Objective Force Warrior

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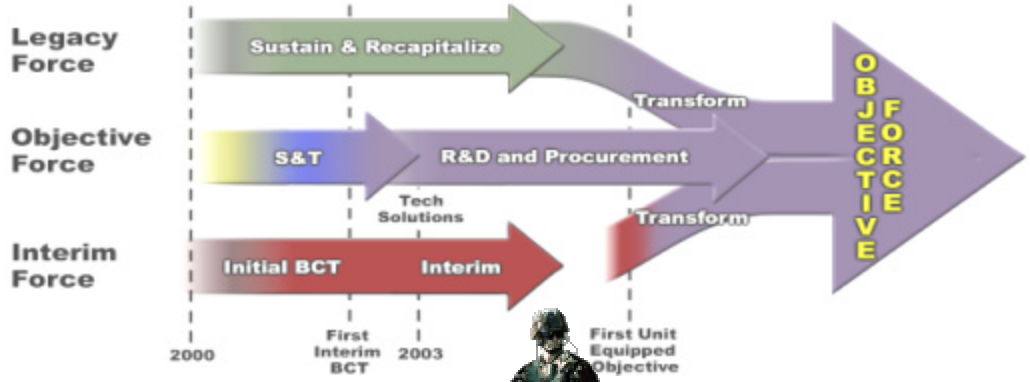
Presented by:
Vernon E. Shisler
Joint Service Small Arms Program Office
973-724-6009
vshisler@pica.army.mil

Warrior Systems Modernization
Supporting Army Transformation



Objective Force Warrior (OFW)

Future Warrior

Land Warrior 2004

OFW Vision, Scope & Technology Plan (FY01)

Soldier-Centric, Rapid, Responsive, Deployable, Agile, Versatile, Lethal, Survivable, Sustainable & Dominant

Objective Force Warrior

- **Major System of Systems S&T Project focused on the *"Centerpiece of the Objective Force Formation"* - the Soldier**
- **Dominant, Revolutionary Capability for the Individual & Small Unit – across Full Spectrum Operations (Missions, Environments & Threats)**
- **Complement & Collaborate with Future Combat Systems to Realize Objective Force Vision**

"The core of any land-based operation will rest on the *HUMAN DIMENSION*. That is the heart and soul of tactical and operational dominance." – Army Transformation White Paper

Objective Force Warrior

Inputs that Shape the Concept

- The Army Vision
- The TRADOC Objective Force "Specification"
- Original Future Warrior Concept
- IRT Recommendations
- Program Definition Workshop
- Special Study Group
- ASB Summer Study

Objective Force Warrior
A Formidable Warrior……

C4
- Secure C4 integrated into multi-function suit

ISR
- Multi-spectral optics & acoustic in one piece helmet
- Virtual 360 vision

Decision-making
- Integrated Cognitive Aides

Survivability
- One piece multi-function suit
  - Full body ballistic protection
  - NBC protection
  - Laser protection
  - Stealth

Lethality
- Multipurpose precision handheld weapons
- LOS and BLOS capable
- Lightweight systems

Human Factors
- Self- medicating systems including trauma care
- Status Monitoring & Feedback

Training
- Embedded Training and Rehearsal

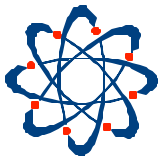
Sustainment
- Integrated rations,water, and waste management

Mobility
Mechanical enhancement for Strength, load-bearing and endurance
- Fuel Cells based Power

Many Revolutionary Capabilities Are Within Our Reach

Objective Force Warrior

Complex "System of Systems" Integration



Power & Energy

- Extend System Operation Times
- Reduce Logistics Support Burden
- Reduce Energy Demand
- New Power Source Technologies

Weight Reduction

- Dramatic System Weight Savings
- Stretch Goal is not to exceed 35% of Body Weight (compared to 92 pounds today)

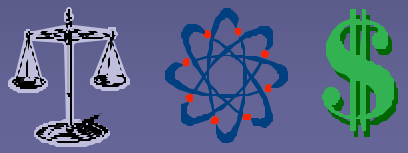
Affordability

- Reduce Total Ownership Costs by 50% (Stretch Goal)

Fightability

- Maximize Combat Performance within the Physical & Cognitive Limits of the Human

Weight, Power, Cost & Performance Trade Offs

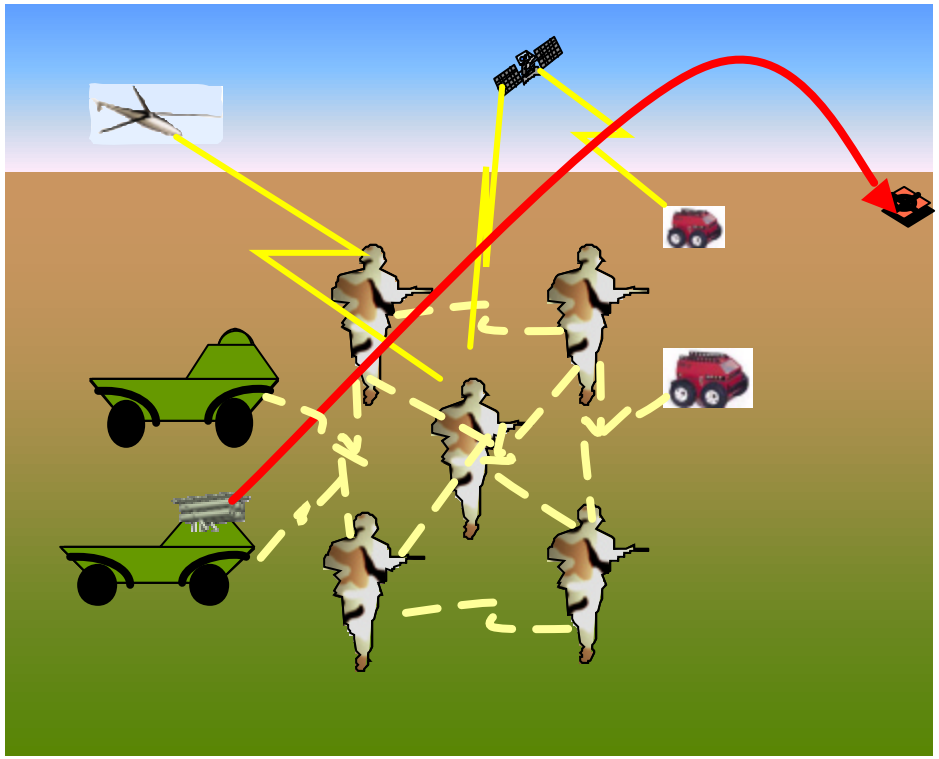


Human Performance & Integration

Competitive System Design Teams

Revolutionary Technology & Innovation

….In an Invincible Team



Many Revolutionary Capabilities Are Within Our Reach

- ***A combined arms force at the fire team level***
- ***C4ISR Provides leap-ahead overmatch effectiveness***
  - *Collaborative real time planning and execution*
  - *Coordinated LOS and BLOS fires and movement*
- ***Robotic "Mules" and "Dogs" provide***
  - *Remote sensing*
  - *Mobility*
  - *Sustainment*
  - *Lethality*

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Preliminary Technology Opportunities

- Lethality
- C4
- Intelligence, Surveillance, Reconnaissance
- Decision Making
- Protection/Survivability
- Mobility
- Sustainment
- Training
- Human Factors

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Lethality Systems and Technologies

- **Beyond Line of Sight Engagement for the Infantryman**
  - Miniaturized GNC
  - Multi-purpose warheads
  - Novel Propulsion
  - Anti-Tank Capability (Top Attack)
- **Enhanced Line of Sight Accuracy (2X Current)**
  - Stabilized or Motion Compensated Helmet Based Aiming and Firing
- **Weapons fully integrated into C4ISR and Decision-making System – Networked & Synchronized Fires**
- **Lightweight Weapon systems**
- **Robotic Mule for Weapon transport and Resupply**

Modular & Multifunctional

MEMS Miniature Electro- Mechanical Fuzing

Dominant Close Combat Power

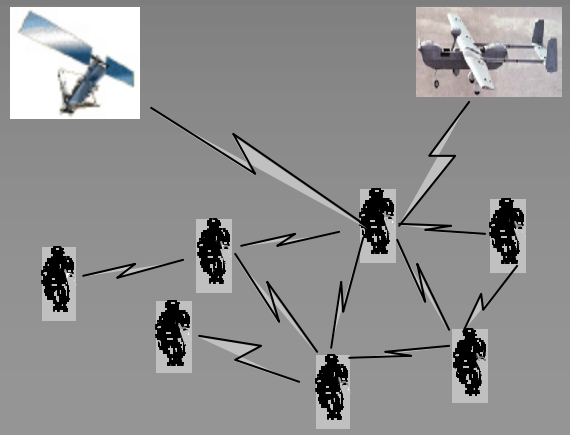
Emphasis on Ultra-Light Lethal Capability

Objective Force Warrior

"Network-Centric" C4

Robust, Secure, Adaptable Communications

- Lowest Level of Future Tactical Internet
- Adapted for Objective Force Operations in Complex Terrain (MOUT)
- Selectable, Robust Bandwidth & Range, Frequency Agility
- Dynamic Relays through Mobile Devices (Warriors, Space, Micro-UAV, UGV and/or Unattended Sensor)
- Common Operational Picture
- Self-Organizing, Ad-Hoc Networks
- Minimize Power & Energy on the Warrior
- Distributed Processing
- System on Chip



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Decision-making Systems and Technologies

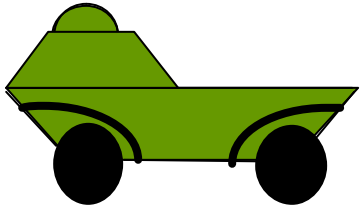
- Processing and Decision Aides to Support:
  - Automation Aided Collaborative Planning
  - Automation Aided Engagement Algorithms
  - Embedded rehearsal
  - Order Generation and Distribution
  - Status Alerts
- Mental Performance Enhancements (to achieve "at rest" Performance)
- Individual Cognitive Performance Modeling
- Logistics Modeling
  - Individual Monitoring for fatigue, health, nutrition, re-supply, etc.

"Revolutionary Individual and Team Information Processing Support"

Objective Force Warrior

Mobility Systems and Technologies

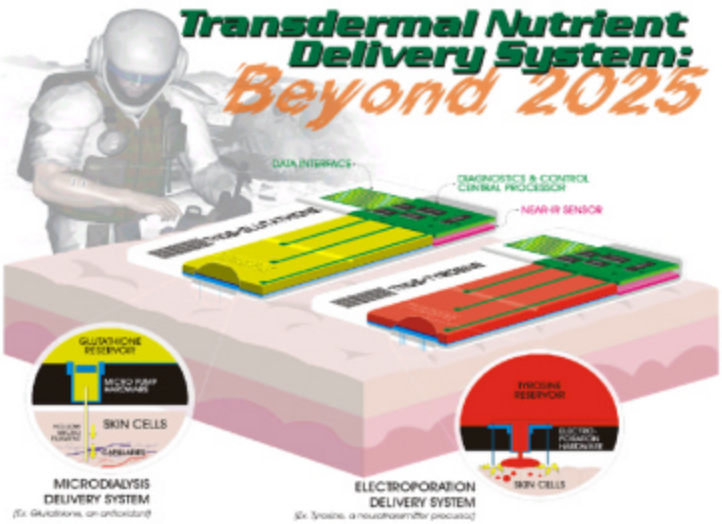
- Enhanced Load-bearing integrated with Combat Suit
- Individual soldier bio-mechanical modeling and monitoring
- Precision air drop for fire-team or individual
- Robotic “mule” for sustainment and mobility
- Continuous Human Factors monitoring and treatment to insure peak performance
- Fuel-cell based power systems



“Revolutionary Mobility Systems for the Soldier and Team”

Objective Force Warrior

Sustainment Systems and Technologies



- **Delivery/Transport**
  - Robotic Mules
  - Precision Airdrop
- **Quality of Life Enhancements**
  - Portable Shelters
  - Hygiene Systems Embedded in Suit
  - Food, Medical, Water, Medications, Treatments Integrated into System of Systems
- **Ammo weight and bulk reduction through precision and miniaturization**
- **Casualty Management Integrated into Soldier Systems**

"Revolutionary Advance in Sustainment Achieved Through Integrated Soldier Systems Technologies"

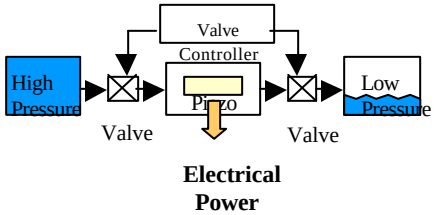
Objective Force Warrior

Sustainment Systems and Technologies

Revolutionary Power Sources

- Advanced, Hybrid Fuel Cells
- Nano-Particle Polymer Photo-Voltaic
- Leverage DARPA Palm Power

Conducting Nanofibers



Heel Strike Power Generation

Solar Cell Patches and Cloths for Direct Power

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Training Systems and Technologies

- Objective Force Warrior will demand higher soldier performance at all levels, placing new demands on training systems
- Individual differences will have to be identified and training optimized to specific needs
- Collaborative and Individual automated training systems embedded in C4 System and Combat Suit and Helmet
- Ability to attain high cognitive performance under stress will be critical training goal

"Revolutionary Advances in Training Systems are Necessary to Enable Objective Force Warrior Vision"

Human Factors Technologies

- Maintaining and enhancing human performance offers significant potential
- Nutrition and supplements (and delivery mechanisms) are a key area– it appears many now using supplements
- Proper sleep and exercise regimes appear to be very important (little is known about mission impact)
- Biologically based protection measures rapidly evolving
- But many system integration issues must be addressed

Objective Force Warrior

Human Factors/Human System Integration Issues

- **Total Soldier Team Performance Assessment:**
  - **this soldier; in this team; performing these tasks; using this equipment**
- **Operations on the move - vulnerable first minutes after exit**
- **Weapon/System maintenance by the soldier**
- **Auditory/visual enhancement**
- **Skill mix in team**
- **Skill decay**
- **Form, fit, function assessment**
- **Operations in extreme conditions**

Objective Force Warrior

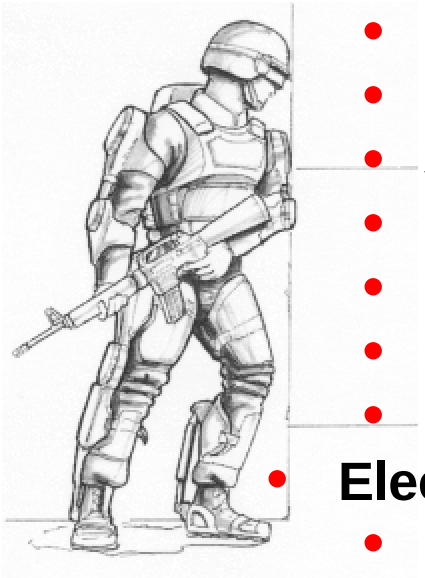
Human Factors/Human System Integration Issues (Con't)

- "Trust" in automation
- Adaptive behavior:
  - thinking by individuals - initial understanding, then tools to train
  - team action response
  - evaluation tools for validation of adaptive behavior in dynamic field environments
- Cognition - overarching consideration in soldier technology performance and use assessment

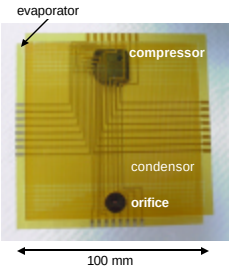
"Adequate Models of Human Behavior in the Objective Force Warrior Environment are needed to Support all Other Development Efforts"

Objective Force Warrior

Survivability Systems and Technologies



- **Integrated Suit and Helmet**
  - Full Body Armor based on nano-technology
  - Environmental Control
  - Stealth
  - Electromagnetic Protection
  - Laser Protection
  - Integrated C4ISR and Lethality Interfaces
  - Integrated CB Protection
- **Electro-mechanical Mobility Enhancement**
  - Increased Load Bearing and strength
  - Increased endurance
- **Multi-spectral Sensing of Threats**
- **Embedded Health Maintenance and Treatment Capabilities**

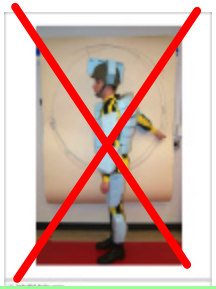


IMCC: Vapor Compression System on a Chip

"Revolutionary Survivability Systems for the Individual Soldier and the Team"

OFW: Integrated Designs, Virtual & Physical Prototypes, Field Demonstrations

From…



Hand Cutting And Placement Of Component Mock-ups to...

Through…

Virtual Prototype Form, Fit, Function Prior to Breadboard Prototyping

To…

Robust, Platoon Level Field Demonstration

Reduced Risk Breadboards, Brassboards, Field Tests of Integrated "System of Systems"

Human Performance Data

- Injury Mechanisms
- Component Mass Properties
- Mobility As a Function of Load and Load Carriage Equipment
- Biomechanics of Fatigue and Individual Movement

Interaction of Human Body, System Equipment & Combat Performance

Infantry Warrior Virtual Prototype Simulation

- Bio-mechanic Simulation Tool
- Analysis of Human and Equipment Performance Under Realistic Use Conditions.

What's in it for Small Arms???

Lightweight, Lightweight, Lightweight, Lightweight

- Potential opportunity to develop and demonstrate lightweight systems

- Compliment OICWs in rifle squad with reduced weight systems with equivalent performance of current

- Goals:
  - M4 Carbine from 7.4 lbs to 5 lbs
  - M249 automatic rifle from 23.3 lbs to 14 lbs
  - M16/M203 Grenade Launcher from 12.6 lbs to 7 lbs

- Integrated Troop Demonstration FY07

Objective Force Warrior

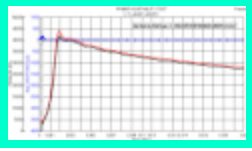
Lightweight Weapon Family

- <u>Program approval Sep 01</u>
- Expect FY02 Start
- Clean Sheet of Paper Design
  - Maximum use Lightweight Composite Structures
  - Simple mechanisms
  - Inexpensive, Lightweight, Polymer or caseless Munitions
- Efficient/Quick Squad Networked Fire Control
- Low Risk Tech Insertions

Ceramic Barrel

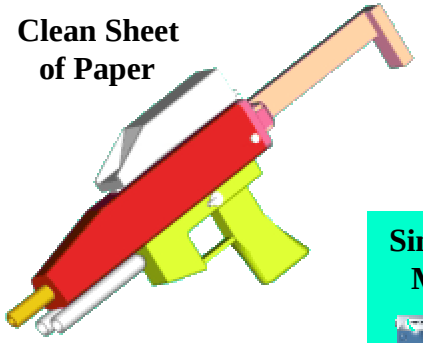
Caseless or Plastic Cased Ammunition

Tailored Propellant



Ergonomic Design

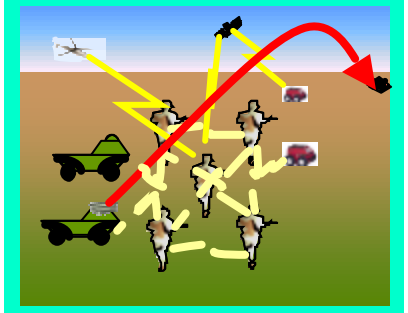
Clean Sheet of Paper



Embedded Sensors

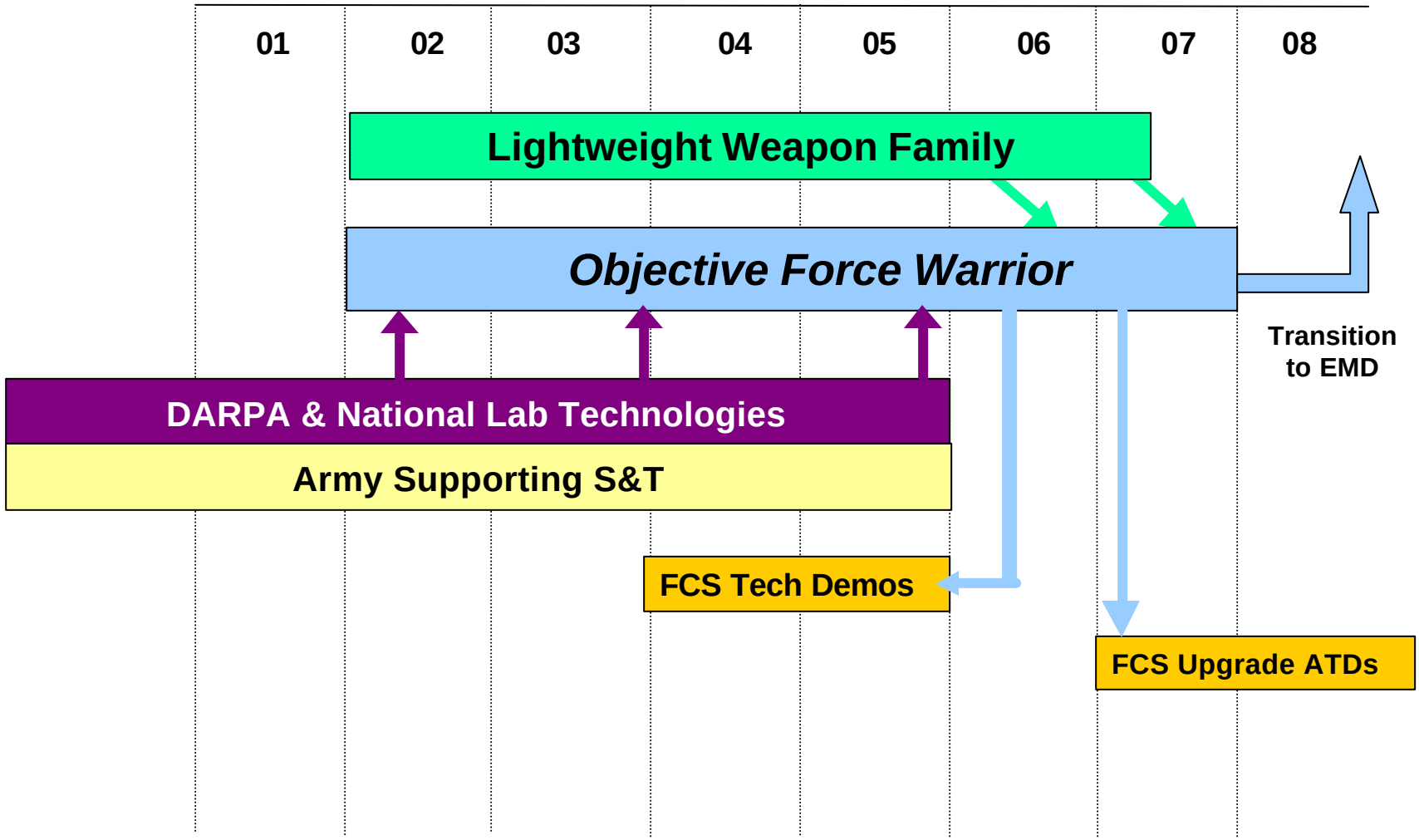
Simple Reliable Mechanisms

Composite Structures



Netted Fire Control

Objective Force Warrior Roadmap



Objective Force Warrior

Summary:

- Technology effort directed at the Dismounted Soldier
- Capstone Demonstrations FY06-07
- Fielding in the Objective Force time frame
- Strong interest in a lightweight weapon family to compliment OICW in the squad.
- Demonstrate a lightweight weapon family offering same capability as current systems in FY07

Objective Force Warrior Operational Needs

(Brainstormed from Draft O&O for Objective Force)

N1	Position/location		N11	Detect/avoid hazardous areas		N21	Direct engagement
N2	Mapping		N12	Visualization of 3D battlespace		N22	Indirect engagement
N3	ID friendly, enemy, non-combatants		N13	Minimal w eight and cube of all OFW equipment		N23	Less than lethal engagement
N4	Tracking of individuals/units		N14	Multi-spectral Obscurants		N24	Remote area denial
N5	Vertical mobility		N15	Target designation		N25	Precision engagement
N6	Lateral mobility		N16	Target recognition		N26	Target hand-off
N7	Subsurface mobility		N17	Target marking		N27	Hands-free NLOS communications
N8	Identify/reduce/defeat obstacles		N18	Variable penetration of rounds/munitions		N28	Comms compatibility w ith all platforms
N9	Precision delivery of troops		N19	NLOS engagement		N29	Common relevant operating picture
N10	Enhanced vision; "see thru/past" obstacles		N20	Synchronization of fires		N30	Information management

Objective Force Warrior Operational Needs

(Brainstormed from Draft O&O for Objective Force)

N31	Get the enemy on our terms	N41	Respiratory protection (oxygen-depleted environment)	**Enabling/overarching needs**	
N32	Environmental protection	N42	Joint protection	N48	Efficient/reliable power source(s)
N33	Thermal load protection/balance	N43	Emergency sustainment	N49	Training
N34	Ballistic protection	N44	Immediate [casualty] aid	N50	Mission planning/rehearsal
N35	Flame protection	N45	Recover wounded with minimal exposure	N51	TTP development
N36	Prevent detection	N46	Sustenance	N52	Interoperability
N37	Cut protection	N47	Water	N53	Tactical resupply
N38	Laser eye protection			N54	Intell collection/dissemination
N39	Hearing protection			N55	Terrain/urban databases
N40	Chem/bio protection			N56	Cultural, etc. databases
				N57	IPB Analytic tools (?)