate bottom-up perception and top-down reasoning to execute doctrinally correct tasks with no human intervention

Human Performance, Training, and Education Vision for Excellence

- Marine as a system
- Enhanced combat capabilities at individual & small unit level
- Crisis-based decision making
- Distributed Operations (DO) Small Unit Excellence
- Lightened load of all Warfighters
- DO-enabled training methodologies & technologies
- Increased resilience to extreme and austere environments

Tech Investment Area:

Enhanced Physical Readiness

Perceive → Think → Act

Nutrition, Physiology, Strength, Endurance, Agility

Heat, Cold, Altitude, Humidity, Mission Duration…

Tech Investment Area:

Expertise Development

Perceive → Think → Act

Knowledge, Skills, Abilities

Info Overload, Time Pressure, Mission Performance…

Tech Investment Area:

Mental Resilience & Cognitive Agility Development

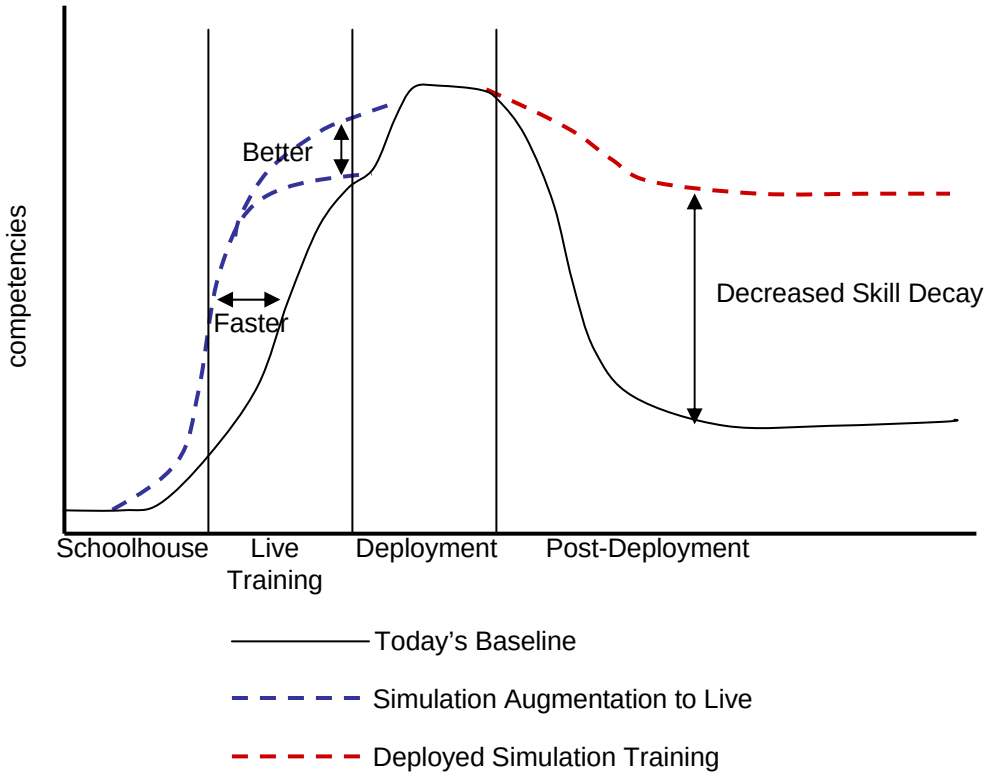
Perceive → Think → Act

Adaptiveness, Emotional Fortitude

Rules of Engagement, Moral and Ethical Challenges

Impact of Training

- Training today achieves a certain level of proficiency
  - Simulation training can increase rate of proficiency development, enabling greater benefits of live pre-deployment training to be achieved
- During or post-deployment, unused skills deteriorate rapidly
  - Simulation training (synthetic and live) will reduce skill loss by providing training opportunities otherwise not available



Infantry Immersion Trainer (IIT)

OBJECTIVES:

- Develop a prototype mixed reality system for highly effective Home Station MOUT training prior to Mojave Viper
- Inoculate Marines to the sights, smells, sounds, and chaos of urban battle
- Demonstrate and experiment with new technologies

TECHNICAL APPROACH:

- Maximum use of COTS components
- Leverage ONR and Army RDECOM technologies
- Government controlled architecture
- Modular Design
- Incremental improvements
- SESAMS (paintball) weapons with custom lasers
- Projected Avatars on selected walls

Accomplishments and Plans:

- Over 10,000 Marines, Soldiers, and Allies trained
- Smaller scale system for Human Factors research- Gruntworks Research for Infantry Integration Testing (GRIIT) facility at Stafford, VA in use by PM MERS
- Improvements to I MEF IIT:
  - Improved Call for Fire Software
  - Improvements to Avatars (virtual characters); lasers; and improved instructor control
  - ONR Software to be used at JIEDDO funded I MEF IIT Phase 2, II MEF, and III MEF facilities
  - Continued improvements under ONR Technical leadership as part of the FITE JCTD

The Ultimate Customer – The Warfighter!

ONR S&T enables Sailors and Marines!

- S&T in support of Expeditionary Maneuver Warfare (continued primary importance to both Navy and Marine Corps)
- S&T in support of Combating Terrorism – aka Maritime/Irregular Warfare (MIRWAR), GWOT, Long War, etc. (rapidly growing emphasis in both Navy and Marine Corps)
- Survive and Win
- Be more lethal
- Expand their area of influence
- Be flexible in all phases of warfare
- Move between kinetic and non-kinetic tactics
- Predict actions of Irregular enemies
- Generate combat power operationally/tactically
- Operational Adaptation in new paradigm of Hybrid Complex Warfare

Questions?

Back-Up


EXPEDITIONARY MANEUVER WARFARE
& COMBATING TERRORISM S&T DEPARTMENT

MANEUVER

Marine forces of the future will be significantly more agile, lethal, mobile and survivable. Technologies will be developed to increase the warfighting capabilities and effectiveness of the Marine Corps Air Ground Task Force (MAGTF) with emphasis on improving survivability, providing enhanced maneuver, and providing maneuver enabler systems in Distributed Operations and Irregular / Asymmetric Warfare.

ONR

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RECENT TRANSITIONS

GLADIATOR TACTICAL GROUND UNMANNED VEHICLE (FNC)
Transitioned to MCSC

RECONNAISSANCE, SURVEILLANCE, & TARGETING VEHICLE (FNC)
Transitioned to MCSC

EXPEDITIONARY DECISION SUPPORT SYSTEM (FNC)
Transitioned to MCSC and NAVAIR

MODELING & SIMULATION BASED DESIGN (D&I)
Transitioned to MCCDC

JLTV STUDIES AND ANALYSES, TECHNOLOGY DEMONSTRATOR, AND BLAST HULL TESTING
Transitioned to MCSC, MCCDC, Army

T = Transition

KEY	Plus-up	Other	FNC	D&I	E&D

Technology Investment Areas

Survivability

MVR STO-2: Advanced materials and survivability technologies to enhance the performance and survivability of combat vehicles

MVR STO-8: Vehicle design for Marine Survivability and Usability

FP STO-4: Active protection system for vehicles against rocket propelled grenades.(deleted in new S&T plan)

NECE/NSW STOs

Advanced Mobility

MVR STO-1: Advanced power plants, drive trains, and suspensions

MVR STO-2:Advanced materials and survivability technologies to enhance the performance and survivability of combat vehicles

NECE/NSW STOs

Maneuver Enablers

MVR STO-3: Augmented cognition for combat vehicle crews and operators of maneuver systems

MVR STO-5: Marine performance enhancements

MVR STO-6/NSW MVR 09-15: Advanced robotic systems for ground combat

NECE/NSW STOs

PROJECTS

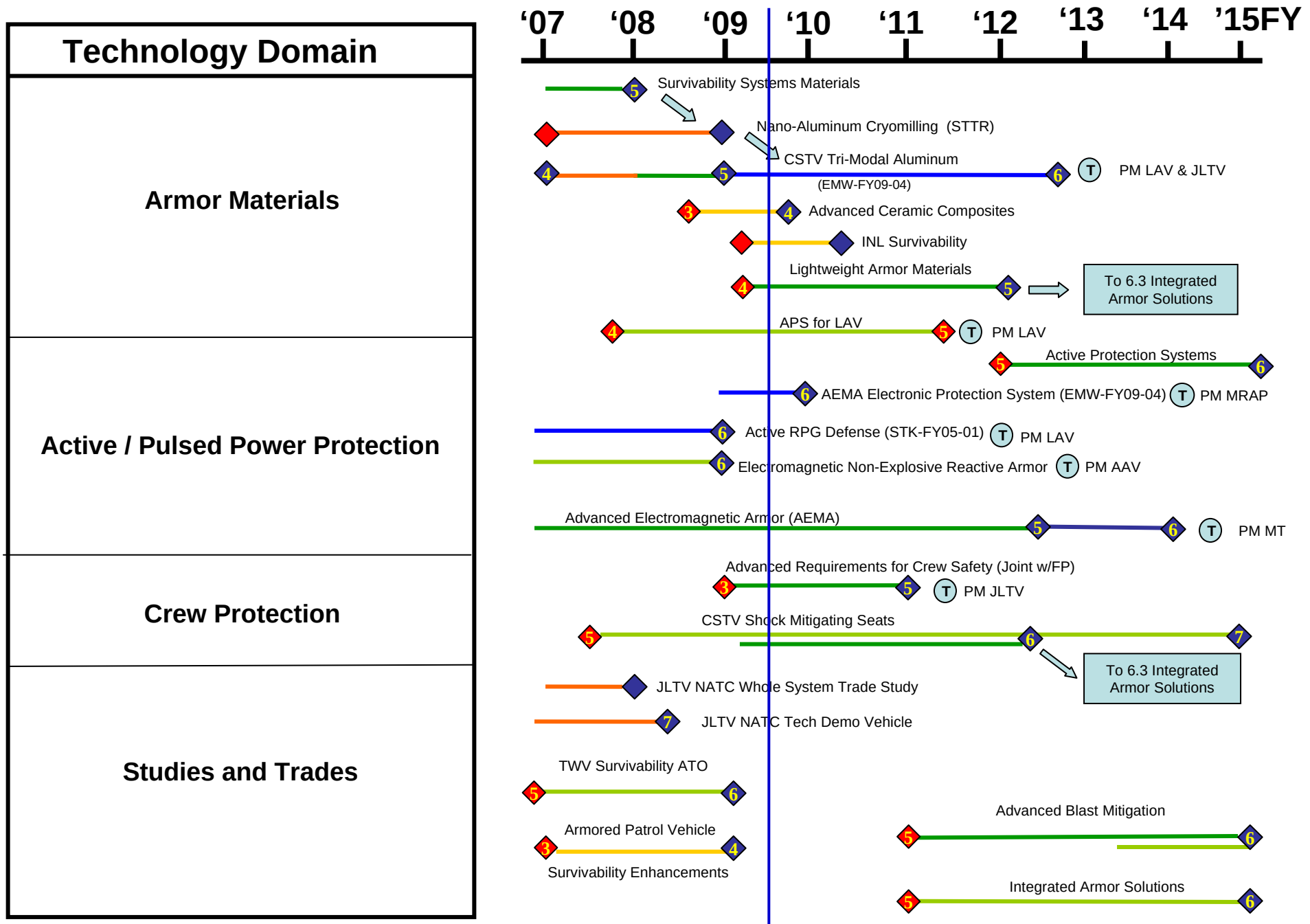
- Lightweight Armor Materials (D&I)
- CSTV Tri-Modal Aluminum (FNC)
- Advanced Electromagnetic Armor (D&I and E&D)
- AEMA (EPS) (FNC)
- Advanced Requirements for Crew Safety (D&I)
- Advanced Ceramic Composites (Plus-Up)
- CSTV Shock Mitigating Seats (D&I and E&D)
- INL Survivability (Plus-Up)
- Active Protection System for LAV (E&D)

- Vehicle Stability (D&I)
- Hybridization and Re-Power (E&D)
- Military Driving Cycle Assessment (E&D)
- Integrated Power & Propulsion (E&D)
- Fuel Efficiency Enabling Technologies w/ TARDEC (E&D)
- Advanced LAV Suspension System (FNC)
- Electronic Acceleration Assist and Integral Starter / Generator System (E&D)
- On-Board Vehicle Power Systems Development (Plus-Up)

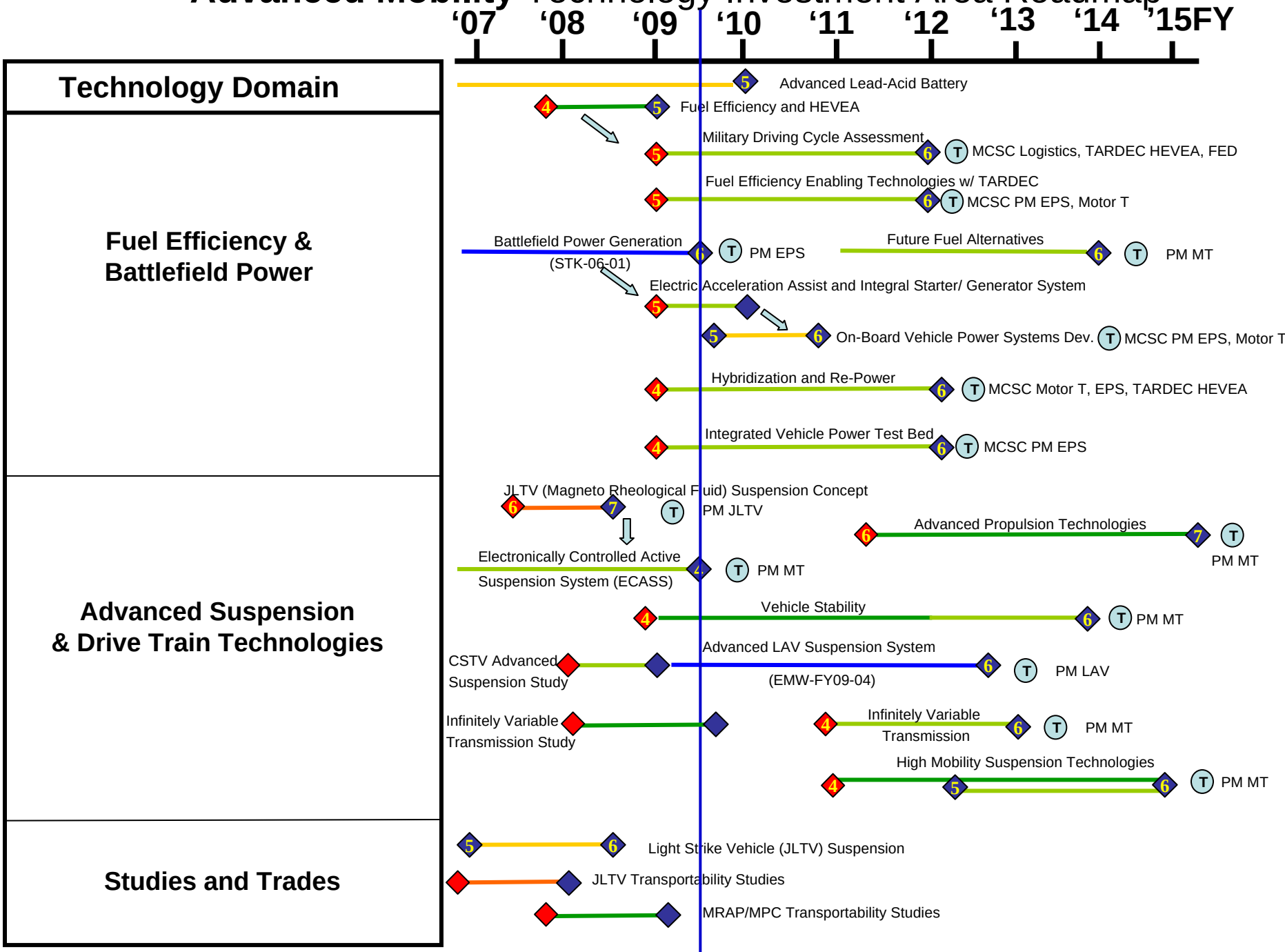
- Advanced Interfaces and Ground Controls (D&I)
- MAGTF Situational Awareness (Plus-Up)
- Small Unit Mobility Enhancement Technologies (SUMET) (D&I and E&D)
- Naval Expeditionary Overwatch (NEO)

Revised: 02JUN09

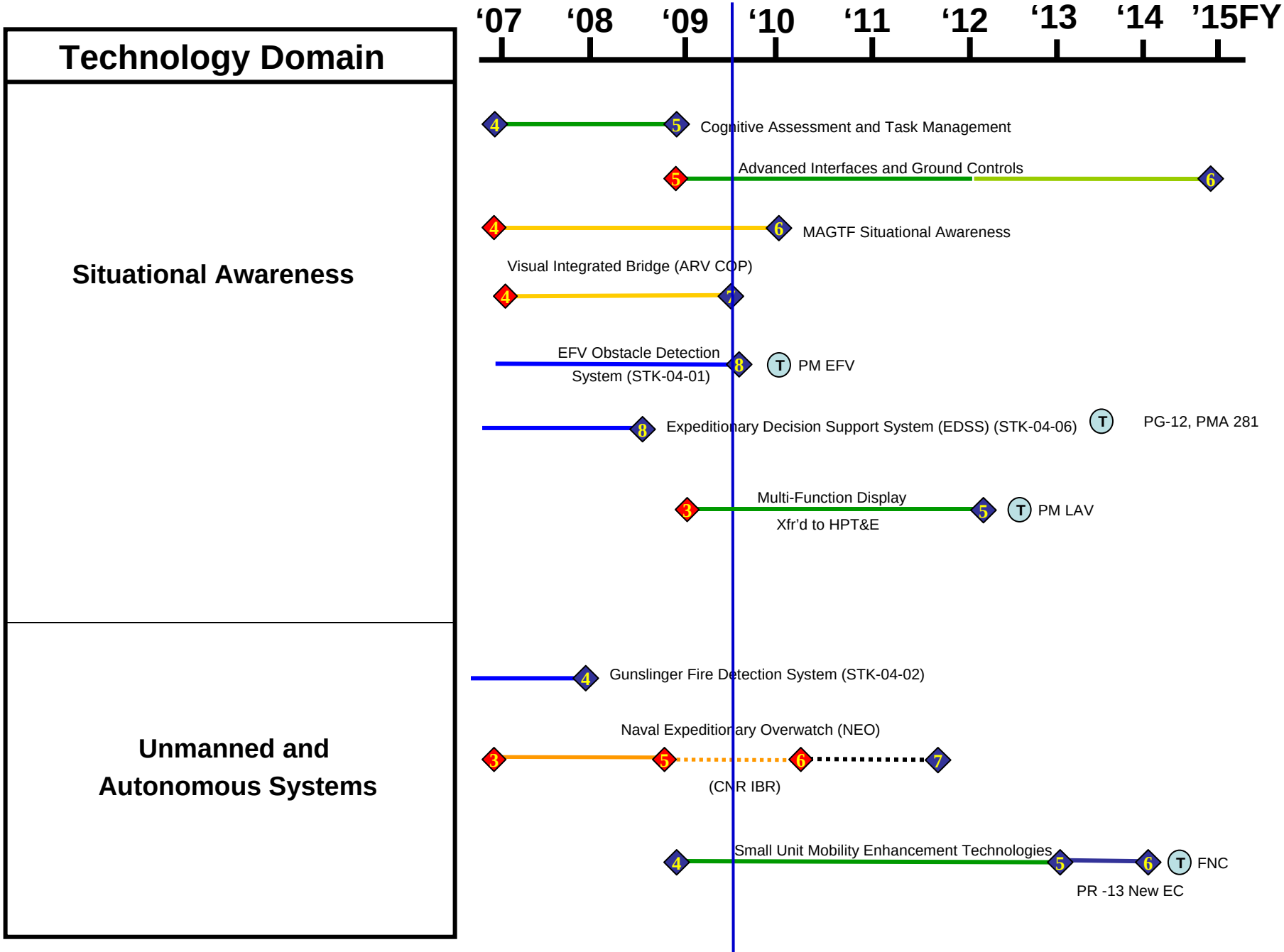
Survivability Technology Investment Area Roadmap



Advanced Mobility Technology Investment Area Roadmap



Maneuver Enablers Technology Investment Area Roadmap



COMMAND & CONTROL, COMPUTERS, COMMUNICATION FY10

To provide tomorrow's naval expeditionary warfighters with the precise information they need, when they need it, under all conditions with emphasis on small units in complex, hybrid warfare environments

KEY	D&I	E&D	FNC	Other	Plus up

ONR

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RECENT TRANSITIONS

Conformal Antennas 6.2 (D&I)

- Transitioned to CERDEC

System Integration Environment

- Transitioned to MAGTF C2
- Transitioned to MACCS-X
- Transitioned to MCSC (DARPA DTN)

M2C2 (Plus-up)

- Transitioned to MCSC
- 2d MEB

TECHNOLOGY INVESTMENT AREA

NETWORK CENTRIC WARFARE / INTEROPERABILITY

USMC/NECC/NSW C2 STO-1 : Converged services networks with assured, robust communications linking all echelons of the MAGTF

USMC/NECC/NSW C2 STO-2: Multilevel information security and assurance

USMC/NECC/NSW C2 STO-3: Intelligent network monitoring, maintenance, and mobility

USMC/NECC/NSW C2 STO-4: Improved situational awareness for warfighters at all echelons

OVER-THE-HORIZON COMMUNICATIONS/ GATEWAYS

USMC/NECC/NSW C2 STO-1
USMC/NECC/NSW C2 STO-3
NECC/NSW C2 STO-6: Self-deployed communications relay
NECC/NSW C2 STO-7: Watercraft command-and-control station technology
NSW C2 09-12: Multi-function VHF, UHF, and UHF SATCOM Antenna

PROJECTS

- Adaptive Networks 6.2 (D&I)
- MOBILE MODULAR COMMAND & CONTROL-NETWORK MGMT TOOLS (M2C2) (Plus-Up)
- System Integration Environment (E&D)
- Agile Coalition Environment and TEMPO (Plus-Up)
- DTCN EC (FNC)

FY10 START

- Signal Distribution Research (D&I)
- M2C3 DEVELOPMENT
- NON-LINE OF SIGHT COMMS Tech (D&I)
- RF TECHNOLOGIES 6.2
- FSO COMMS TECH (D&I)
- RECONFIGURABLE AMPLIFIER
- TACTICAL RF SYSTEMS (E&D)
- Comms Relay (OSD)
- Advanced HF Communications (E&D)
- Characteristic Modes (STTR)
- SATCOM OTM Int/Demo (E&D)
- Compact HF Antennas (STTR)
- Software Reprogrammable Payload (E&D)
- M2C2: PROTOTYPE PACKAGE & ANTENNAS (Plus-Up)
- Low-Cost SATCOM Antennas (FNC)

COMMAND & CONTROL, COMPUTERS, COMMUNICATION FY10

To provide tomorrow's naval expeditionary warfighters with the precise information they need, when they need it, under all conditions with emphasis on small units in complex, hybrid warfare environments

KEY	D&I	E&D	FNC	Other	Plus up

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TECHNOLOGY INVESTMENT AREA

SMALL UNIT TECHNOLOGIES

USMC/NECC/NSW C2 STO-1: Converged services networks with assured, robust communications linking all echelons of the MAGTF
USMC/NECC/NSW C2 STO-2: Multilevel information security and assurance
USMC/NECC/NSW C2 STO-3: Intelligent network monitoring, maintenance, and mobility
USMC/NECC/NSW C2 STO-4: Improved situational awareness for warfighters at all echelons
USMC/NECC/NSW C2 STO-5: Blue Force Tracking/ PLI/ Combat ID*
USMC C2 STO-6/NSW STO-10: Collaborative Planning and Synchronized Execution

PROJECTS

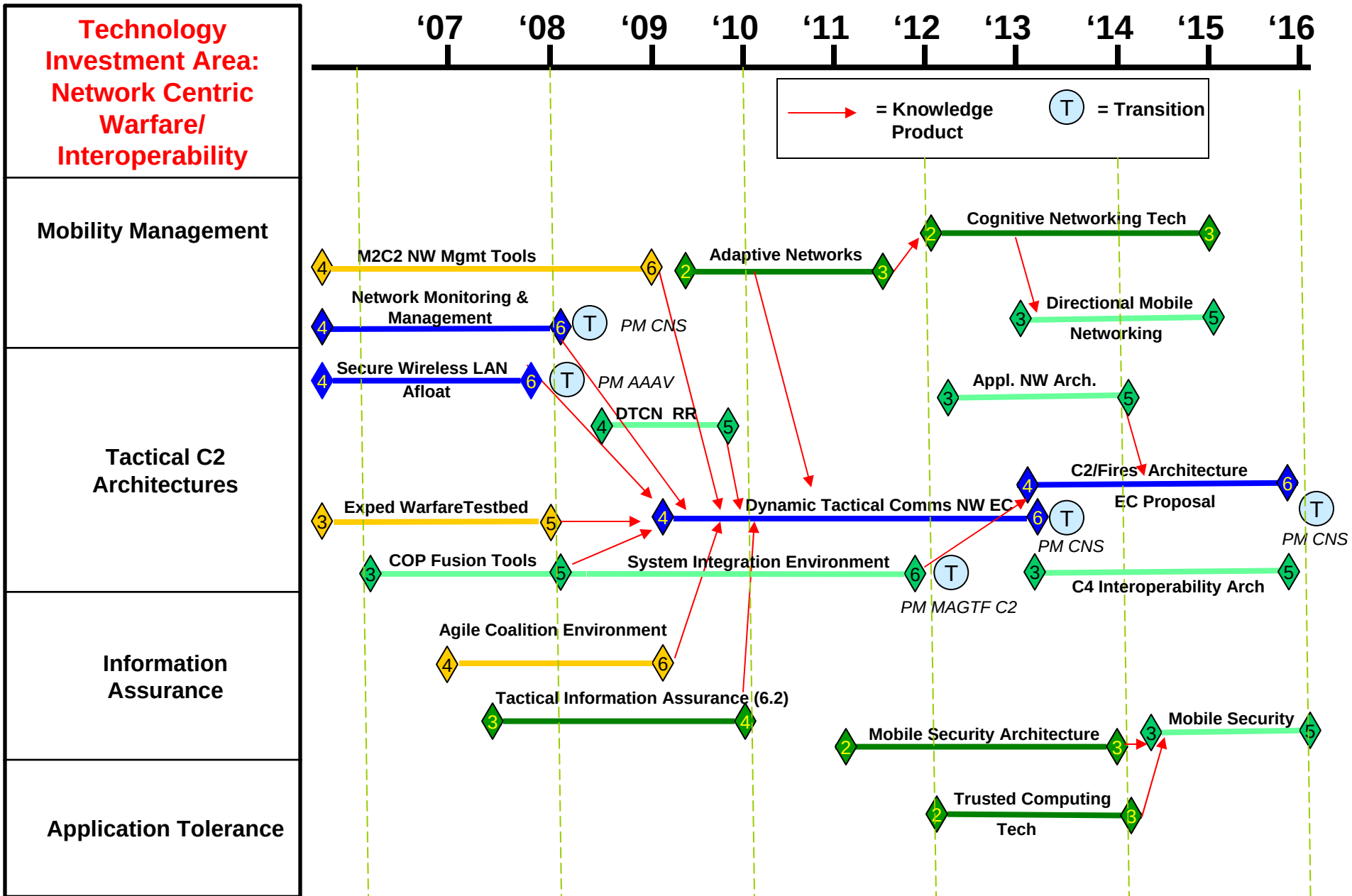
- DISTRIBUTED COMPUTING 6.1 (D&I)
- ADAPTABLE ANTENNAS (D&I)
- Info on Demand Tech 6.2 (D&I)
- SELF-ADAPTING RADIO PROTOTYPE 6.2 (D&I)
- Assured Connectivity 6.2 (D&I)
- SPR Security Architecture (SBIR)

FY10 START

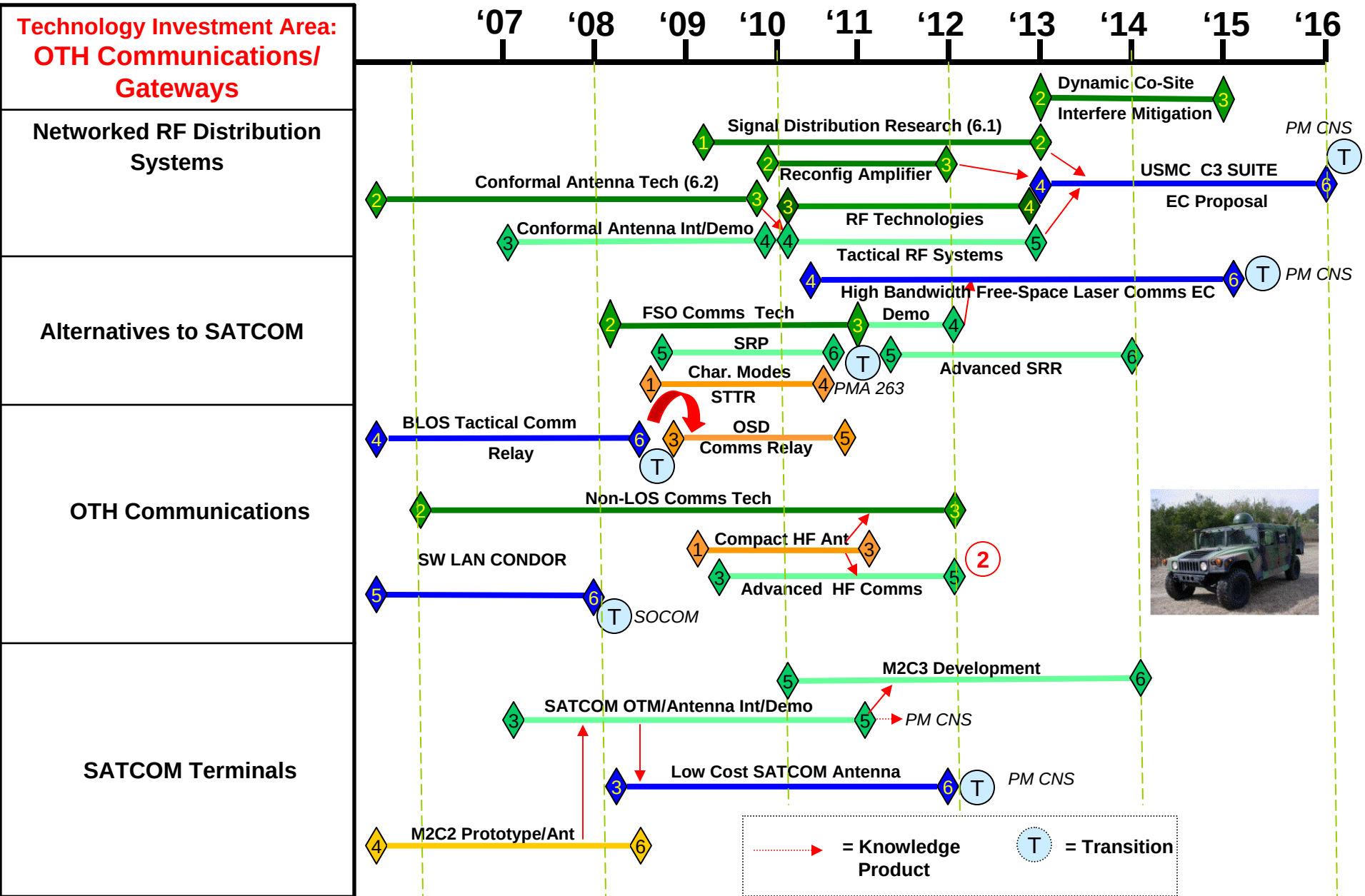
* *Funding planned in FY11*

Jul09v12

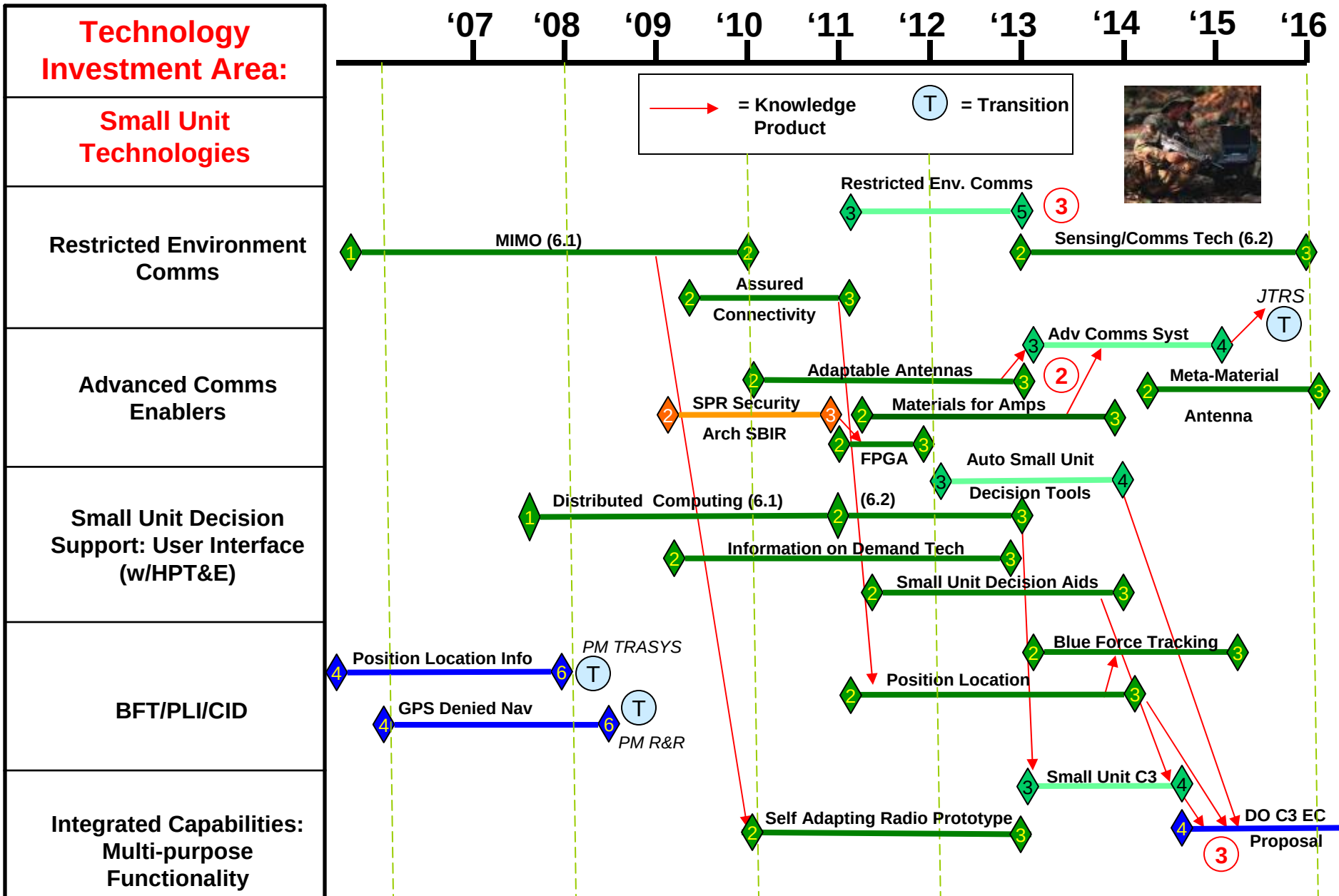
C4 S&T Roadmap 1/3



C4 S&T Roadmap 2/3



C4 S&T Roadmap 3/3



FIRES

Discovers and develops technologies to provide decisive, unrivaled new capabilities for, or to improve the performance of Navy and Marine Corps warfighters in the areas of Fires; with particular focus on Distributed Operations and Asymmetric/Irregular Warfare; to include Naval Expeditionary and other weapons, munitions, fuzes, ballistics, propulsion, weapons systems control and guidance, enhanced accuracy, tailored lethality including non-lethal alternatives, enhanced targeting (to include detection, locating, identification, designation, and tracking), directed energy, and lightweight components; and to avoid technological surprise.

KEY:	Other	FNC	D&I	E&D	Plus-Up

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RECENT TRANSITIONS

IMPROVED FIRE CONTROL SYSTEM (FNC)
TRANSITIONED TO PM INFANTRY WEAPONS SYSTEMS

LIGHTWEIGHT MORTAR SYSTEM (FNC)
TRANSITIONED TO PM MORTARS & PM INFANTRY WEAPONS SYSTEMS

ADVANCED FIRES COORDINATION TECHNOLOGY
TRANSITIONED TO PM MAGTF C2

ADVANCED GUN BARREL TECHNOLOGY
TRANSITIONED TO PEO-IWS3c

MEMS SAFE & ARM
TRANSITIONED TO PM AMMO

TECHNOLOGY INVESTMENT AREAS

TARGETING & ENGAGEMENT

USMC Fires STO-1: Targeting technologies for faster, more precise engagements, while simplifying fire control tasks

USMC Fires STO-2: Integrated lightweight day-night optics

USMC Fires STO-3: Engagement damage assessments

USMC Fires STO-4: More capable, lighter weight ammunition across the spectrum of lethality, with increased reliability, range, precision, and safety

USMC Fires STO-6: Increased capabilities and reduced weight of all ground combat weapons systems

USMC Fires STO-7: Technologies that utilize the electromagnetic spectrum to detect, exploit and target adversary systems, equipment, or individuals

NECE Fires STO-6: Lightweight day-night optics

NSW Fires 09-7: Lightweight, All Weather, Precision Targeting Technologies

NSW Fires 09-9: Lightweight Day-Night Weapons Optics

NSW Fires 09-13: Munitions Terminal Guidance for NSW Applications

NSW Fires 09-16: Highly Responsive Loitering Munitions/Weaponized UAS

NSW Fires 09-18: Advanced Weapons and Propellant Technologies

PROJECTS

- IMPROVED FIRE CONTROL SYSTEM (IFCS)
- DISTRIBUTED OPERATIONS PRECISION ENGAGEMENT (DOPE)
- NON-MAGNETIC AZIMUTH SENSING (NMAS)
- INTEGRATED DAY/NIGHT SIGHT TECHNOLOGY (IDNST)
- MICRO-PULSE LASER DESIGNATION
- MEMS INERTIAL SENSORS (UC IRVINE)
- FLIGHT CONTROLLED MORTAR
- PRECISION ENGAGEMENT TECHNOLOGIES (PET)

FIRES

Discovers and develops technologies to provide decisive, unrivaled new capabilities for, or to improve the performance of Navy and Marine Corps warfighters in the areas of Fires; with particular focus on Distributed Operations and Asymmetric/Irregular Warfare; to include Naval Expeditionary and other weapons, munitions, fuzes, ballistics, propulsion, weapons systems control and guidance, enhanced accuracy, tailored lethality including non-lethal alternatives, enhanced targeting (to include detection, locating, identification, designation, and tracking), directed energy, and lightweight components; and to avoid technological surprise.

KEY:	Other	FNC	D&I	E&D	Plus-Up

TECHNOLOGY INVESTMENT AREAS	PROJECTS
ADVANCED AMMUNITION	TACTICAL URBAN STRIKE WARHEAD (TUSW) 81mm EXTENDED RANGE MORTAR AMMUNITION (ERMA) CASELESS AMMUNITION 1901 A IGNITION SAFETY DEVICE REVOLUTIONARY TARGET EFFECTS MEMS MORTAR S&A
ADVANCED WEAPONS	HIGH PERFORMANCE ALLOYS FOR WEAPONS APPLICATIONS

USMC Fires STO-4: More capable, lighter weight ammunition across the spectrum of lethality, with increased reliability, range, precision, and safety

USMC Fires STO-5: Improved propellants and energetic materials

USMC Fires STO-6: Increased capabilities and reduced weight of all ground combat weapons systems

NSW Fires 09-11: Measured-Effect Munitions

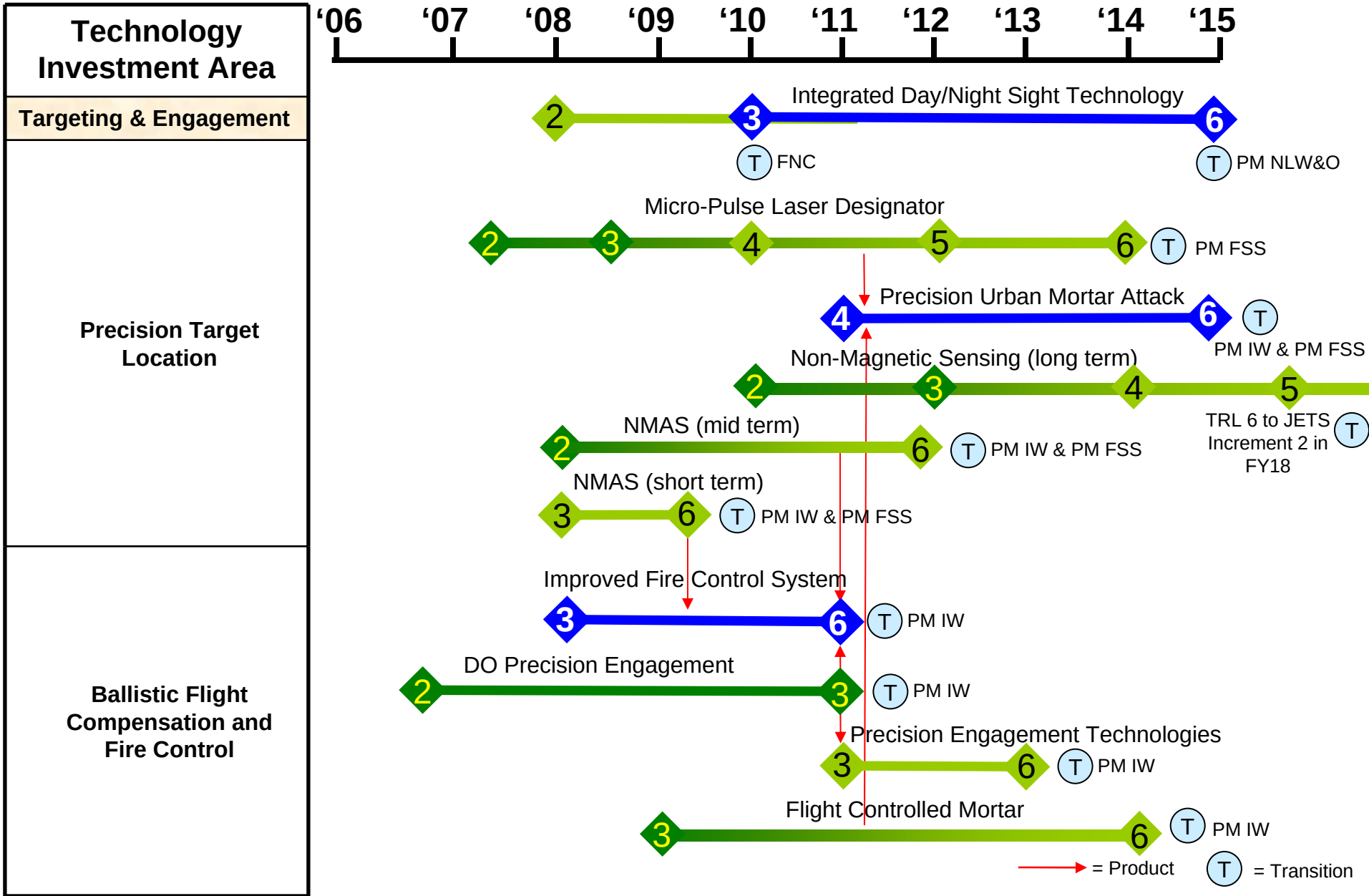
NSW Fires 09-12: Clandestine Structure Penetration

NSW Fires 09-18: Advanced Weapons and Propellant Technologies

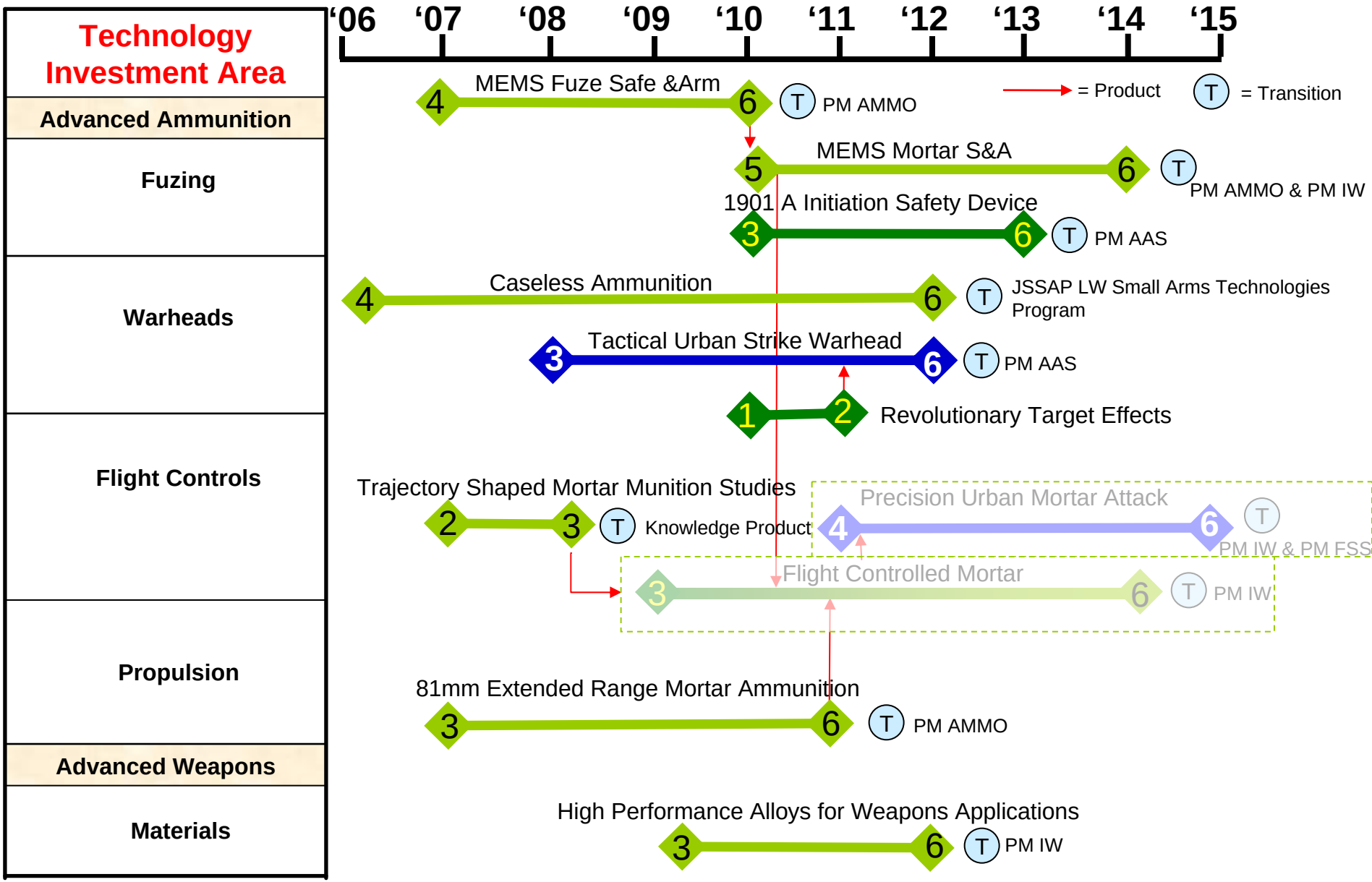
USMC Fires STO-6: Increased capabilities and reduced weight of all ground combat weapons systems

NSW Fires 09-18: Advanced Weapons and Propellant Technologies

ONR 30 FIRES S&T Roadmap (1 of 2)



ONR 30 FIRES S&T Roadmap (2 of 2)



HUMAN PERFORMANCE, TRAINING & EDUCATION

Expeditionary Warfighters that are physically, mentally, emotionally, and cognitively ready to deploy anywhere in the world on short notice, to serve within their team, or take on leadership roles as needed, and to complete their mission efficiently and effectively under any extremes of condition.

ONR30 HPT&E

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RECENT TRANSITIONS

Infantry Immersive Trainer (IIT)

ONR prototype, transitioned directly to I MEF

Gruntworks Research for Infantry Integration Testing (GRIIT)

ONR prototype, transitioned directly to PM Marine Expeditionary Rifle Squad

Automatic Performance Evaluation and Lessons Learned (APELL)

ONR prototype, transitioned directly to PM Training System (PM TRASYS)

VIDEO FLASHLIGHT (D&I)

Fielded to USMC ranges as Tactical Video Capture System (TVCS)

Multi-platform Operational Team Training Immersive Virtual Environment

Transition to:

- TRASYS DVTE
- TBS
- IOC
- EWS
- EWTG-LANT and –PAC for JTAC sustainment training

AAV Turret Trainer

ONR prototype, directly to series production; currently fielded as an USMC training simulator.

Technology Investment Areas

Enhanced Physical Readiness

Med STO 2: Human Performance Enhancement Capabilities

Med STO 3: Fatigue Management

Med STO 7: Warfighter Physiology

Med STO 8: Physical Readiness Conditioning and Nutrition Monitoring

Mental Toughness & Cognitive Agility

T&E STO-2: Learning OPFOR

T&E STO-6: High Fidelity Virtual Environment

T&E STO-8: Non-Kinetic Effects Simulation

T&E STO-9: Squad Immersive Training Environment Enablers

PROJECTS

Assessment, Development & Validation of PT Regimens (D&I)

Biomarkers of Heat Stress and Resilience (D&I)

Enhancing Warfighter Psycho-physical Performance (E&D)

Sprint Interval Training & Nrf2 Activator Supplementation (D&I)

Physical Conditioning Impacts on Combat Readiness (E&D)

Mitigation of Sleep Deprivation (E&D)

Increasing Sensitivity of the Human Eye (YIP)

Simulation Tool for Lightening the Load of Warfighters (STTR)

Enhanced Technologies for Optimization of Warfighter Load (ETOWL) (FNC)

Trainable Automated Forces (TAF)(D&I)

Vehicle Common Adaptive Display (E&D)

Workload, Stress and Perf. in Immersive Training (D&I)

NonKin Village (E&D)

Unmanned Ground Vehicles MMI (Man-Machine Interface) (E&D)

Virtual Environment Prototyping (E&D)

General Purpose Real-time Mitigation Engine (E&D)

Real-time Adaptive Training Environment (E&D)

Adapting Processing to Promote applied Learning Efficiency (APPLE) (E&D)

Expressive Interactions for Desktop VE

Automated, Real Time Bi-directional Communication (SBIR)

Incorporating Affective Learning in Virtual Training Environments (AVETTS) (SBIR)

Infantry Immersive Trainer (Tech Solutions)

Closed-Loop Real-Time Neurophysi-Driven Simulation-Based Training System (SBIR)

Development of Low-Cost Tracking System for Infantry Training (STTR)

Development of Low-cost Augmented Reality Head Mounted Display (STTR)

Warfighter Rapid Awareness Processing Technology WRAPT (Cong)

Technology for Assessing the Resilience of Training to Stressful Conditions (ONR-Global)

Key	D&I	E&D	Cong	FNC	other

HUMAN PERFORMANCE, TRAINING & EDUCATION

Expeditionary Warfighters that are physically, mentally, emotionally, and cognitively ready to deploy anywhere in the world on short notice, to serve within their team, or take on leadership roles as needed, and to complete their mission efficiently and effectively under any extremes of condition.

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- IOC
- EWS
- EWTG-LANT and –PAC for JTAC sustainment training

AAV Turret Trainer

ONR prototype, directly to series production; currently fielded as an USMC training simulator.

Technology Investment Areas

Expertise Development

T&E STO-1: Warfighter Cognition

T&E STO-2: Learning OPFOR

T&E STO-3: Physics Based Library for Battlefield Effects

T&E STO-4: Warrior Training

T&E STO-5: Experiential Learning Technologies and Pedagogy

T&E STO-6: High Fidelity Virtual Environment

T&E STO-7: Automated Performance Assessment

T&E STO-8: Non-Kinetic Effects Simulation

T&E STO-9: Squad Immersive Training Environment Enablers

T&E STO-10: Live Virtual Constructive Training Environment Enablers

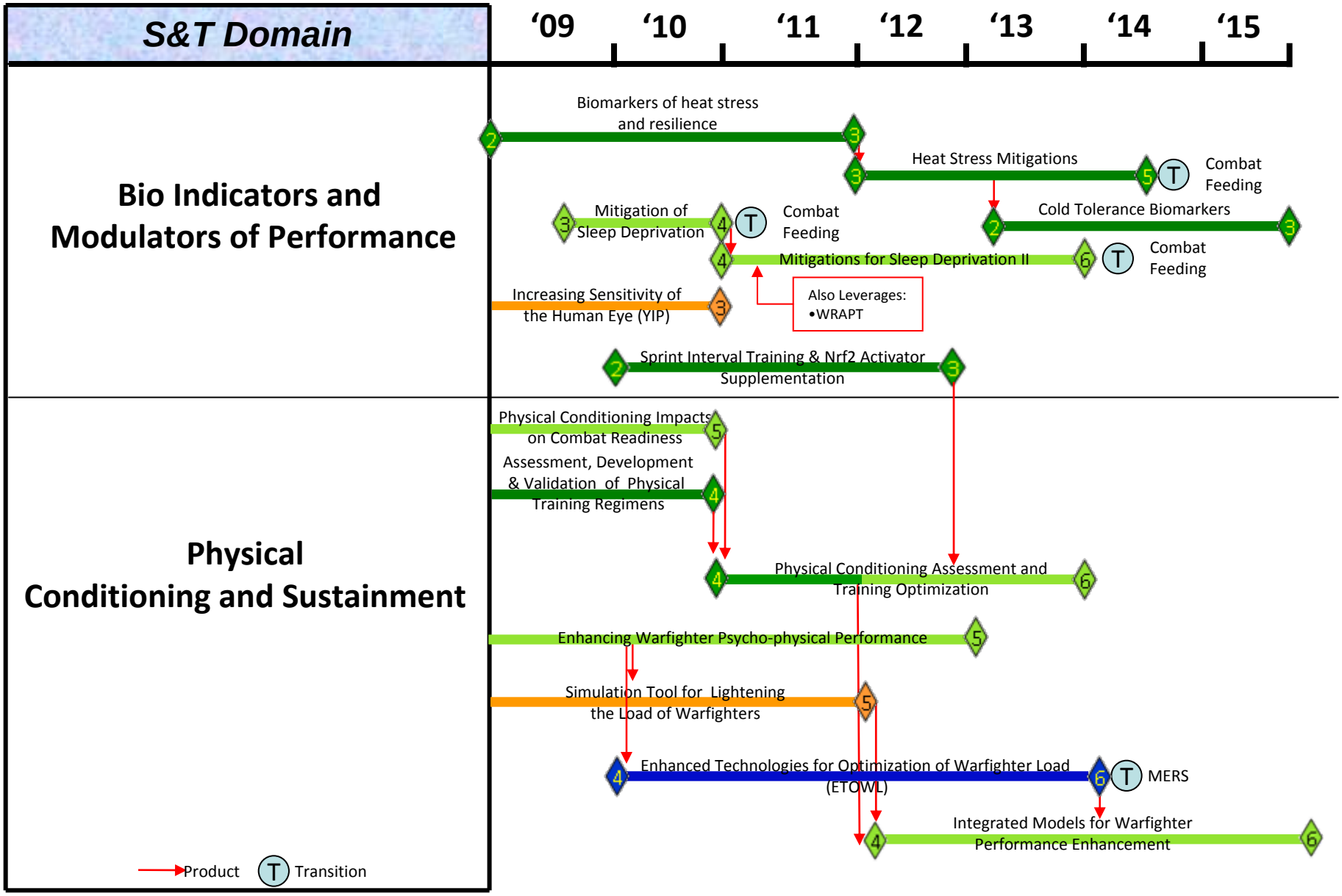
PROJECTS CONTINUED

- Neuroadaptive Language Training (D&I)
- Mobile Field Technologies for Assessing SA (D&I)
- INSITE (D&I)
- Measuring Performance Using Human Movement Tracks (D&I)
- Neural Control of Actions in Context(D&I)
- Brain Dynamics of Coordinated Teams (D&I)
- Adaptive Perceptual Training (D&I)
- Smart Tutoring System (D&I)
- MC Small Arms and Marksmanship Training (D&I)
- Predictive Training Transfer Toolset (E&D)
- ObSERVE (E&D)
- Trident Communication Analysis System (TCAS)
- Perceptually-informed Virtual Environment (STTR)
- Physiological-based Tools for Virtual Environment (STTR)
- Live Fire Virtual Sniper/Counter Sniper Training System (SBIR)
- ImmersSci for Training & Mission Rehearsal (PDB 709)
- MURI: A Multi-scale, Multi-Modal Investigation of Spatial Learning
- IMPACTS (SBIR)
- Mobile Brain Imaging (BRC)
- Objective Live-Training Infantry Performance Metrics for Automated After Action Review (SBIR)
- Integrated System for Language Education Training (FNC)
- Behavioral, Analysis & Synthesis Intelligent Training (FNC)
- Next Generation Expeditionary Warfare Intelligent Train (FNC)

Key	D&I	E&D	Cong	FNC	other

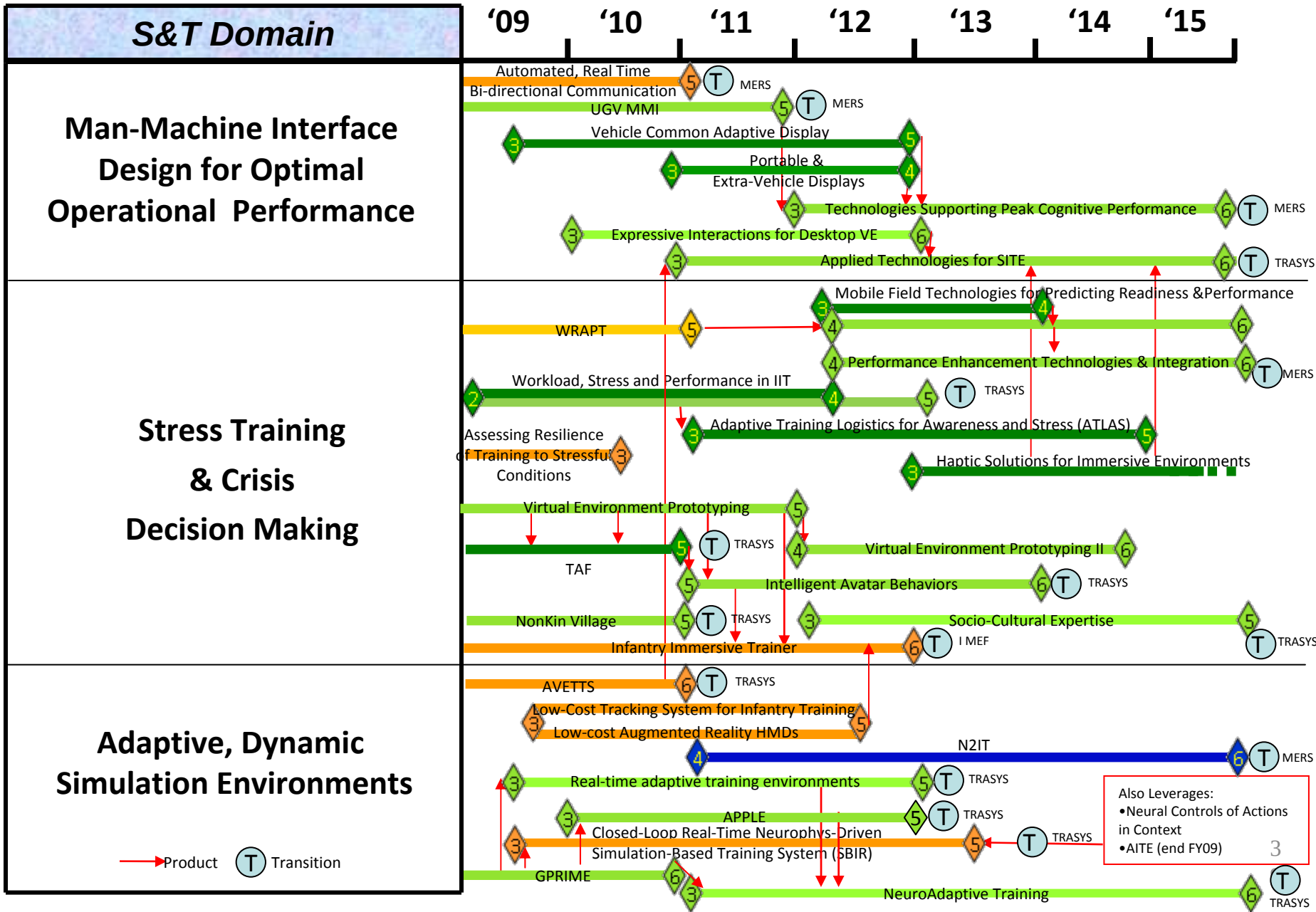
HPT&E S&T Road Map

TIA: Enhanced Physical Readiness



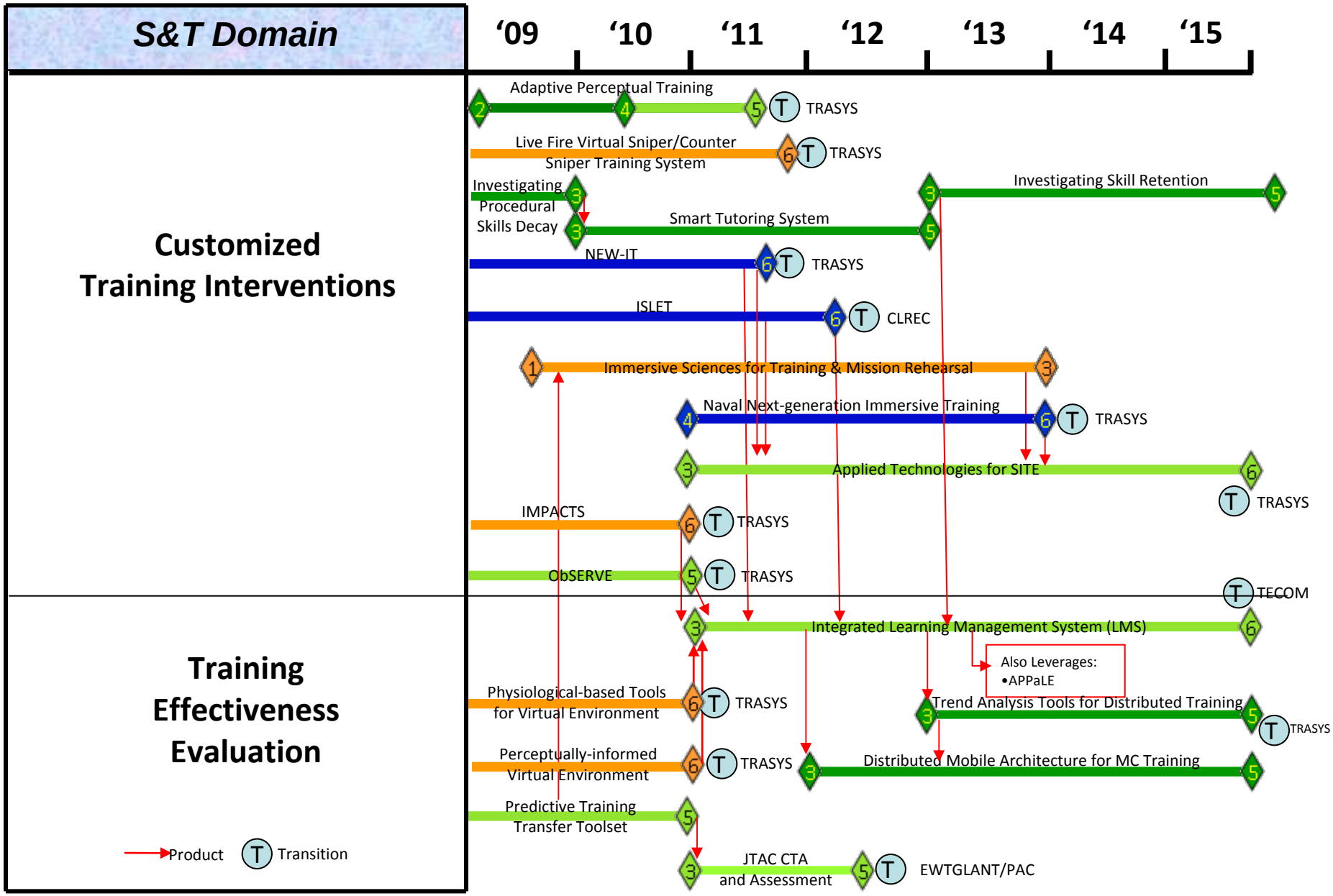
HPT&E S&T Road Map

TIA: Mental Toughness & Cognitive Agility



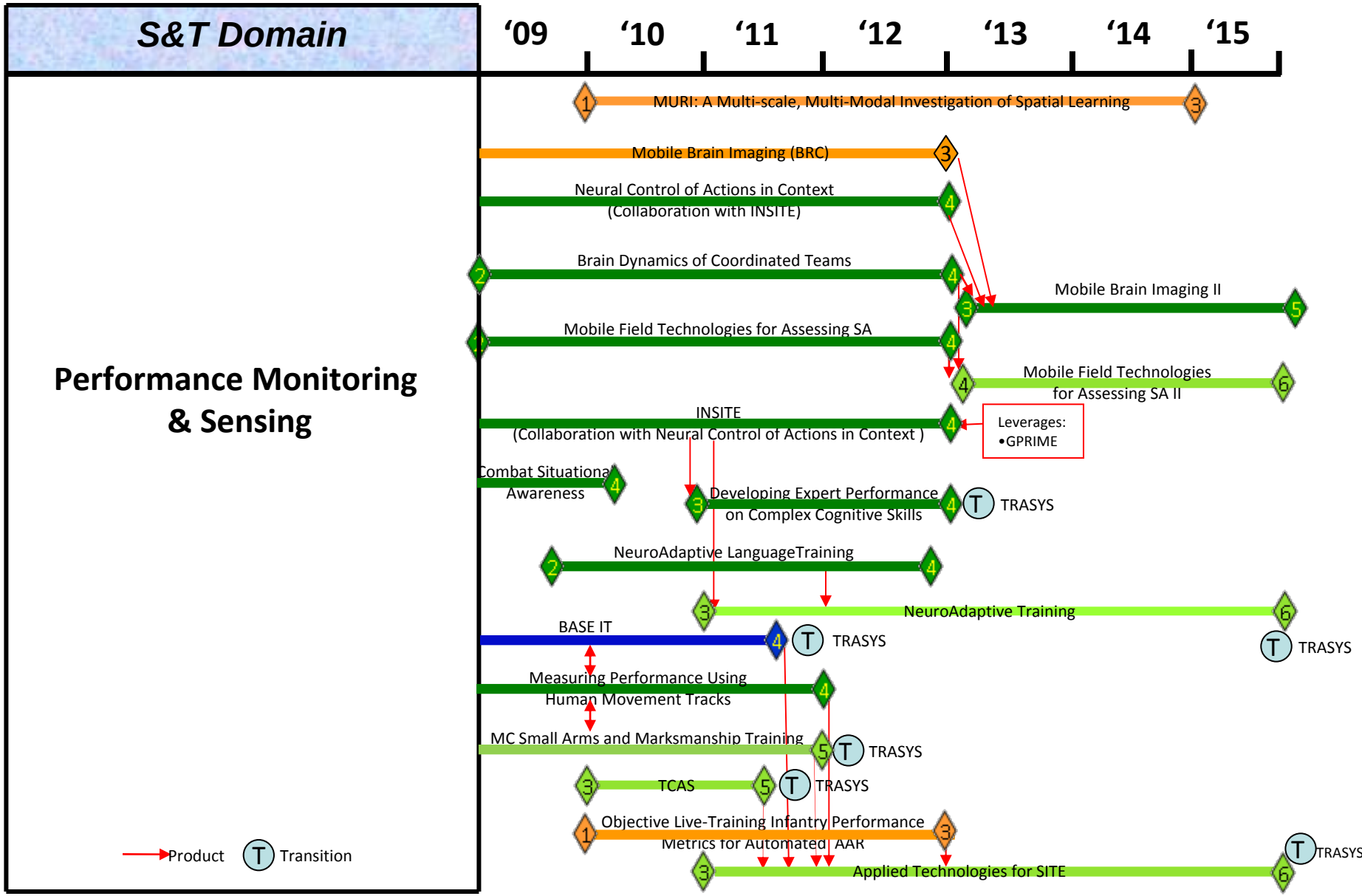
HPT&E S&T Road Map

TIA: Expertise Development I



HPT&E S&T Road Map

TIA: Expertise Development II



INTELLIGENCE, SURVEILLANCE & RECONNAISSANCE

Enhance situational awareness and understanding to enable real time tactical decision making for Distributed Operations and provide proactive and predictive capabilities for Asymmetric and Irregular Warfare.

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RECENT TRANSITIONS

- SIGINT VISUALIZATION (FNC) → Transitioned to MCSC
- MASINT CORE (FNC) → Transitioned to MCSC
- EA ANTENNA (FNC) → Transitioned to MCSC
- TACTICAL LITTORAL SENSING (FNC) → Transitioned to NAVSEA
- RF EMITTER ID AND GEOLOCATION (FNC) → Transitioned to MCSC
- AUTOMATED PATTERN RECOGNITION (FNC) → Transitioned to MCSC
- DISTRIBUTED TACTICAL INTEL DATABASE (FNC) → Transitioned to MCSC
- REMOTE SENSOR FUSION CARD (FNC) → Transitioned to MCSC

KEY	D&I	E&D	FNC	Other	Cong

TECHNOLOGY INVESTMENT AREA

PERSISTENT INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR)

Intel STO-2: Provide quality tactical sensing

Intel STO-3: Ensure mission-focused situational awareness in urban environments

Intel STO-4: Enhance tag, track, and locate (TTL), biometric, and chemical, biological, radiological, nuclear, and explosive (CBERNE) detection capabilities

Intel STO-6: Translate data to combat information at the point of collection

KNOWLEDGE GENERATION

Intel STO 1-: Enable smart sensor field planning and management

Intel STO-4: Enhance tag, track, and locate (TTL), biometric, and chemical, biological, radiological, nuclear, and explosive (CBERNE) detection capabilities

Intel STO-5: Expose enemy networks, and anticipate and influence their behavior

Intel STO-7: Provide actionable intelligence to tactical units

ISR - C2 (ACTIONABLE INTELLIGENCE)

Intel STO-3: Ensure mission-focused situational awareness in urban environments

Intel STO-7: Provide actionable intelligence to tactical units

Intel STO-8: Deny enemy use of communications and networks

BIOMETRICS

Intel STO-3: Ensure mission-focused situational awareness in urban environments

Intel STO-4: Enhance tag, track, and locate (TTL), biometric, and chemical, biological, radiological, nuclear, and explosive (CBERNE) detection capabilities

TAG, TRACK, AND LOCATE (TTL)

Intel STO-4: Enhance tag, track, and locate (TTL), biometric, and chemical, biological, radiological, nuclear, and explosive (CBERNE) detection capabilities

Intel STO-7: Provide actionable intelligence to tactical units

INTELLIGENCE, SURVEILLANCE & RECONNAISSANCE

Enhance situational awareness and understanding to enable real time tactical decision making for Distributed Operations and provide proactive and predictive capabilities for Asymmetric and Irregular Warfare.

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TECHNOLOGY INVESTMENT AREA

PERSISTENT INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR)

Intel STO-2: Provide quality tactical sensing

Intel STO-3: Ensure mission-focused situational awareness in urban environments

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Intel STO-6: Translate data to combat information at the point of collection

PROJECT

- AWARE BUILDING (Congressional)
- TYPE 3 WITNESS MATERIALS (6.1)
- NANO TECHNOLOGY ENABLED SENSOR FIELDS (D&I)
- TAG, TRACK AND LOCATE TECHNOLOGIES (D&I)
- SMART DISTRIBUTED SENSOR FIELDS (6.1)
- AGILE TACTICAL SENSOR NET (E&D)
- IDENTITY DOMINANCE ENABLED BY INTEGRATED BIOMETRIC / TTL CAPABILITY (E&D)
- TAG, TRACK AND LOCATE DEMONSTRATIONS (E&D)
- SENSORS FOR AUDIO SURVEILLANCE (E&D)
- SERVICE ORIENTED SENSOR NETWORK (LTSN)
- SMART ALGORITHMS FOR TACTICAL SENSORS (LTSN)
- AGILE SENSORS (GWOT TPS)
- TAG, TRACK AND LOCATE (GWOT TPS)
- COMMUNICATIONS ENHANCEMENTS FOR TACTICAL SENSOR (GWOT TPS)
- SENSING THROUGH WALLS (TUS)
- DETECT AND ID FACILITIES (TUS)
- ADVANCED OPTICS ZOOM HYPER SPECTRAL SENSOR (SBIR Phase II)
- AUTOMATED CLASSIFICATION USING SOFT BIOMETRICS (SBIR Phase II)
- RF MODELING OF COMPOSITE BUILDING MATERIAL (SBIR Phase II)

KEY: D&I | E&D | FNC | Other | Cong

INTELLIGENCE, SURVEILLANCE & RECONNAISSANCE

Enhance situational awareness and understanding to enable real time tactical decision making for Distributed Operations and provide proactive and predictive capabilities for Asymmetric and Irregular Warfare.

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RECENT TRANSITIONS

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KEY	D&I	E&D	FNC	Other	Cong

TECHNOLOGY INVESTMENT AREA

KNOWLEDGE GENERATION

Intel STO 1-: Enable smart sensor field planning and management

Intel STO-4: Enhance tag, track, and locate (TTL), biometric, and chemical, biological, radiological, nuclear, and explosive (CBERNE) detection capabilities

Intel STO-5: Expose enemy networks, and anticipate and influence their behavior

Intel STO-7: Provide actionable intelligence to tactical units

PROJECT

- DECISION PREDICTION, MANIPULATION, STIMULATION, LEARNING DETECTION (D&I)
- REAL-TIME METHODS FOR IDENTIFYING HUMAN NETWORKS (D&I)
- SPARSE DATA CULTURAL MODELS (6.1)
- MODELING SURGICAL COGNITIVE I/0 (6.1)
- DISTRIBUTED SENSOR EXPLOITATION (6.1I)
- DISCOVERY, CLASSIFICATION, & UNCERTAINTY (6.1)
- DYNAMIC WIKI / RESOURCE MANAGER (D&I)
- HUMAN NETWORK DECISION MODELING (E&D)
- NETWORK IDENTIFICATION (Formerly Enemy COA) (E&D)
- ACTIVE WIKI KNOWLEDGE REPOSITORY (E&D)
- AUTOMATED TACTICAL PLATFORM & SENSOR PLANNING & MANAGEMENT (LTSN)
- DESIGN TOOLS ENABLING MISSION SPECIFIC SENSOR FIELDS (LTSN)
- TACTICAL DISTRIBUTED DATA ANALYSIS & AUTOMATED I&W (LTSN)
- DECISION AIDS (TUS)
- DEGRADE TAGGANTS (SBIR Phase II)
- BINARY MULTI-STATE OPTICAL TAGGANT (STTR Phase II)
- ISOLATING AND LOCATING SPEAKERS IN CLUTTER (STTR Phase II)
- PRESAGE – LARGE DATA EXPLOITATION USING NEURAL NETWORKS (SBIR Phase II)
- DISCOVERY OF HUMAN BEHAVIOR FROM VIDEO (SBIR Phase I)
- SEMANTIC WIKI FOR PAGE ALERTING (SBIR Phase I)
- DESIGNING LARGE DATA HANDLING ARCHITECTURES (SBIR Phase I)
- SIMILARITY MEASURES FOR PERSONA/HUMAN NETWORKS (SBIR Phase I)
- NETWORK METRICS TO BEHAVIOR ATTRIBUTES (SBIR Phase I)

INTELLIGENCE, SURVEILLANCE & RECONNAISSANCE

Enhance situational awareness and understanding to enable real time tactical decision making for Distributed Operations and provide proactive and predictive capabilities for Asymmetric and Irregular Warfare.

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RECENT TRANSITIONS

- SIGINT VISUALIZATION (FNC) → Transitioned to MCSC
- MASINT CORE (FNC) → Transitioned to MCSC
- EA ANTENNA (FNC) → Transitioned to MCSC
- TACTICAL LITTORAL SENSING (FNC) → Transitioned to NAVSEA
- RF EMITTER ID AND GEOLOCATION (FNC) → Transitioned to MCSC
- AUTOMATED PATTERN RECOGNITION (FNC) → Transitioned to MCSC
- DISTRIBUTED TACTICAL INTEL DATABASE (FNC) → Transitioned to MCSC
- REMOTE SENSOR FUSION CARD (FNC) → Transitioned to MCSC

TECHNOLOGY INVESTMENT AREA

ISR - C2 (ACTIONABLE INTELLIGENCE)

Intel STO-3: Ensure mission-focused situational awareness in urban environments

Intel STO-7: Provide actionable intelligence to tactical units

Intel STO-8: Deny enemy use of communications and networks

PROJECT

- ADVANCED TACTICAL SENSOR TECH (D&I)
- WARFIGHTER AS A SENSOR (E&D)
- OA PROOF OF CONCEPT DEMONSTRATIONS (E&D)
- TACTICAL NET & DCGS INTEGRATION (LTSN)
- HUMAN TO SENSOR FIELD INTERFACE (SMART DATA PULL) (LTSN)
- OA ENTERPRISE SERVICES

KEY: D&I | E&D | FNC | Other | Cong

INTELLIGENCE, SURVEILLANCE & RECONNAISSANCE

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- TACTICAL LITTORAL SENSING (FNC) → Transitioned to NAVSEA
- RF EMITTER ID AND GEOLOCATION (FNC) → Transitioned to MCSC
- AUTOMATED PATTERN RECOGNITION (FNC) → Transitioned to MCSC
- DISTRIBUTED TACTICAL INTEL DATABASE (FNC) → Transitioned to MCSC
- REMOTE SENSOR FUSION CARD (FNC) → Transitioned to MCSC

KEY	D&I	E&D	FNC	Other	Cong

TECHNOLOGY INVESTMENT AREA

BIOMETRICS

Intel STO-3: Ensure mission-focused situational awareness in urban environments

Intel STO-4: Enhance tag, track, and locate (TTL), biometric, and chemical, biological, radiological, nuclear, and explosive (CBERNE) detection capabilities

TAG, TRACK, AND LOCATE (TTL)

Intel STO-4: Enhance tag, track, and locate (TTL), biometric, and chemical, biological, radiological, nuclear, and explosive (CBERNE) detection capabilities

Intel STO-7: Provide actionable intelligence to tactical units

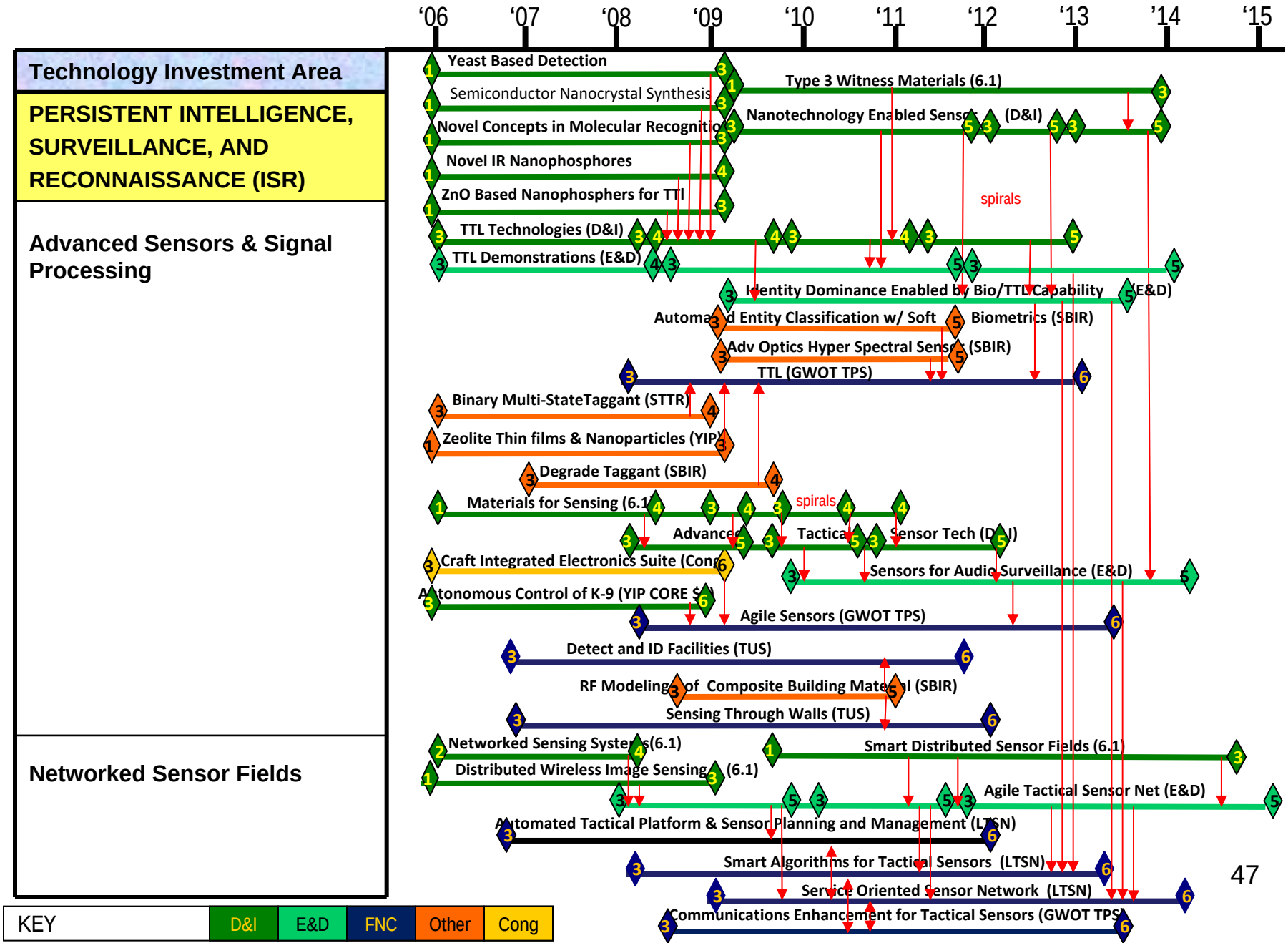
PROJECT

- IDENTITY DOMINANCE ENABLED BY INTEGRATED BIOMETRIC /TTL CAPABILITY (E&D)
- ISOLATING AND LOCATING SPEAKERS IN CLUTTER (STTR Phase II)
- SMART ALGORITHMS FOR TACTICAL SENSORS (LTSN)
- Contextual Meaning of Presence
- AGILE SENSORS (GWOT TPS)
- AUTOMATED CLASSIFICATION USING SOFT BIOMETRICS (SBIR Phase II)
- Tracking w Hard and Soft Biometrics

- TAG, TRACK AND LOCATE TECHNOLOGIES (D&I)
- TAG, TRACK AND LOCATE (GWOT TPS)
- TAG, TRACK AND LOCATE DEMONSTRATIONS (E&D)
- TTL to Network Analysis
- DEGRADE TAGGANTS (SBIR Phase II)
- Deployment Technologies
- BINARY MULTI-STATE OPTICAL TAGGANT (STTR Phase II)
- Contextual Meaning of Presence

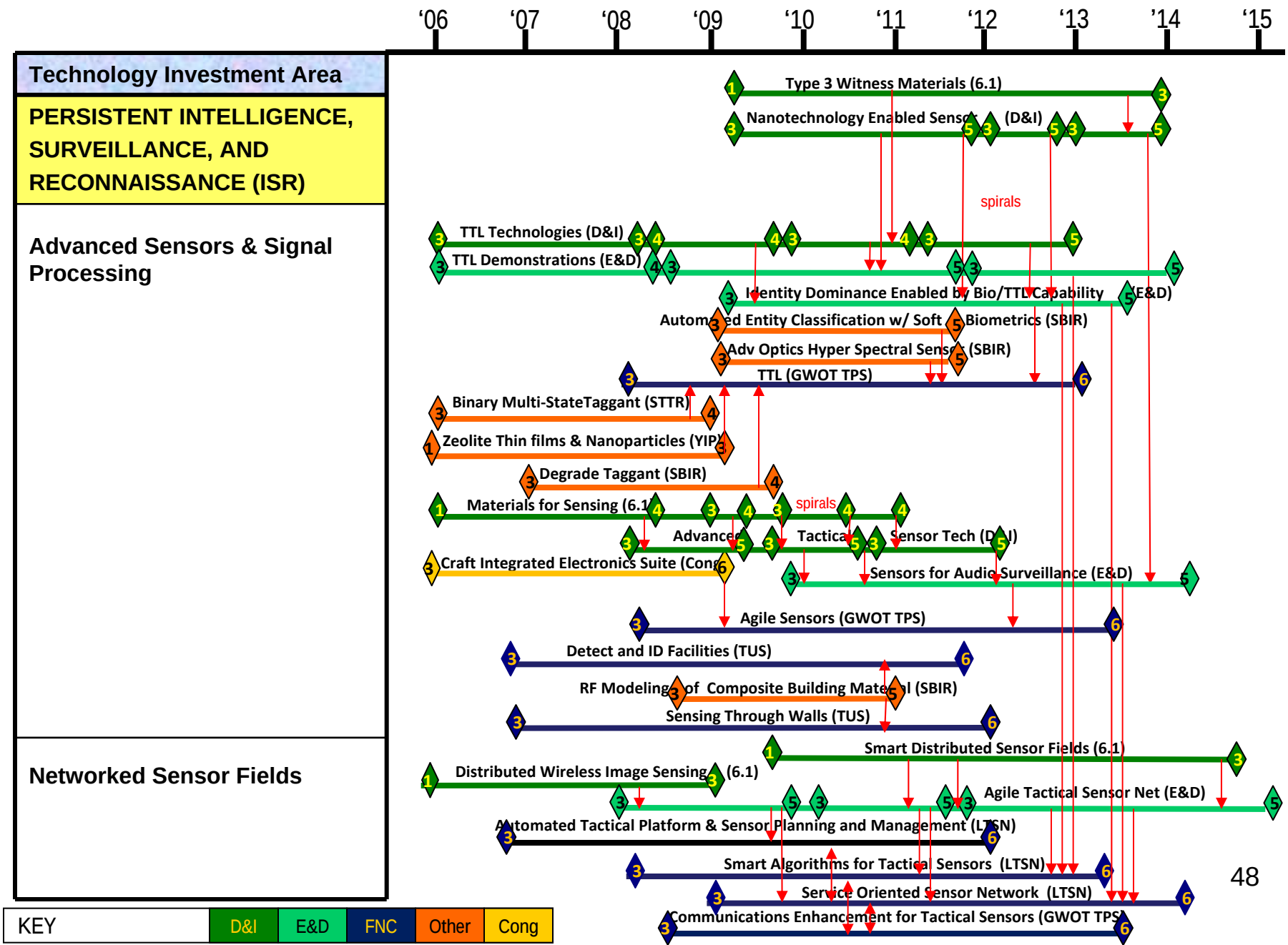
ISR S&T Road Map

WITH ENDING PROGRAMS

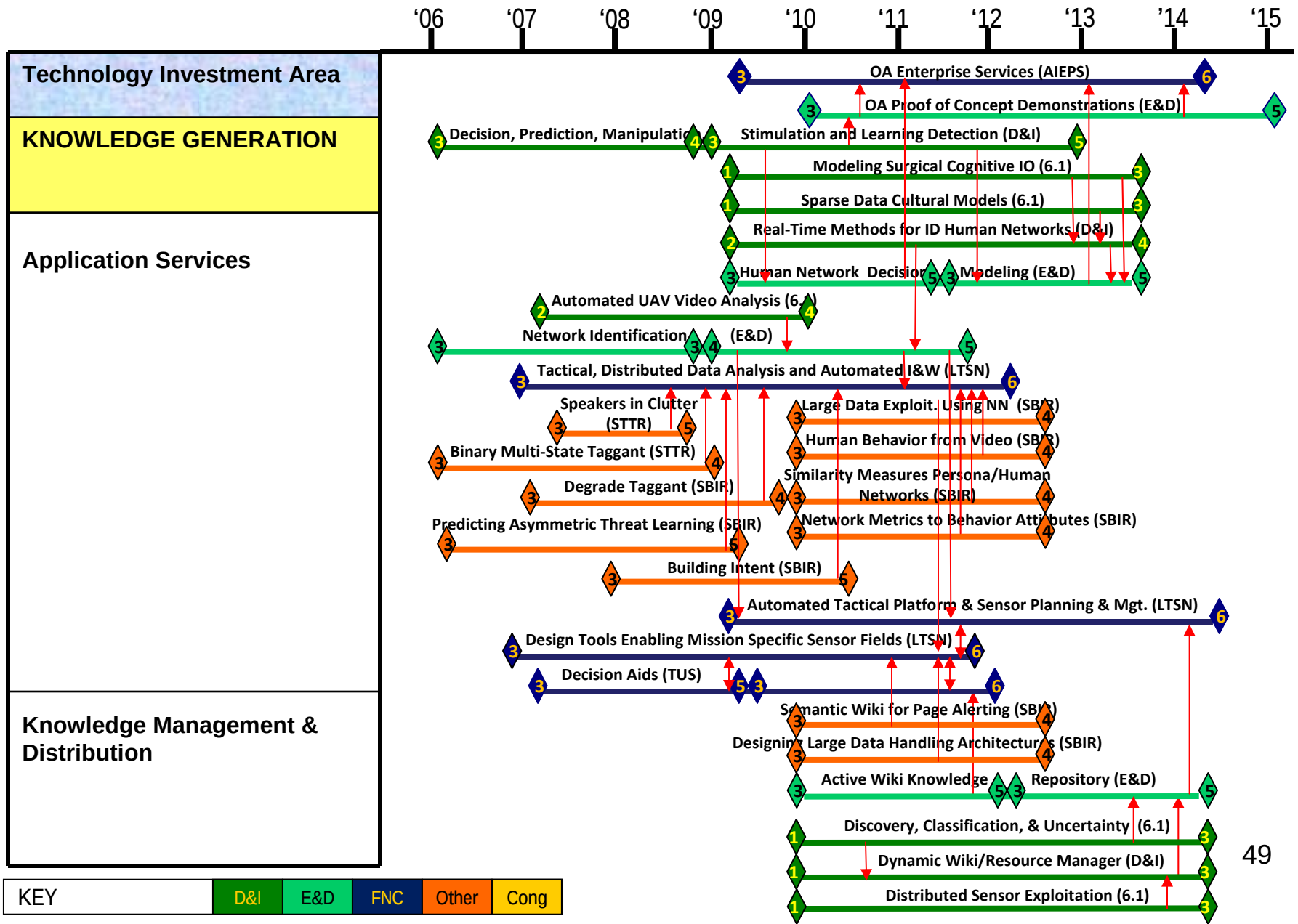


ISR S&T Road Map

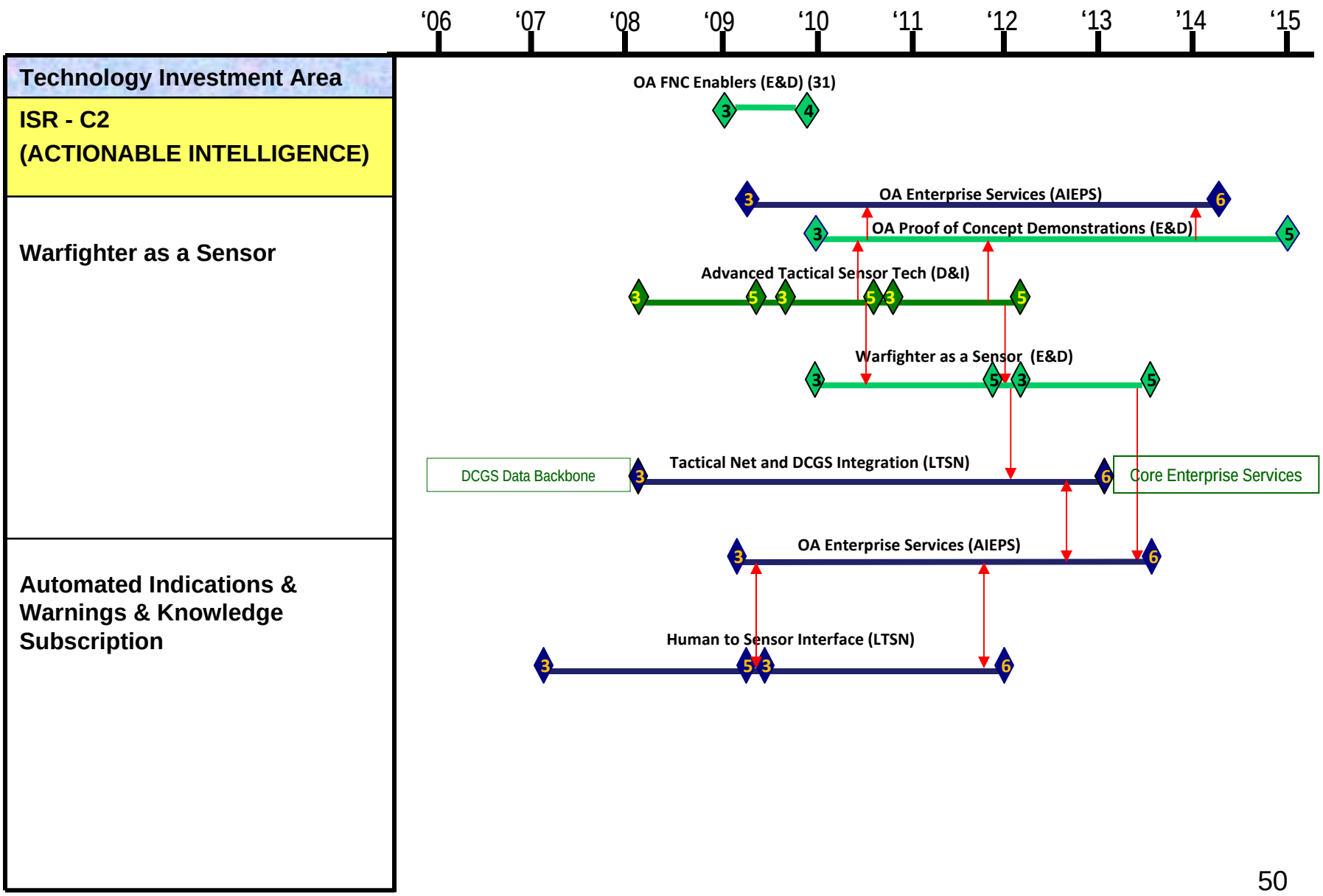
NO ENDING PROGRAMS



ISR S&T Road Map (cont)

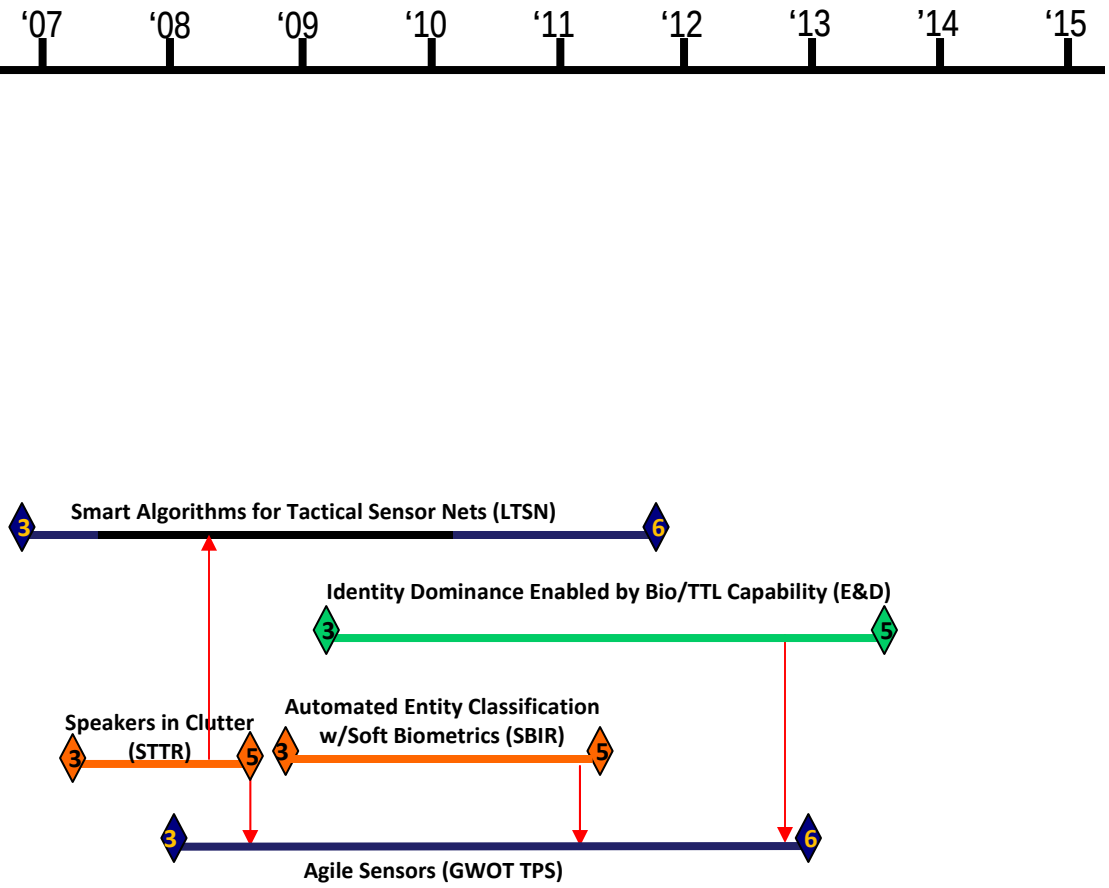


ISR S&T Road Map (cont)



ISR S&T Road Map (cont)

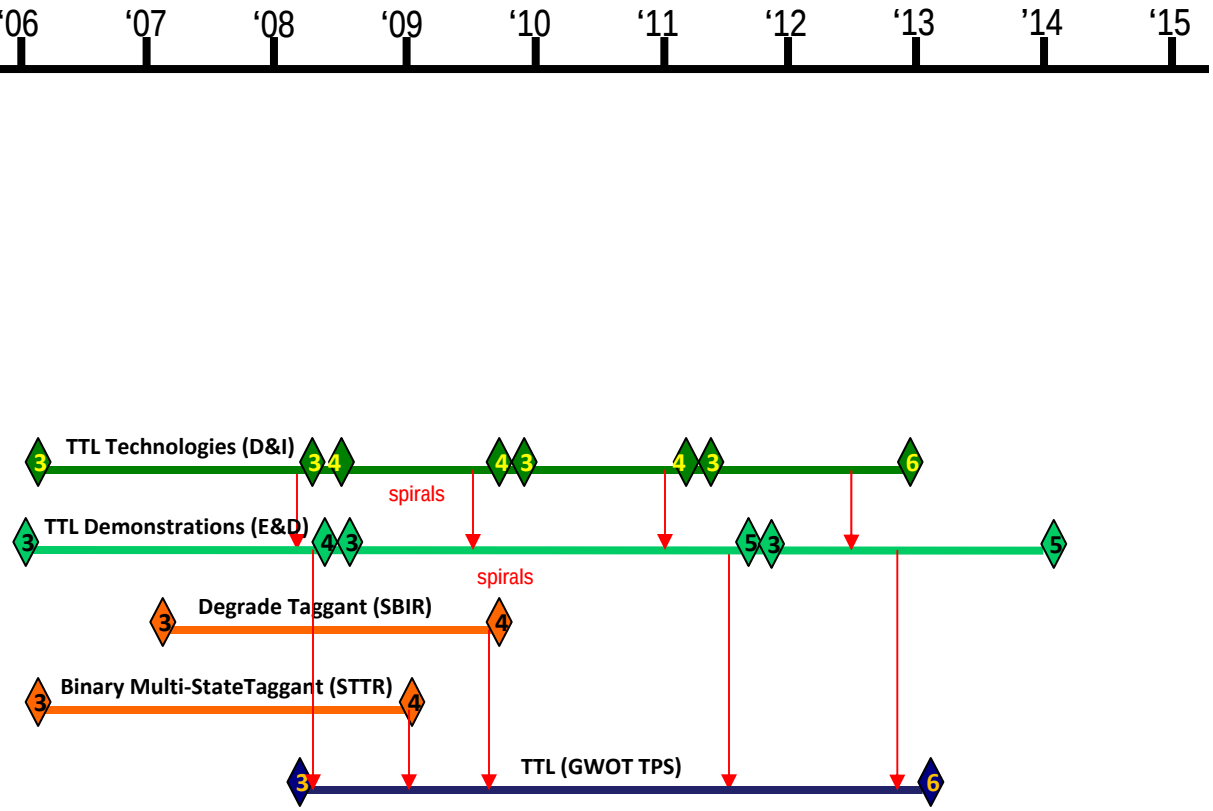
Technology Investment Area
BIOMETRICS
Feature Identification



KEY	D&I	E&D	FNC	Other	Cong

ISR S&T Road Map (cont)

Technology Investment Area
TAG, TRACK, AND LOCATE (TTL)
TTL Technologies



KEY | D&I | E&D | FNC | Other | Cong

LOGISTICS

Marines of the future will benefit from a precisely tailored level of logistic sustainment from seabased platforms to rapidly maneuvering forces ashore. Logistic planning, delivery and recovery systems of the future will be more responsive and flexible, enabling Marines to out-pace rapidly changing operational scenarios. Likewise, delivered logistic commodities will provide more operational value per unit weight, enhancing combat unit self sufficiency and maneuverability. Finally, operational units will benefit from technologies that maximize equipment readiness by minimizing both down-time and maintenance requirements.

KEY	FNC-EC	Plus-up)	OTHER	D&I	E&D

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RECENT TRANSITIONS

INFO-SENSORS FOR VEHICLE HEALTH REPORTING

Transitioned from Core funding to Sense and Respond Logistics EC

HARVESTING POWER FROM WALKING

Small business formed to market power harvesting backpack invention from ONR Basic Research

POET SEABASED LOGISTIC TRANSPORT MODEL

MCCDC personnel trained to use simulation tool.

ASSET VISIBILITY

USMC Log STO-1: Logistic Commodity inventory/Tracking

LOGISTICS TRANSPORT

USMC Log STO- 2: Air Cargo Delivery

USMC Log STO- 3: Dismounted Transport

OPERATIONAL SELF-SUFFICIENCY

USMC Log STO- 4: Enhanced Self-Sufficiency for Fuel

USMC Log STO- 5: Enhanced Self-Sufficiency for Water

USMC Log STO- 6: Enhanced Self-Sufficiency for Electric Power

Possible Start in FY 2011

- MONO TILTROTOR FLIGHT DYNAMICS & CONTROLS
- SEABASED SMALL PAYLOAD DELIVERY SYSTEM
- EMERGENCY AIR CARGO DELIVERY
- CQ-10 "B" CARGO UAV SYSTEM
- ALT. HUMAN LOAD CARRYING CONCEPTS
- PORTABLE FUEL ANALYSIS TECH.
- DUAL STAGE WATER PURIFICATION
- SMALL SCALE FLUID PARTICLE SEPARATOR
- DOUBLE LAYER PROPERTIES FOR CDI SYSTEMS
- DIRECT JP-8 ADVANCED CELL DEV.
- LIGHTWEIGHT ELEC. ENERGY FOR DISMOUNTED ...
- HIGH PERF. CERAMIC ANODES FOR SOFC
- HIGH ENERGY ELECTROCHEMICAL CAPACITOR
- CARBON NANOFOAM CATHODE FOR METAL-AIR BATTERIES
- MEDIATOR-ENHANCED POLY. ELECTROLYTE SUPERCAPACITOR
- PSEUDOCAPACITOR BASED ON NiO NANOSTRUCTURES
- LIGHTWT. MULTI-FUEL THERMOELECTRIC BATTERY CHARGER
- PERSONAL POWER NETWORK
- HARVESTING POWER FROM WALKING
- HIGH POWER ZINC-AIR BATTERY
- INTEGRATING "POWERSAGE" INTO A C4I DEVICE
- HYBRID CAPACITOR SUPERCELL

LOGISTICS

Marines of the future will benefit from a precisely tailored level of logistic sustainment from seabased platforms to rapidly maneuvering forces ashore. Logistic planning, delivery and recovery systems of the future will be more responsive and flexible, enabling Marines to out-pace rapidly changing operational scenarios. Likewise, delivered logistic commodities will provide more operational value per unit weight, enhancing combat unit self sufficiency and maneuverability. Finally, operational units will benefit from technologies that maximize equipment readiness by minimizing both down-time and maintenance requirements.

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MAINTENANCE REDUCTION

USMC Log STO- 7: Materials for Reduced Maintenance

- POLYFIBROBLAST SELF-HEALING COATING
- MULTIFUNCTIONAL SMART COATING STACK-UP
- SELF LUBRICATING COATINGS/ALLOYS
- ALL ORGANIC CORROSION RESISTANT PRIMERS

TEMPORARY INFRASTRUCTURE

USMC Log STO- 8: Temporary Mobile Infrastructure

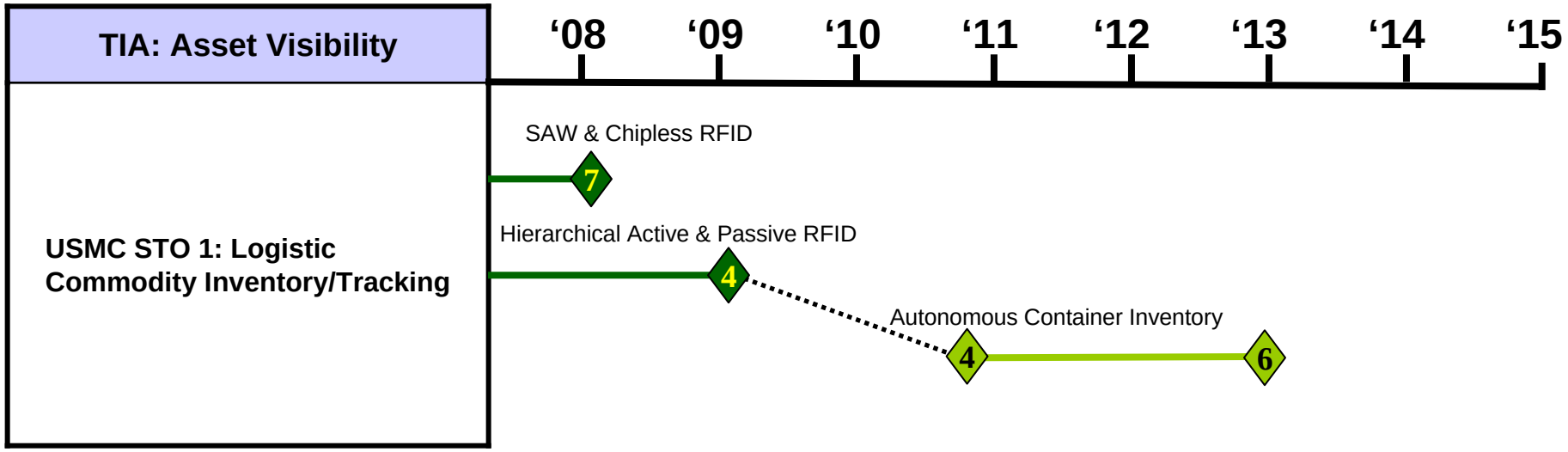
- ADV. IN-FIELD MFG OF MOD. COMP. BRIDGES
- COMPOSITE JOINT ASSAULT BRIDGE TECH DEMO

CASUALTY EVACUATION

USMC Log STO-9: Improved Life Support for Casualties at Point of Injury through Evacuation

ONR Code 34 investment only

Asset Visibility
Technology Investment Area



3 = Technology Readiness Level

Logistics Transport
Technology Investment Area

TIA: Logistic Transport

'08 '09 '10 '11 '12 '13 '14 '15

USMC STO- 2: Air Cargo Delivery

POET Seabased Log Simulation 6.3) 6

CQ 10"B" (Autogyro) 5 7

Emergency Air Cargo Delivery 5 7

Seabased Small Payload Sys 4 5

Mono Tiltrotor 3 3

Deep Sustainment UAS
(Innovative Naval Prototype) 5 7

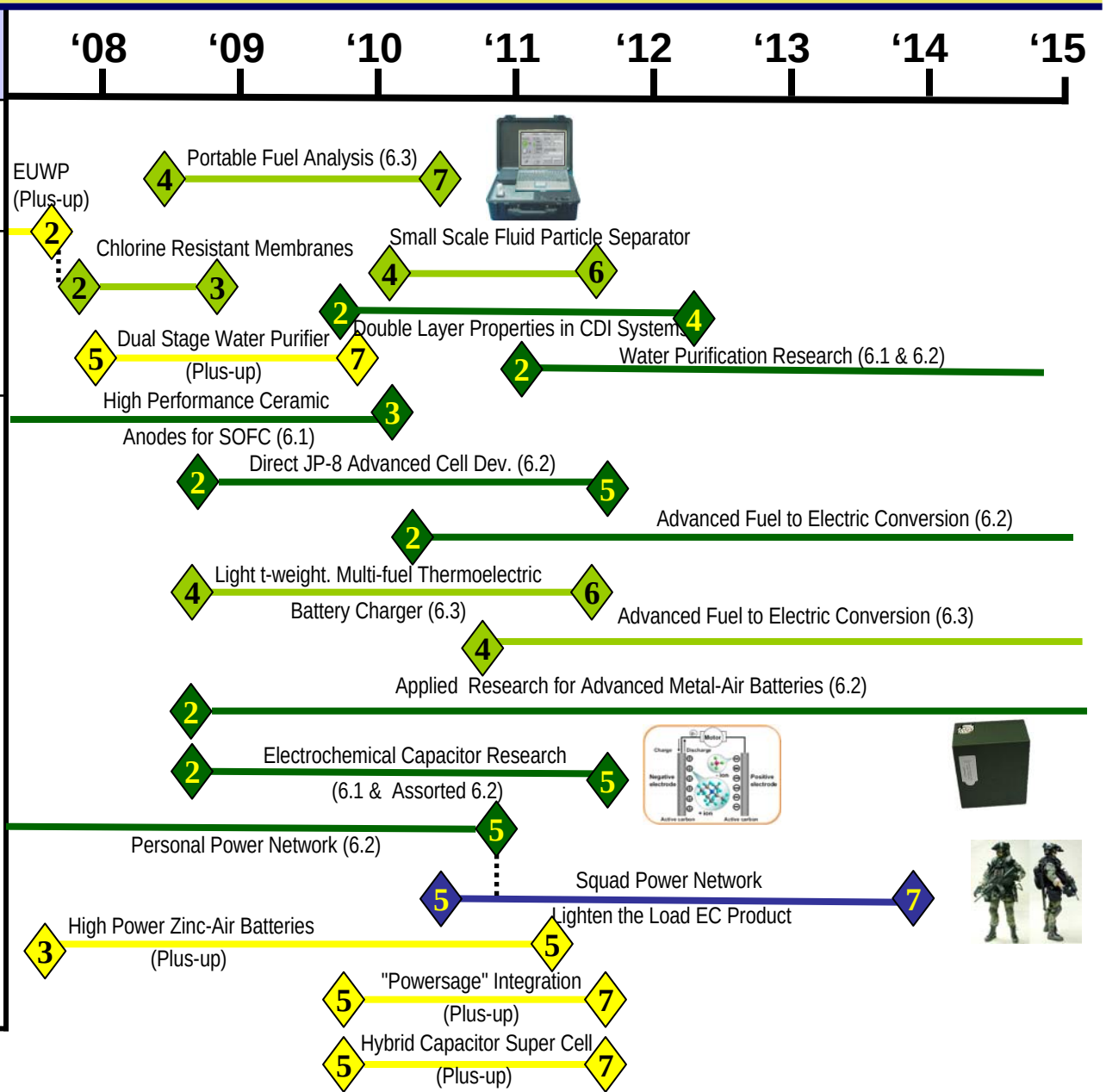
USMC STO- 3: Dismounted Transport

Alternative Human Load
Carrying Concepts (6.3) 3 6

3 = Technology Readiness Level

Operational Self-Sufficiency Technology Investment Area

TIA: Operational Self Sufficiency
USMC STO 4: Enhanced self sufficiency for fuel
USMC STO 5: Enhanced self sufficiency for water
USMC STO 6: Enhanced self sufficiency for electric energy

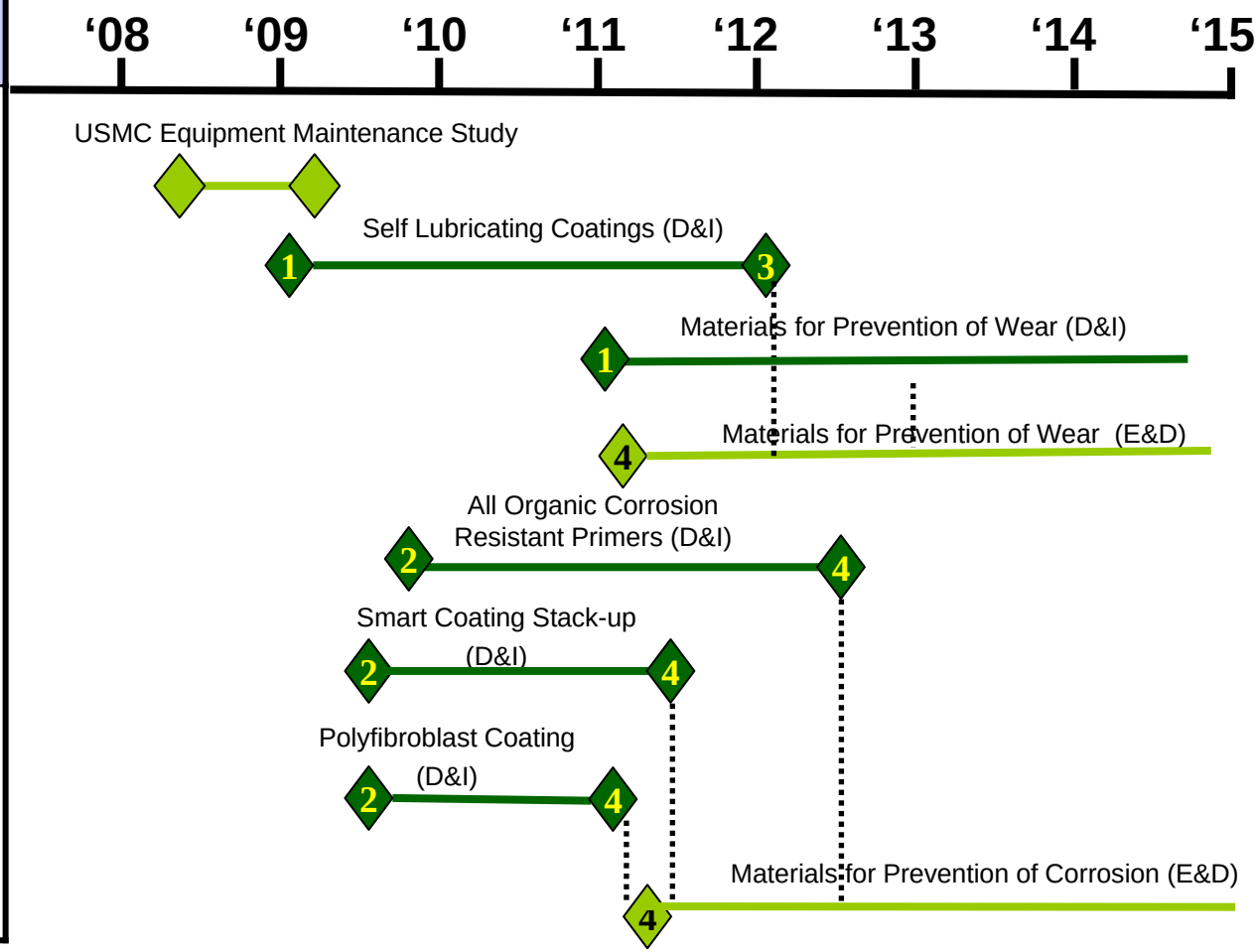


3 = Technology Readiness Level

Maintenance Reduction Technology Investment Area

TIA: Maintenance Reduction

USMC STO-7: Materials for reduced maintenance

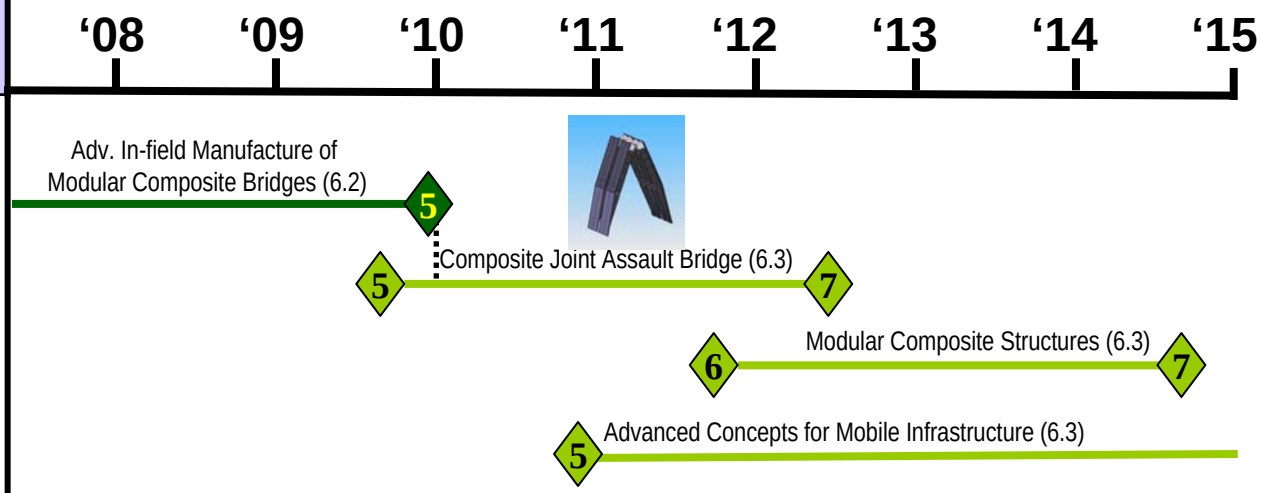


3 = Technology Readiness Level

Temporary Infrastructure Technology Investment Area

TIA: Temporary Infrastructure

USMC STO 1: Temporary Mobile Infrastructure

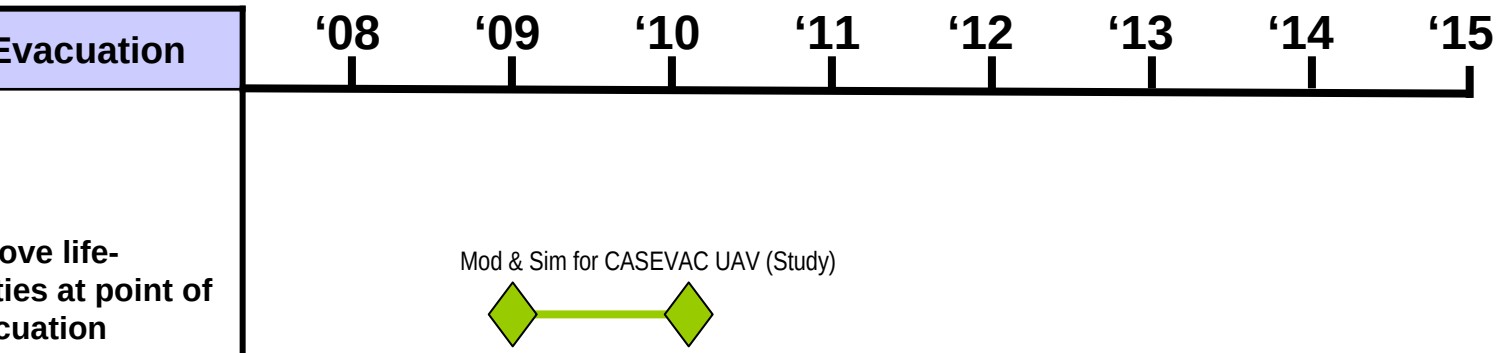


3 = Technology Readiness Level

Casualty Evacuation
Technology Investment Area

TIA: Casualty Evacuation

USMC STO 9: Improve life-support for casualties at point of injury through evacuation



3 = Technology Readiness Level