



# *2002 International Infantry & Small Arms Symposium*

## *21<sup>st</sup> Century Military Operations and Technology*

# *Objective Force Warrior*

*15 May 2002*

*Philip Brandler  
Director,  
Natick Soldier Center*





# *Soldier System Paradigm Shift*

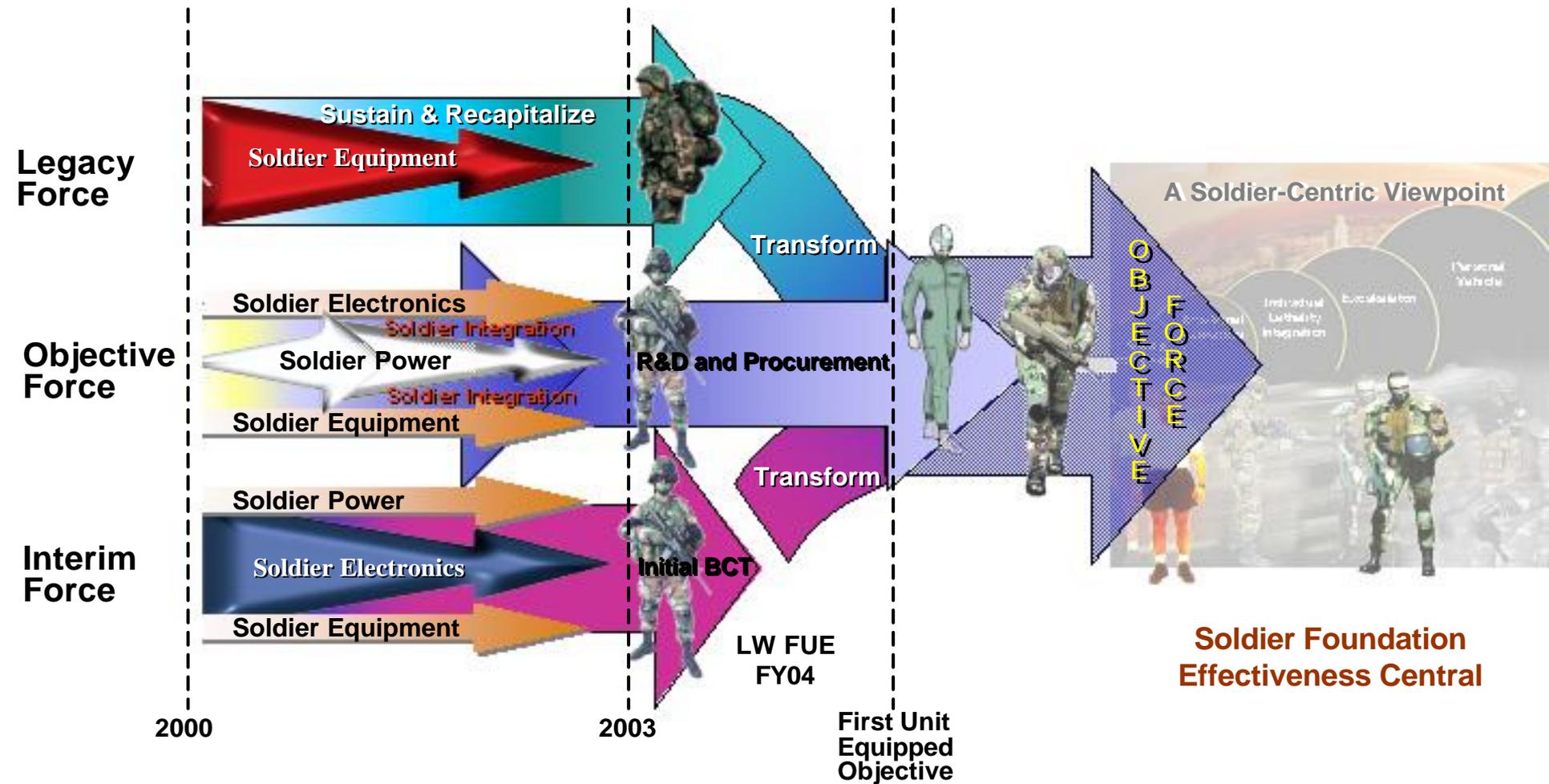


*...Christmas Tree* 🌲

*...Integrated Human-Centric System*



# Soldier Systems in the Army Transformation



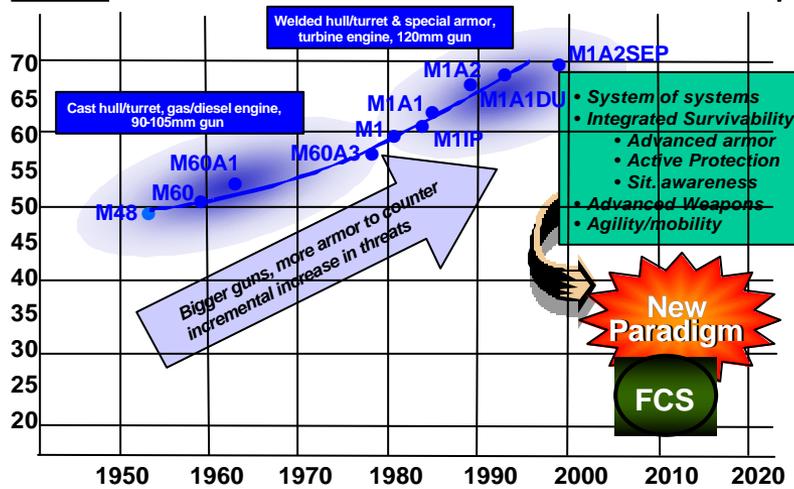
**Soldier Systems are Centric to Army Transformation**



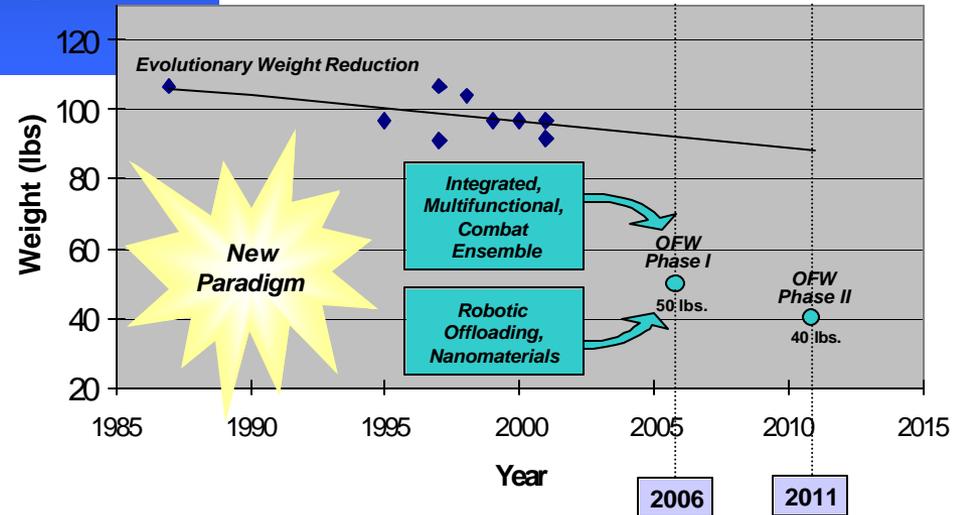
# FCS Thinking Extends to Soldier Systems

**Unprecedented agility and empowerment of soldiers in FCS and OF concepts drives need for a Paradigm Shift**

## Rapid Deployability Drives Need for Paradigm Shift



## Soldier System Weight





# Five Independent Study Panels on Objective Force Warrior



OFW Independent Review Team  
OFW Special Study Group (SSG)  
Army Science Board (ASB) Summer Study on OFW  
Oak Ridge Visioning Teams  
FCS Technology Assessment Panels

Including  
TRADOC  
TSM-Soldier

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**250+ Leading  
Experts from Ind,  
Gov & Acad**

## Consistent Vision & Message

- ✓ Major Technology Investment Needed
- ✓ Revolutionary Improvements over LW Possible
- ✓ Initiate Flagship Objective Force Warrior System of Systems Integration Program
  - Milestone B No Earlier than end of FY06 (as late as FY08) for Leap Ahead

Conducted Between Oct 2000 and Nov 2001



# *IRT View of S&T Investment in the Warrior System*



***Current Warrior S&T Investment is approximately 5% of the Army S&T Budget...***

- **Sufficient to meet the needs of the “Soldier-Centric” Objective Force?**
- **Comparison: FCS investment is 35% of the Army’s S&T**
- **Similar challenges face future warrior systems...**
  - **Increased protection at a lighter weight**
  - **Greater lethality at a reduced weight**
  - **More enduring power sources**



# IRT Findings & Recommendations



## Findings:

- The S&T program can yield revolutionary soldier performance in this decade *if the program is redefined/re-resourced (\$300-400 M over the POM)*

## Recommendations:

- To achieve a revolutionary capability in this decade:
  - Initiate a *flagship* Objective Force Warrior program **NOW**
  - Develop revolutionary warrior system design by following FCS Program strategy

***Revolutionary Soldier Performance Requires Aggressive, High Risk Actions***



# Land Warrior – A Success Story

- **It works**
- **Dramatic cost reductions**
- **Big gains in effectiveness**
- **The LW Team deserves high praise**
- **However, significant challenges remain:**
  - **Fightability**
  - **Weight**
  - **Power**
  - **Affordability**
  - **Systems Approach**



# Toward Achieving the Goals

## Factors

C4ISR

Mobility

Lethality

Survivability

Sustainment

People

Affordability

## Potential Technical Opportunities

See First

Understand First

Act First

Finish Decisively

Endure

People

Buy & Sustain

- Micro & Mini UAVs & UGVs
- Mine/Booby Trap Sensing
- Through Wall Sensing
- Sniper Detection
- Soldier C4ISR Connectivity
- Decision Aids
- ID Friend, Foe, & Neutral (IFFN)
- Responsive Organic & Joint Netted Fires
- Exoskeleton Assist Systems
- Robotic Mule
- Sustainment by UAV
- Signature Management
- Robotic Targeting & Attack
- Agile Target Effects
- Physiological Monitoring
- Power Management
- Lightweight Integrated Soldier System
- Water Purification & Generation
- Acquisition
- Assignment
- Sustainment
- Soldier Life-Cycle

CAIV/COTS

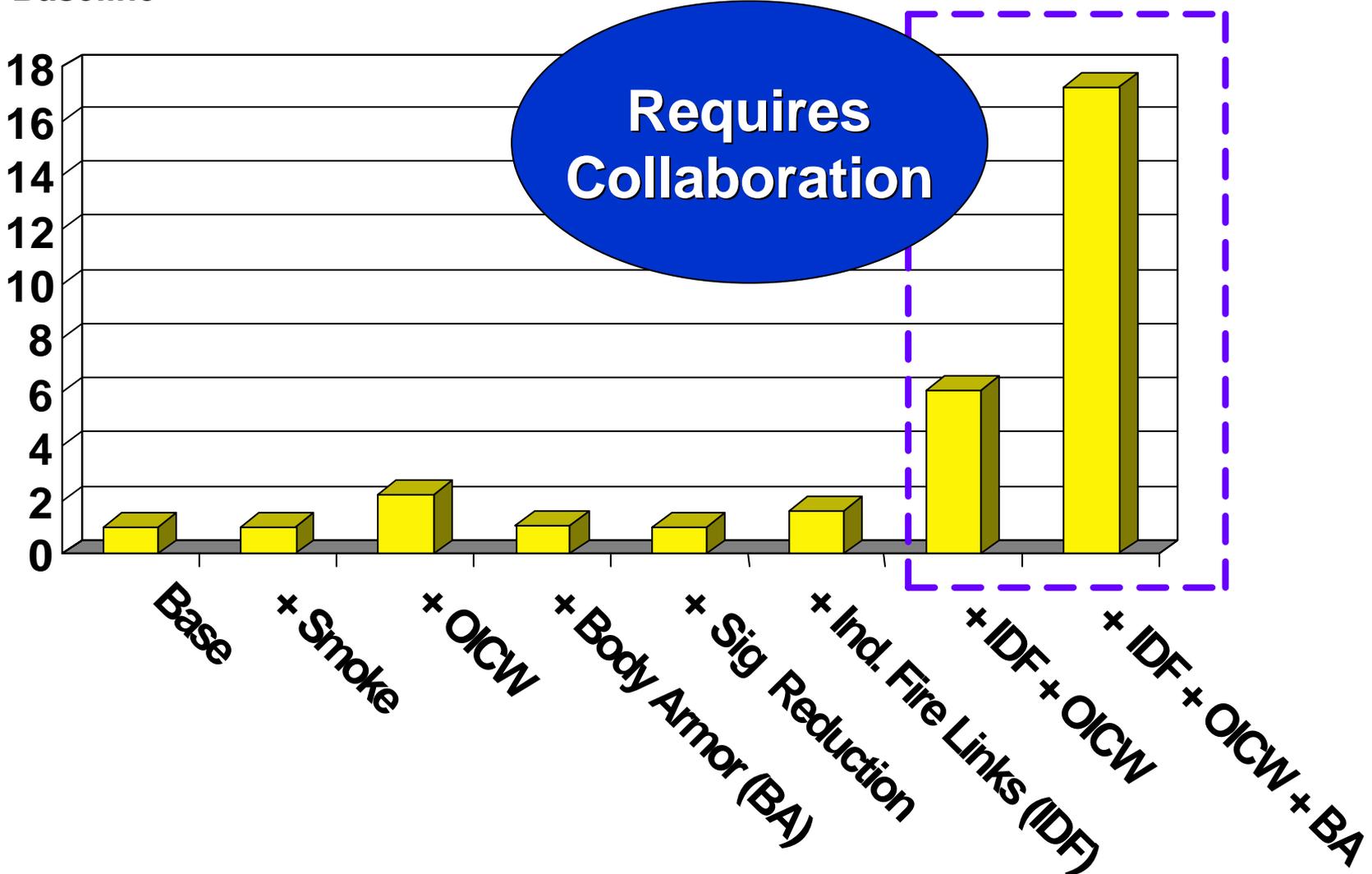
A Systems Approach to These Factors Is the Key to Success

10X Effectiveness



# Alternative Options Show Significant Improvement

LER Improvement Over Baseline



Requires Collaboration

SUMMER STUDY

2001



# Mid Term Recommendations

## Objective Force Warrior

(TRL7 by 2008 – FUE by 2012)

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2001

**Agile Target Effects**

**Signature Management (Limited Spectrum)**

**Rechargeable Energy Systems**

**Micro UAVs & UGVs**

**Soldier C4ISR Connectivity**

**Sniper Detection**

**Robotic Mules (Semi-Autonomous)**

**Power Management (Selective)**

**Responsive Joint Netted Fires**

**Lightweight Integrated Soldier System**

**Water Purification & Generation**

**Robotic Targeting & Attack (Human in the Loop)**

**Physiological Monitoring**

**Through Wall Sensing (Proximity)**

**Sustainment (ID Foe/Neutral) By UAV**

**Mine/Booby Trap Sensing**

**IFFN**

**Collaborative**

UNDERSTAND  
AND ACT  
FIRST

FINISH  
DECISIVELY

SEE FIRST

SURVIVE  
& ENDURE

EXPLOIT  
THE POWER  
OF THE ENTIRE FORCE





# ***VISION — Essential Principles***

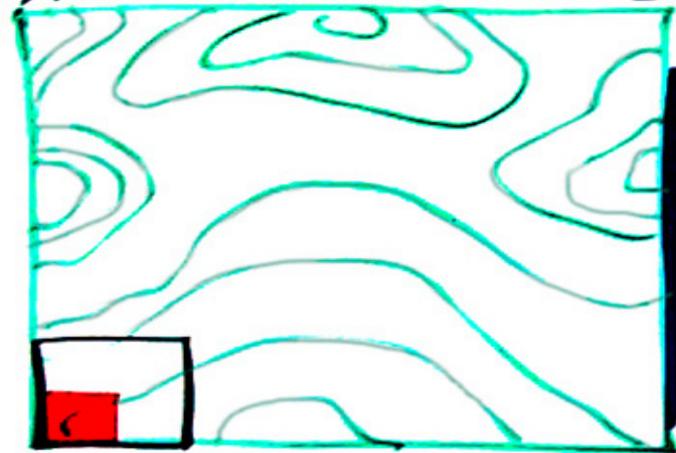


- **“Overmatch” for the Soldier**
  - Dominate with Information
- **Apply the Power of the Force**
  - Collaborative massed effects
- **Three-dimensional Aspect of Effects**
  - Vertical integration
  - Stand-off
  - Expanded Area Under Control
- **Warrior Culture**
  - Human performance - centric design
  - Extended cohesion
  - Paradigm shifts in recruiting, manning, and training
- **Open Architecture**
  - Integrate emerging capabilities continuously

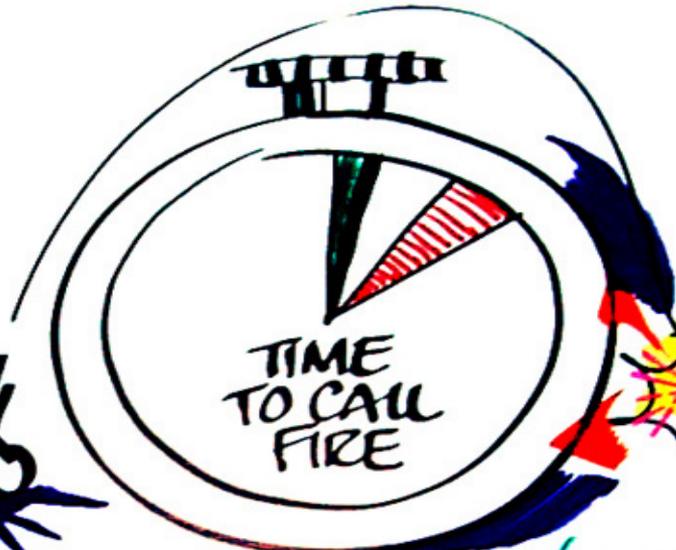


# BATTLEFIELD CONTROL

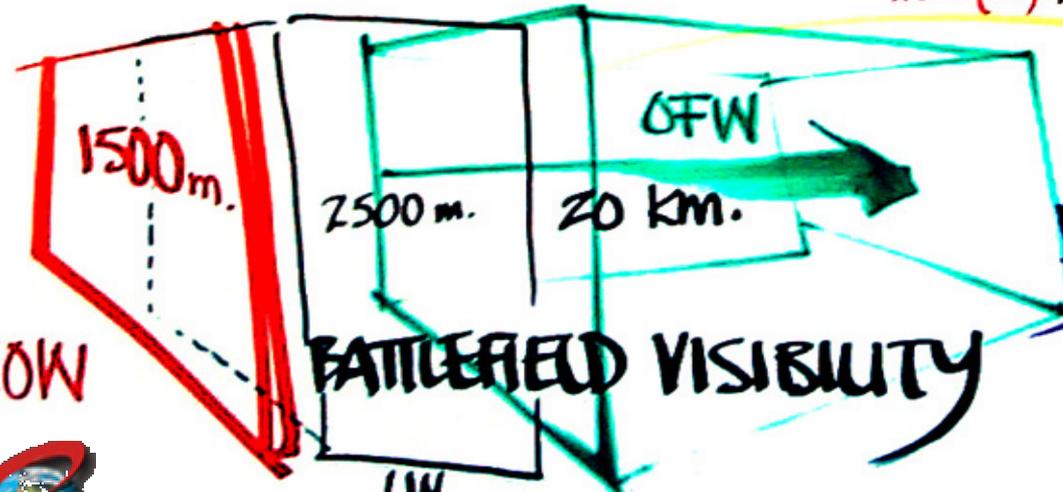
AREA UNDER CONTROL



NOW LW OFW



NOW (10) LW (3-5) OFW (1 MIN.)



NOW

MASSED EFFECTS



WHAT THE APACHE  
ATTACK TEAM DOES  
TODAY

OF W

TODAY



THE SOLDIER WILL BE  
ABLE TO DO TOMORROW



# ***“MUST HAVE” OFW COMPONENTS***

**Collaborative  
Situational  
Awareness**

**Strike**

**Move**

**Protect**

**Sustain**

**Embedded  
Training**

- **Collaborative Situational Understanding**
  - **Netted Communications**
- **Apply/Mass FCS Combat Multipliers to Overmatch**
  - **OCSW critical**
- **Reduce Weight**
  - **UGV load-carrier now**
  - **Lighter equipment technologies**
- **Individual Survivability**
  - **Protective equipment**
  - **Integrated combat ensemble**
- **Power**
  - **Advanced fuel cell**
- **Training Integration**



# EXPONENTIAL LEAP-AHEAD POSSIBLE

BY 2018



**Optimized Situational Understanding**

- Netted Commo
- Netted Fires
- Intelligent Agents

**Next Generation Power Source**

**Advanced Robotics**

- Sensors
- Load Carriers
- Fighting Functions
- Exoskeleton

**Next Generation Weapon**

**Smart Bullets**

**Integrated Fighting Ensemble**

- Full Ballistic Protection
- Nanotechnology Materials
- Total Environmental Management
- Very Fightable

**Optimized Performance-Centric Design**

- Training
- Neural
- Medical
- Rations



**More Options to “Close With” and “Destroy”**



# ***EQUIPMENT DEVELOPMENT THOUGHTS***



- **Keep It Small and Simple**
- **Spiral Development (Deploy with Tech Teams for first units)**
- **Field by Unit Sets**
- **Economically Producing in Quantity**
- **Open Architecture to Maximize off the Shelf (Moore's Law)**
- **Modular Mission Payloads (Soldier and Vehicle)**
- **Minimize Logistics Tail**
- **OFW Lead System Integrator Linked to FCS Integrator**





# SUMMARY



- The Old Wisdom Endures — Move, Shoot, Communicate, Along with Survive and Endure, Still Wins**
- The Future Champion — Netted Communications Leading to Situational Awareness, Collaboration, Massed Effects, Sensing, and Synergy is the Key to the Future**
- The Over-Arching Gestalt — Exploit the Power of the Entire Force**
- Four Technology Imperatives — Information, Power, Miniaturization, and Robotics**
- The Urgent Cry — Passionate Call for a “MULE” like Tool**
- The “OTHER FORCE” — The Human-centric Battlefield Dynamics of the WARRIOR CULTURE are Key Combat Multipliers**





# OFW

## *Special Study Group (SSG)*



- **SSG Direction:** Established ('01) by ASA(ALT) to address IRT recommendations
  - Define a vision, investment, and acquisition strategy for Warrior Systems for the Objective Force
- **SSG Composition:**
  - Co-Chaired by Dir, NSC and TSM Soldier
  - Composed of members of the Soldier related technology community, including NSC, ARDEC, CERDEC, MRMC, TARDEC, ARL, ARI, STRICOM
  - Included TRADOC and Users



# *OFW SSG Process*

## *Premised on Warfighter Needs*



- **Derived warfighter needs for OFW from key Transformation documentation**
- **Brainstorm capabilities for each need**
  - **Users and developers**
  - **Warfighter SME panel banded capabilities**
- **Broad-based technology inquiry to ID technologies for capabilities to meet needs**
- **OFW Needs not yet Vetted or Prioritized by Headquarters TRADOC**

# OFW Needs Grouped into Capability Areas



**Lethality** - Direct and indirect engagement; less than lethal engagement; target detection/recognition; synchronization of fires; target handoff; ID friendly/enemy/non-combatants; target designation

**C4I** - Situational Understanding; information management; comms; enhanced vision/senses; detect/avoid hazardous areas; area denial; mark items of interest; intel collection & dissemination; mission planning/rehearsal

**Power Sources** - High Density, lightweight, efficient, safe, reliable power (hybrids, rechargeable)

**Analysis & Assessment** - Modeling tools to enable optimal system development and assessment; virtual prototyping; individual and force on force modeling



**Survivability** - Full spectrum individual protection; signature management; thermal management; physiological status monitoring

**Mobility** - Horizontal, vertical mobility; reduce/offload equipment carriage; ID/reduce/defeat obstacles; position/location/tracking

**Sustainability** - Delivery of tactical resupply; water purification/generation; water management

**Training** - Individual, small unit, leader training concepts; embedded training, novel TTPs to exploit OFW capabilities

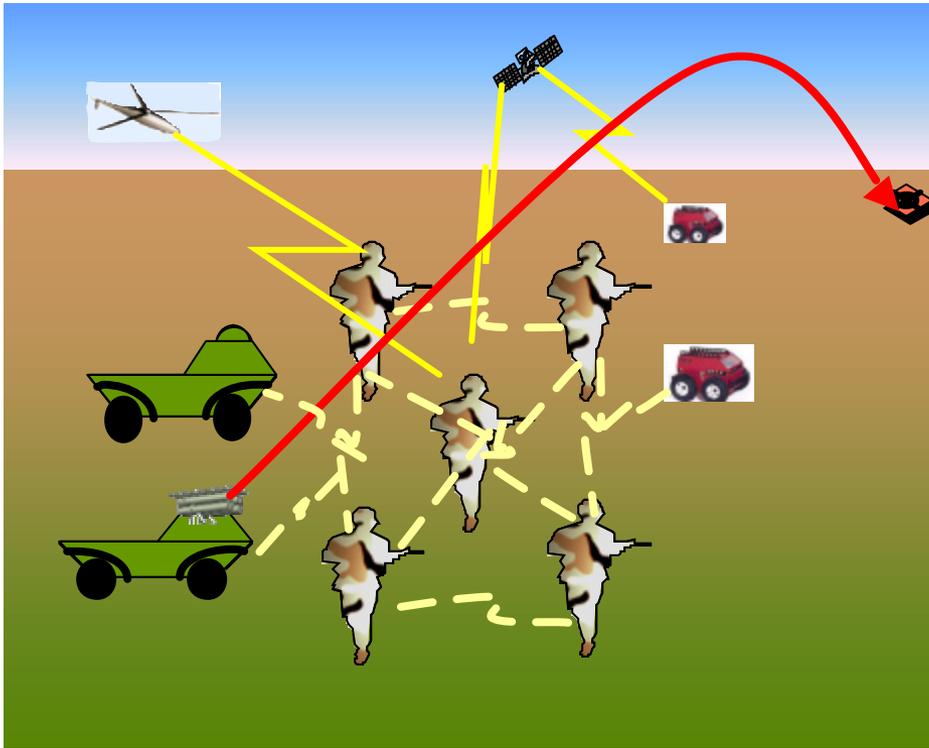
**Human Performance** - Sustain and enhance individual and team performance; optimize system and team fightability; optimize human endurance, cognitive and physical capabilities

**System Engineering and Integration** - Integrate all technical areas into comprehensive, integrated system of systems; weight, power, and cost treated as independent variables

## OFW Capabilities Create A Formidable Warrior.....



# ....In an Invincible Team



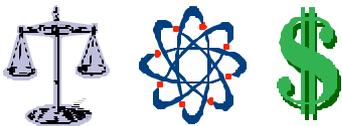
- A combined arms force at the fire team level
- C4ISR Provides leap-ahead overmatch effectiveness
  - Collaborative real time planning and execution
  - Coordinated LOS and BLOS fires and movement
- Robotic “Mules,” “Dogs” and “Eagles” provide
  - Remote sensing
  - Mobility
  - Sustainment
  - Lethality

***Many Revolutionary Capabilities Are Within Our Reach***



# Technology & Systems Integration

## Systematic Incorporation of Revolutionary Technologies



**Balance  
Weight,  
Power, Cost &  
Performance**

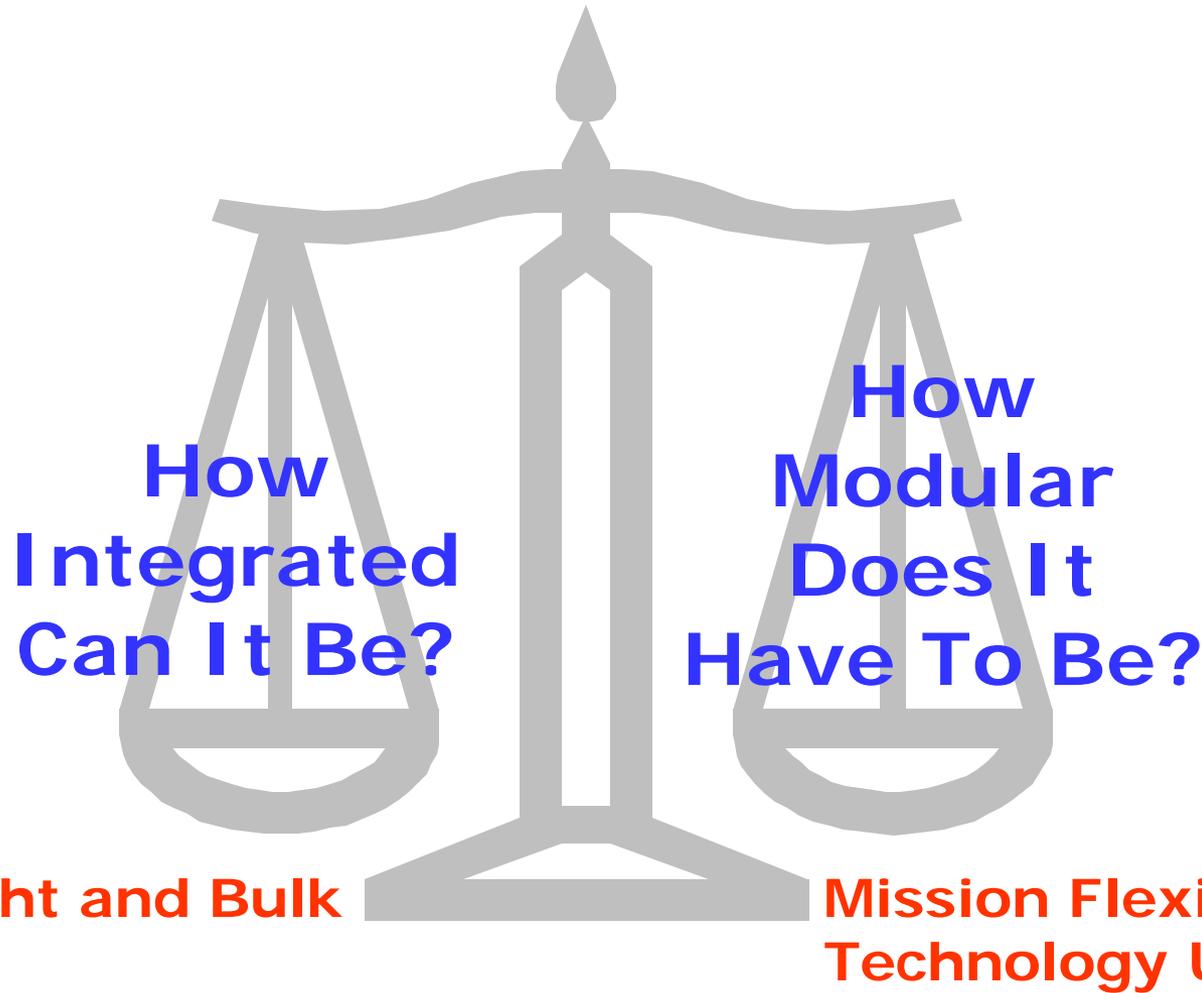
**Human  
Performance  
& Integration**

- **Integrated Process Product Development & Integrated Product Teams**
  - *Maximizes Developer, Producer, User Interaction & Produces the “Best” System*
- **Holistic System Design Approach**
  - *Maximize Human / System Performance*
- **Robust Analysis & Assessment**
  - *Leverage Government Modeling & Analysis Tools*
- **Synchronize with Objective Force Systems (e.g., FCS, C<sup>3</sup> on the move, Networked Sensors)**

**Program Structured to Leverage both DoD & Marketplace Technology**



# *Finding the Balance*





# *Combat Ensemble - The Chassis for Technology Integration*

**Physical  
Interfaces &  
Integration**

**Human  
Interfaces &  
Integration**



**Electronic  
Interfaces &  
Integration**

**Software  
Interfaces &  
Integration**

***Interfaces & Integration  
Both Within and  
External to Chassis***

***Human Centric  
System Architecture***

# *The Objective Force Warrior Program*



***A Revolutionary Capability For The Objective Force***



- **Scope: All Combat Warriors within Objective Force Unit of Action**
- **Diverse, Large Scale Integration Program Structured to Leverage cutting edge Technologies from both Government & Industry**
  - **Currently in S&T Phase**
- **System of Systems Concept Tailored to Maximize Effectiveness of Team of Teams Operations**
- **Synchronized/Compatible with FCS**



# Planned Technologies for Objective Force Warrior



- **Near Real Time Fire Synchronization**
  - Netted FCS Fires
  - OFW Direct & Area (w/ HE from OICW, OCSW)
- **Ultra-Light Grenade Launcher, Kinetic Energy (KE) Combat Rifle, Machine Gun & Ammo (Block II)**
  - Integrated Multi-Spectral Fire Control
- **Hybrid Fuel Cell Energy Systems**
  - Reduced Logistics Footprint & Cost
- **Compact, Low Power Networking Digital Radio (SUO/SAS ?)**
  - JTRS Compatible
  - Voice, Data & Video
- **OFW Mobile, Ad Hoc Tactical Network**
  - Links Warriors, Mules, & Team UAV
  - WIN-T Compatible for FCS Network Integration
  - Dominant Information & Awareness
- **Hybrid All Terrain Navigation**
  - 3 Meter, Vertical & Horizontal Accuracy



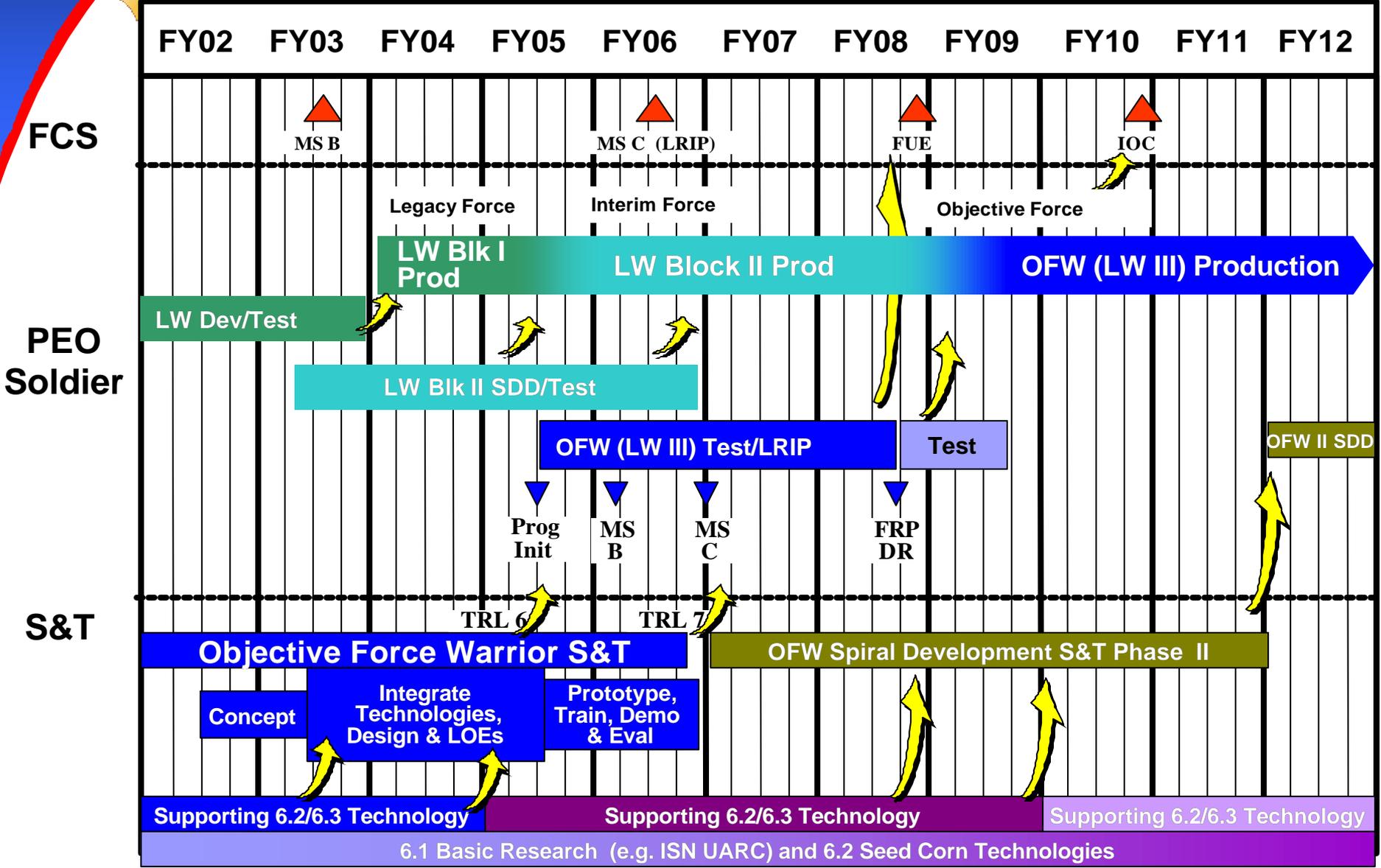
# Planned Technologies for Objective Force Warrior



- **Integrated Combat Suit & Headgear**
  - Ultra-Light, Novel Integration
  - Full Spectrum Protection
  - Signature Management (Near & Far IR)
  - Directional Long Range Hearing
- **Fused Thermal, I<sup>2</sup> Integral with Headgear**
  - High Resolution Color Display
- **Unmanned Aerial Vehicle**
  - Organic to Warrior Team
  - Man-packable and/or Mule Launched
- **Robotic Mule**
  - Reduce Soldier Carried Weight to 40-50 pounds
- **Physiological & Medical Sensors & Algorithms**
- **Micro-Climate Cooling & Heating**
- **Customized Voice, Tactile, Visual, & Auditory Human Interface**
- **Embedded Training & Rehearsal**
  - Netted, Collaborative
- **Human Performance Enhancements**

# Accelerated OFW Acquisition Strategy

## - Meets FCS FUE in FY08 -





# ***OFW Solicitation Highlights***



- **Contracting Vehicle “Other Transactions for Prototypes” Agreement**
- **Bids Received 1 May**
- **Contract Award Estimated For 15 July**
- **PEO, TRADOC, OFTF, ARL, ARI, RDEC, STRICOM and MRMC Representation in Source Selection**
- **“LTI” Concept with two Competing LTIs**
- **OFW LTIs tied to FCS LSI**



# Government/Industry Relationships



- **Government is Leader in OFW Program Decision Processes**
  - **Government IPT to review, assess and influence competing Lead Technology Integrator (LTI) OFW concepts**
  - **Full Government participation on LTI IPTs**
    - **Appropriate firewalls**
- **Industry Executes OFW Technology Development**
  - **Takes direction from OFW TPO**
  - **Develops OFW Concepts, Explores alternatives**
  - **Executes design, development and fabrication activities**

**Goal: LTI and Government Team dedicated to provide best solutions for Objective Force Warrior**



# Final Remarks

- **Soldier Domain has Historically been Under-Funded**
  - No Rich Source of Technology Options
- ***“Demonstrating a high level of maturity before new technologies are incorporated into product development puts those programs in a better position to succeed”\****
- ***“It is a rare program that can proceed with a gap between product requirements and the maturity of key technologies and still be delivered on time and within costs”\****
- **OFW Strategy is Consistent with:**
  - Five Independent Panel Recommendations
  - Successful Business and Service Practices

\* 1999 GAO Report: Better Management of Technology Development Can Improve Weapon System Outcomes