



# *Objective Force Warrior*



## *NDIA Small Arms Symposium August 2001*

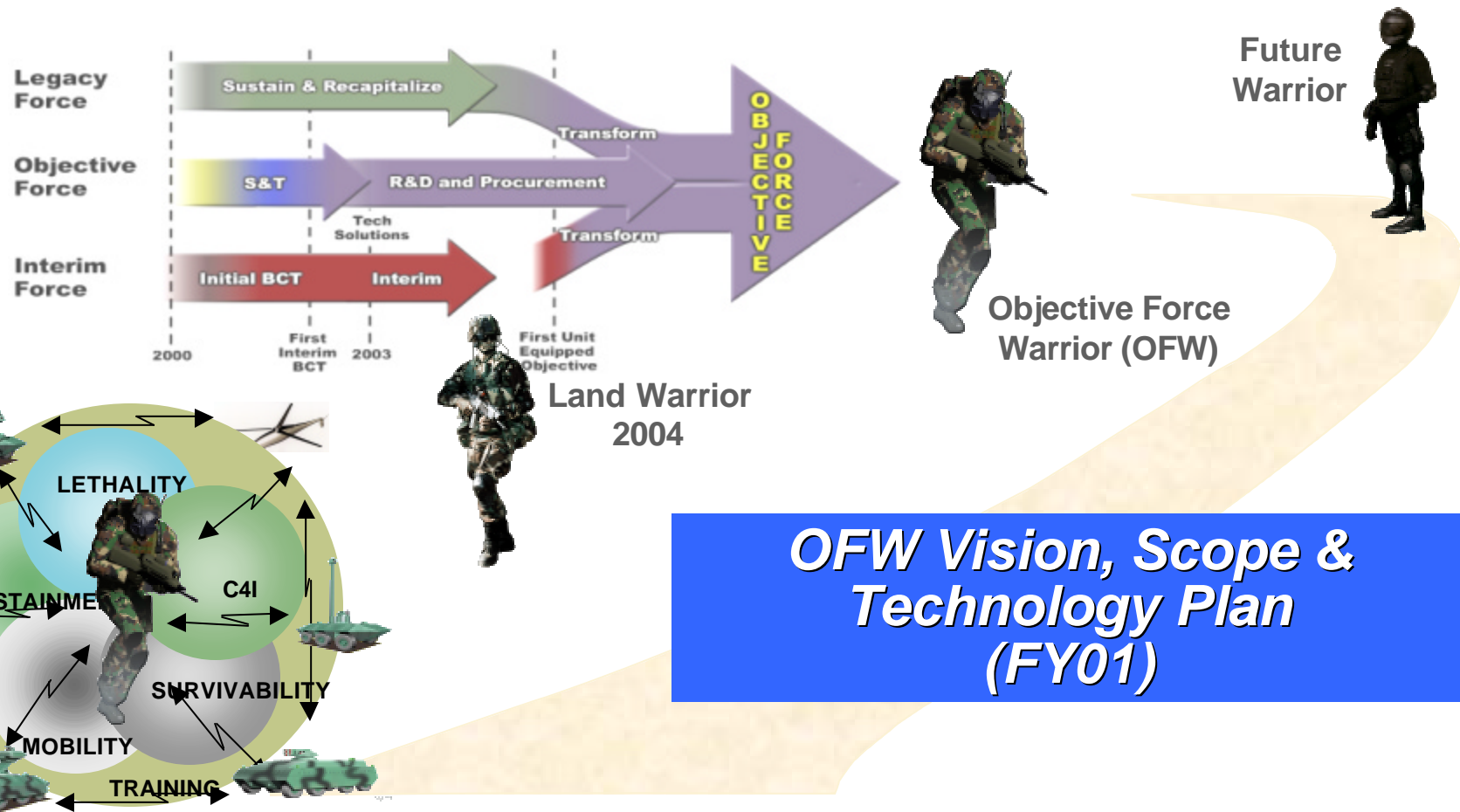
*Presented by:*  
**Vernon E. Shisler**  
Joint Service Small Arms  
Program Office  
973-724-6009  
vshisler @pica.army.mil

## Report Documentation Page

<b>Report Date</b> 13Aug2001	<b>Report Type</b> N/A	<b>Dates Covered (from... to)</b> -
<b>Title and Subtitle</b> Objective Force Warrior		<b>Contract Number</b>
		<b>Grant Number</b>
		<b>Program Element Number</b>
<b>Author(s)</b> Shisler, Vernon E.		<b>Project Number</b>
		<b>Task Number</b>
		<b>Work Unit Number</b>
<b>Performing Organization Name(s) and Address(es)</b> Joint Service Small Arms Program Office		<b>Performing Organization Report Number</b>
<b>Sponsoring/Monitoring Agency Name(s) and Address(es)</b> NDIA (National Defense Industrial Association) 211 Wilson Blvd, STE. 400 Arlington, VA 22201-3061		<b>Sponsor/Monitor's Acronym(s)</b>
		<b>Sponsor/Monitor's Report Number(s)</b>
<b>Distribution/Availability Statement</b> Approved for public release, distribution unlimited		
<b>Supplementary Notes</b> Proceedings from the 2001 Joint Services Small Arms Symposium, Exhibition & Firing Demonstration 13-16 August 2001 Sponsored by NDIA, The original document contains color images.		
<b>Abstract</b>		
<b>Subject Terms</b>		
<b>Report Classification</b> unclassified	<b>Classification of this page</b> unclassified	
<b>Classification of Abstract</b> unclassified	<b>Limitation of Abstract</b> UU	
<b>Number of Pages</b> 26		



# Warrior Systems Modernization Supporting Army Transformation



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

*Committed to Excellence*



# 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***

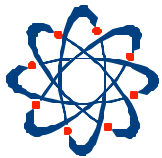
*Committed to Excellence*





# 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

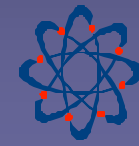
- Reduce Total Ownership Costs by 50% (Stretch Goal)

### Fightability

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

**Revolutionary Technology & Innovation**

**Weight, Power,  
Cost &  
Performance  
Trade Offs**



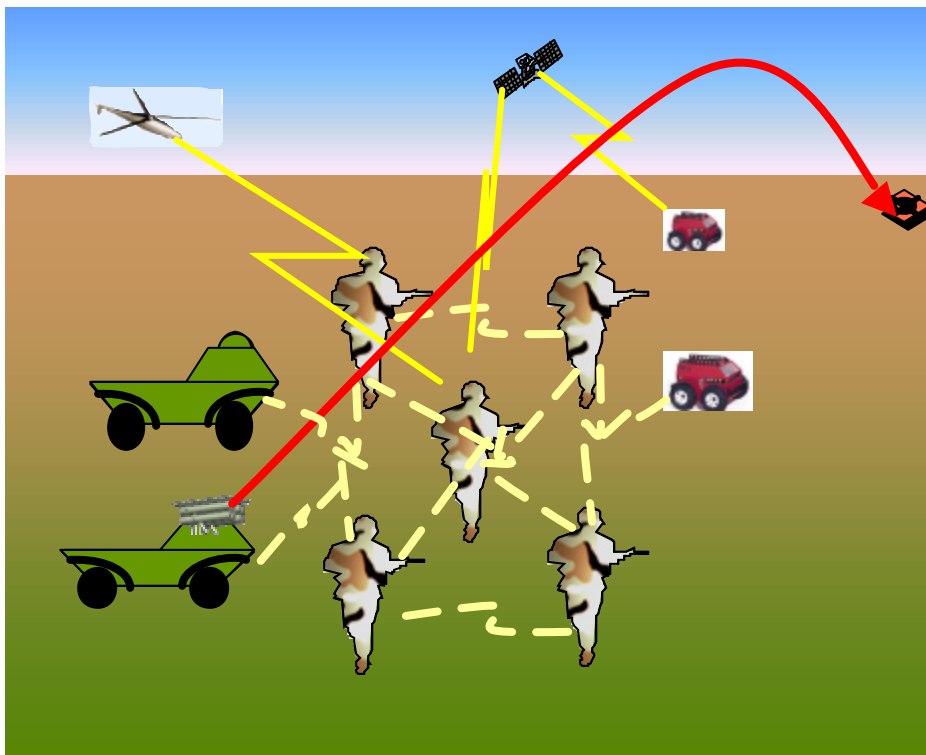
**Human  
Performance  
& Integration**

**Competitive  
System  
Design Teams**

*Committed to Excellence*



## *....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





# ***Objective Force Warrior***



## ***Preliminary Technology Opportunities***

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



# Objective Force Warrior



## 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**

*Committed to Excellence*



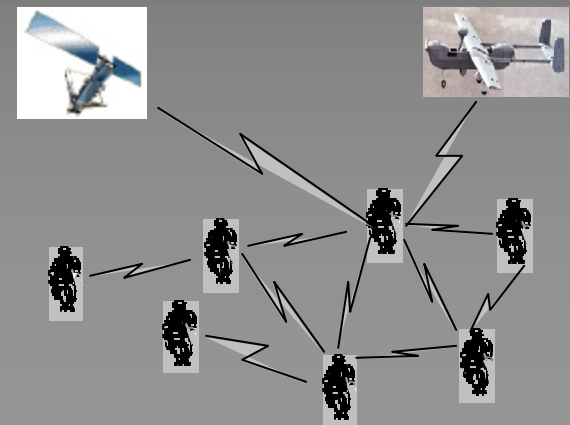
# Objective Force Warrior



## **“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





# Objective Force Warrior



## ***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”**

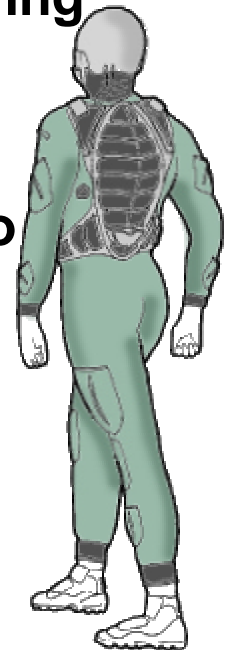
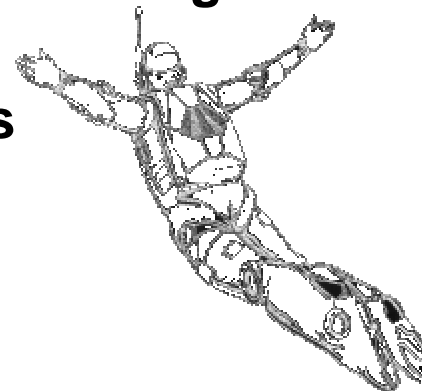
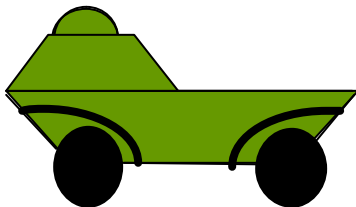


# Objective Force Warrior



## *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

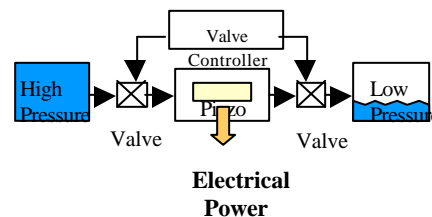
### Revolutionary Power Sources

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

### Conducting Nanofibers



Solar Cell Patches and Cloths  
for Direct Power



Heel Strike  
Power  
Generation



# ***Objective Force Warrior***



## ***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”**



# ***Objective Force Warrior***



## ***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**

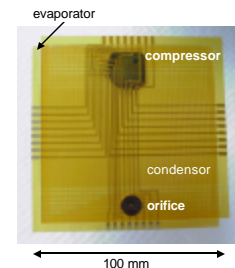
- Full Body Armor based on nano-technology
- Environmental Control
- Stealth
- Electromagnetic Protection
- Laser Protection
- Integrated C4ISR and Lethality Interfaces
- Integrated CB Protection

- **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”**

*Committed to Excellence*



# ***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...***

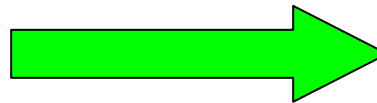


***Reduced Risk Breadboards,  
Brassboards, Field Tests of  
Integrated "System of Systems"***

**Robust,  
Platoon Level  
Field  
Demonstration**

## **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.



# Objective Force Warrior



## 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

- Program approval Sep 01
- 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

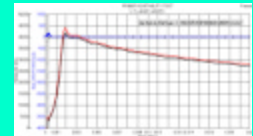


Ceramic Barrel

Caseless or Plastic Cased Ammunition

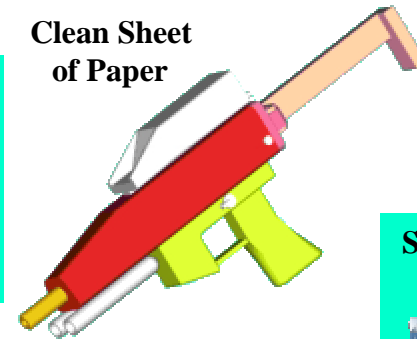


Tailored Propellant



Ergonomic Design

Clean Sheet of Paper



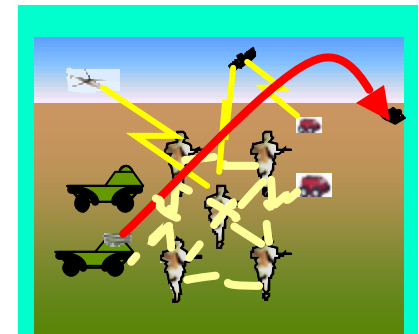
Embedded Sensors



Simple Reliable Mechanisms



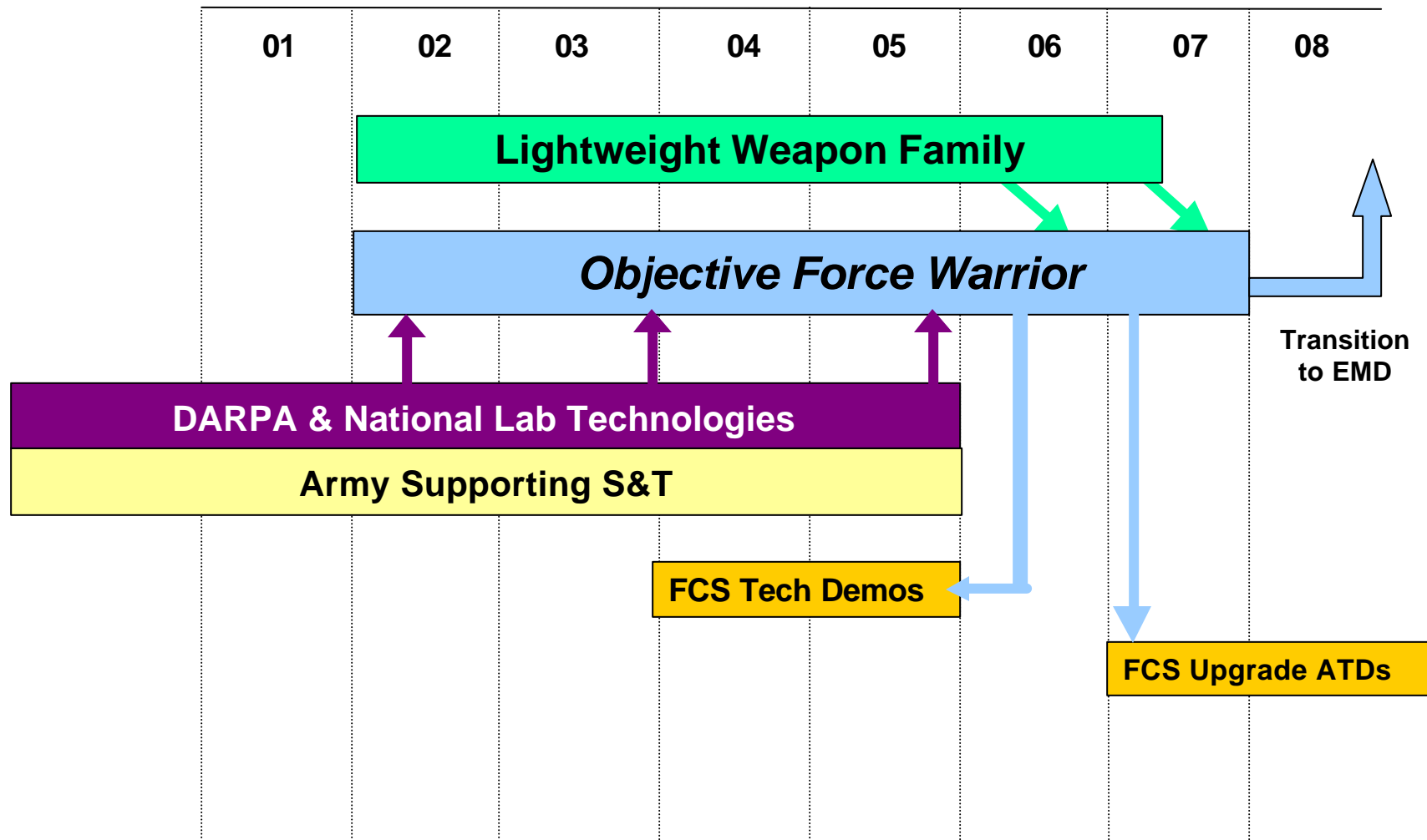
Composite Structures



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 weight 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 with 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

*Committed to Excellence*





# 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)	<b>Enabling/overarching needs</b>	
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 (?)