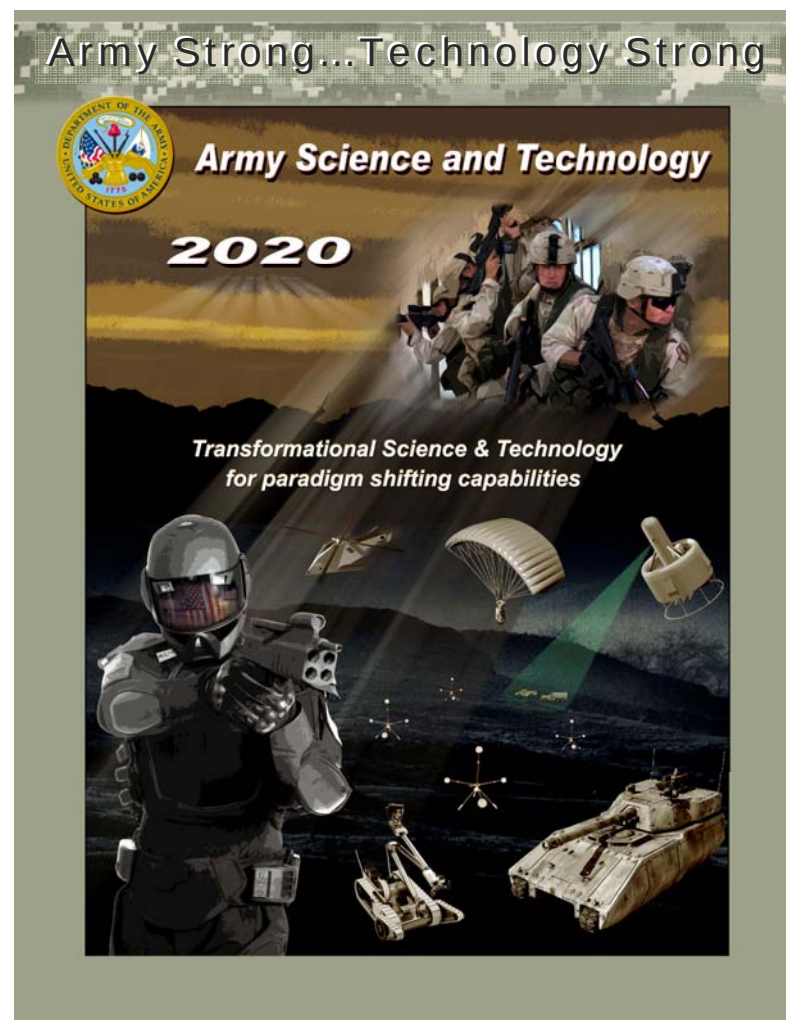




Technology for Future Warfighting

Army Science Conference

27 Nov 2006



Dr. Thomas H. Killion
Deputy Assistant Secretary of the Army
for Research and Technology/
Chief Scientist

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Science & Technology for a Campaign Quality Army with Joint & Expeditionary Capabilities

Strategy

Current Force



~100 lb. load



70+ tons



< 10 mph

Enabling the Future Force

Science and Technology—
develop and mature
technology to enable
transformational
capabilities for the Future
Modular Force while
seeking opportunities to
accelerate technology
directly into the Current
Modular Force

Enhancing the Current Force

Future Force



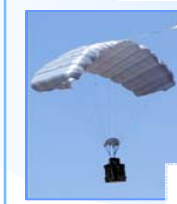
< 40 lb.
load



Fully networked



< 30 tons



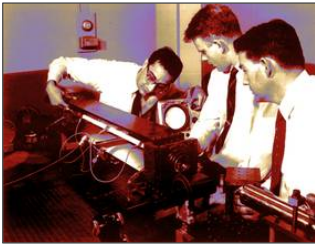
> 40 mph



Generations of Game Changing Technologies

Decade of the 1950's

Lasers

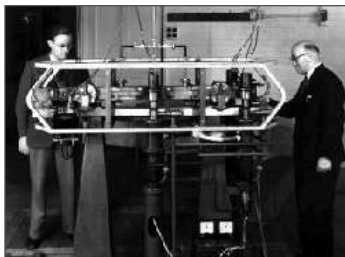
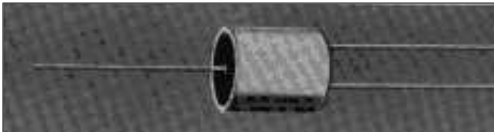


Programmable Systems



**WWII Ballistic Computing/
ENIAC**

Transistor



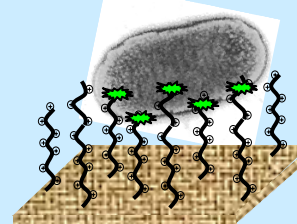
Atomic Clock



DNA

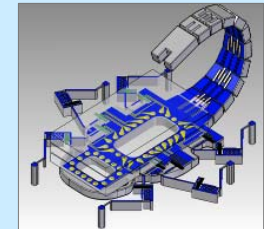
Today for 2020 and beyond...

Nanotechnology



**Institute for Soldier
Nanotechnologies (ISN)**

Micro-robotics

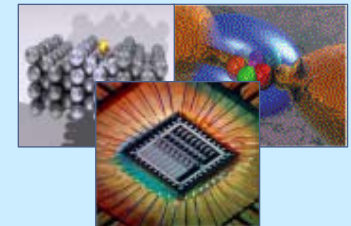


Immersive Environments

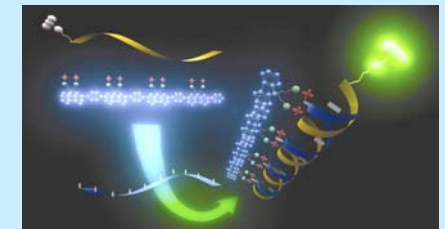


**Institute for Creative
Technologies (ICT)**

**High Performance
Computing**

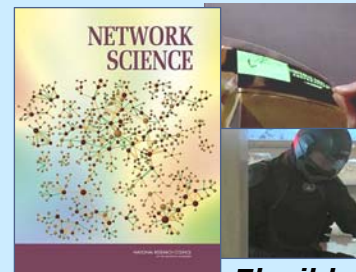


Biotechnology



**Institute for Collaborative
Biotechnologies (ICB)**

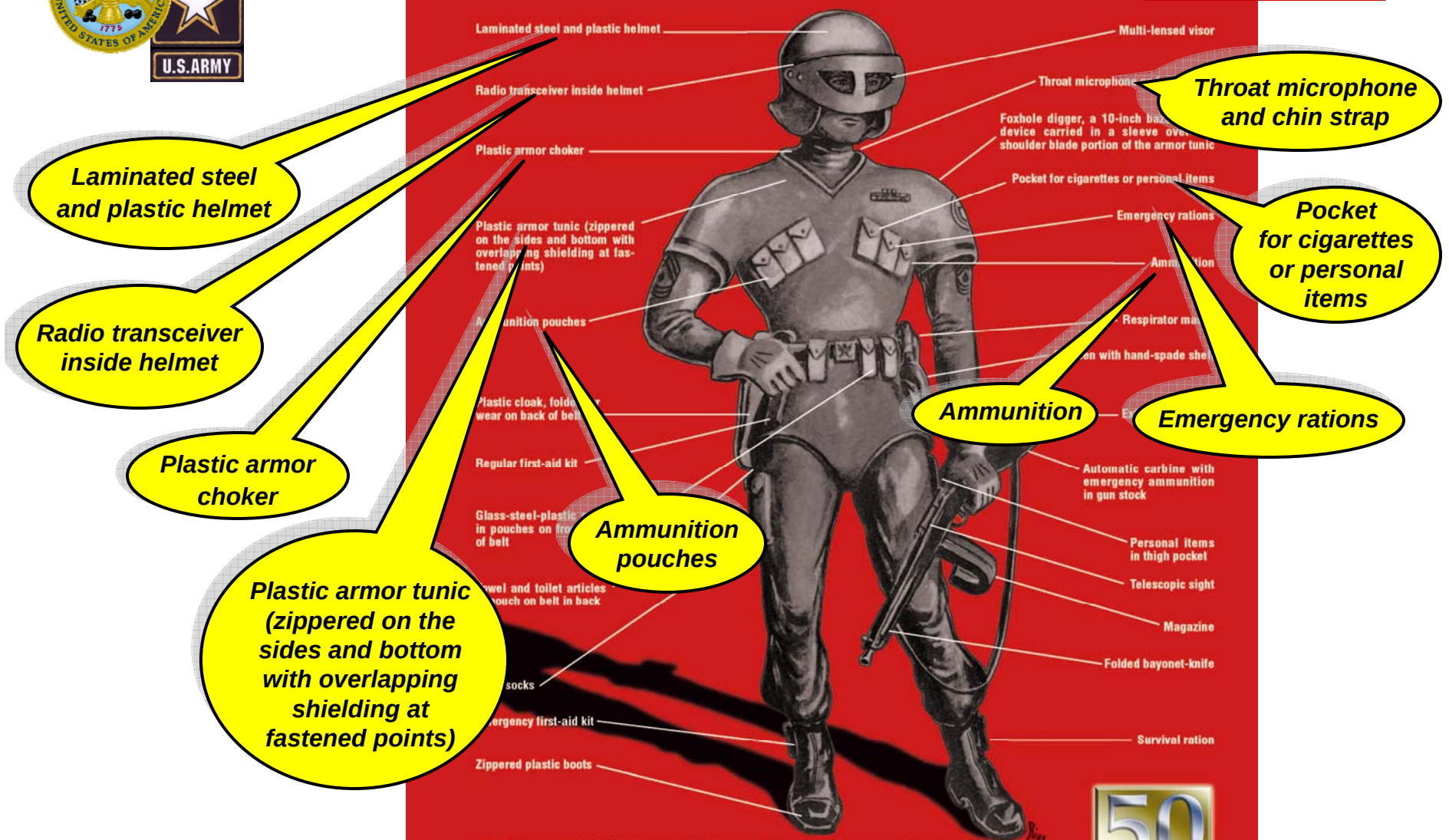
The Network



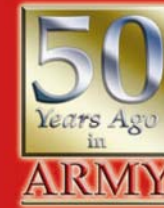
Flexible Displays



Futurarmy Soldier —1956



Wearing a scientifically designed helmet, plastic armor tunic and ultra-light equipment, this Futurarmy soldier will move and fight with greater ease and efficiency than any other soldier in modern history. The helmet visor will not only offer added protection but will provide the soldier with night vision and telescopic sight. Manning a variety of missiles and other weapons, this Futurarmy soldier of the 1970s will be the best protected individual since knights wore steel armor.



38 ARMY ■ November 2006

"Army Magazine" Vol 56. No.11 p.38, November 2006

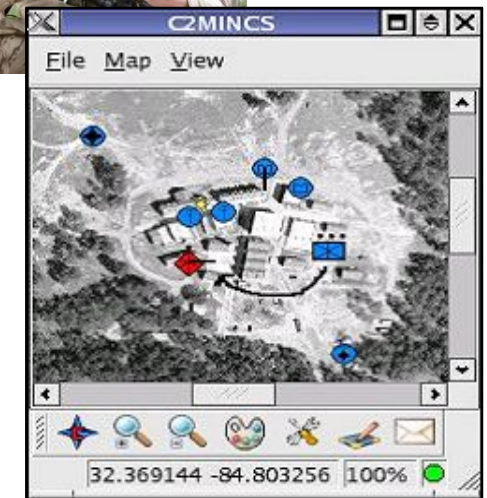
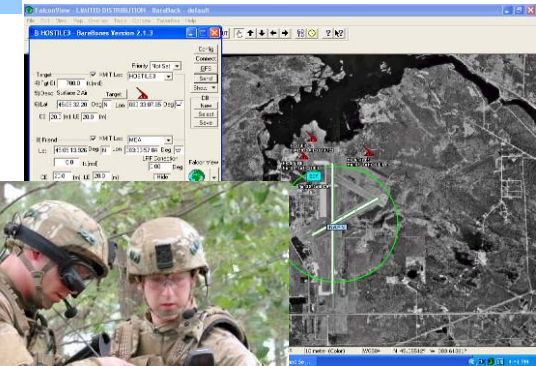


Future Force Warrior (FFW)—2006



- **FFW Increment 1 at C4ISR OTM Jun-Aug 06:**
 - Integration into Future Force network via Soldier Radio Waveform
 - Current force integration via FBCB2
 - Integrated combat ensemble with stand-off body armor/load carriage/electronics and signature management
 - Squad level NLOS cooperative engagement
 - Headgear with integrated fused thermal and I2
 - System voice control
- **FFW Early Increment 2 improvements at OTM 06 and AAEF/Spiral C:**
 - Beyond squad level NLOS cooperative engagement
 - Digital target hand-off to joint platforms (F-16, A-10)
 - Class I UAV imagery feed
 - Goggle mounted “look down” display
 - Physiological status monitoring
- **FFW at C4ISR OTM and AAEF/D in 2007**
 - Precise positioning system
 - Low power flexible display demo
 - Headgear sensor fusion
 - Wireless Personal Area Network and weapons interface
 - UGV, UGS integration to FFW platform
 - Compact computer (Falcon computer from AFRL)
 - Apache digital target hand-off

Leader Screenshot



Soldier Screenshot

FFW transitions to PEO Soldier in 1QFY08 for Ground Soldier System (next generation Land Warrior)



Nanotechnology for Soldiers—2020



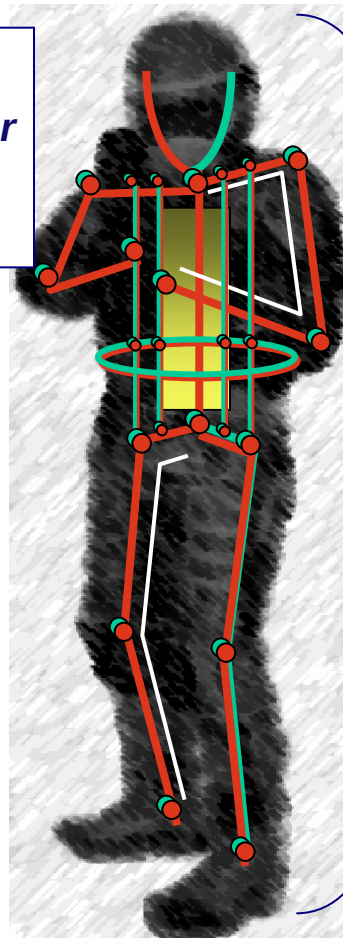
Dynamic Battle Suit Enabled by Integrated Systems of Nanotechnologies



***On-Demand
Chemical/Biological/Radiological/Nuclear
& Blast/Ballistic Global & Directional
Sensing & Protection***

***Physiological Monitoring
Medicines & Healing Agents
Thermal Management***

***Mechanical Performance
Improvement***

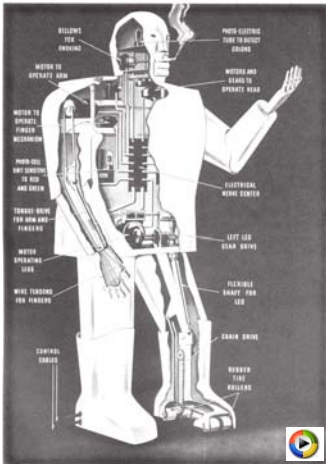


***Networked Sensors,
Mechanical Actuators,
Chemical Reactors, &
Storage Reservoirs...***

***Future Directions
Info & Power Networks
Control of Suit Subsystems***



Evolution of Human-like Robotics



Westinghouse Elektro
circa, 1939

Assumptions:

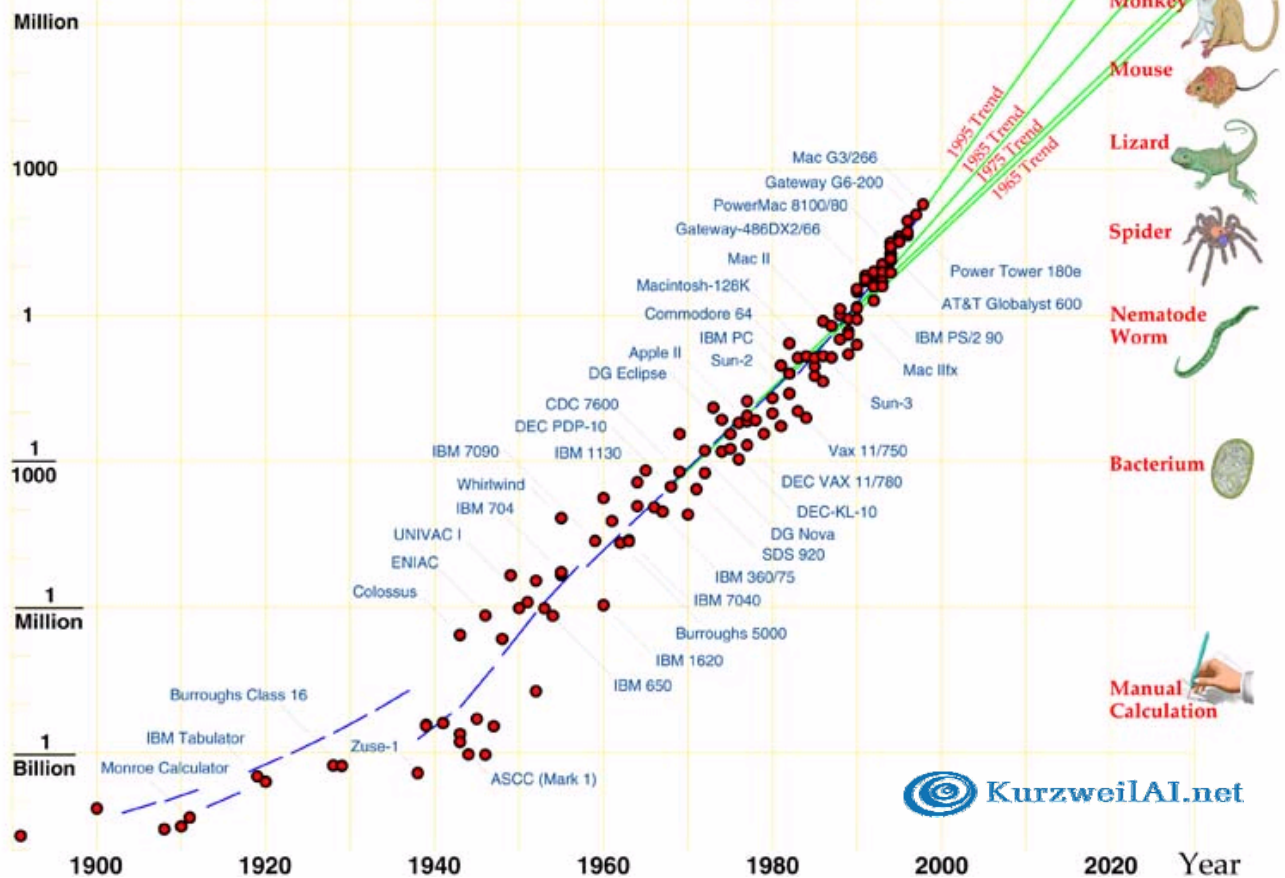
- Continued increase in processing speed
- Continued miniaturization of electronic elements
- Automated, plug n' play software development



Honda ASIMO

Evolution of Computer Power/Cost

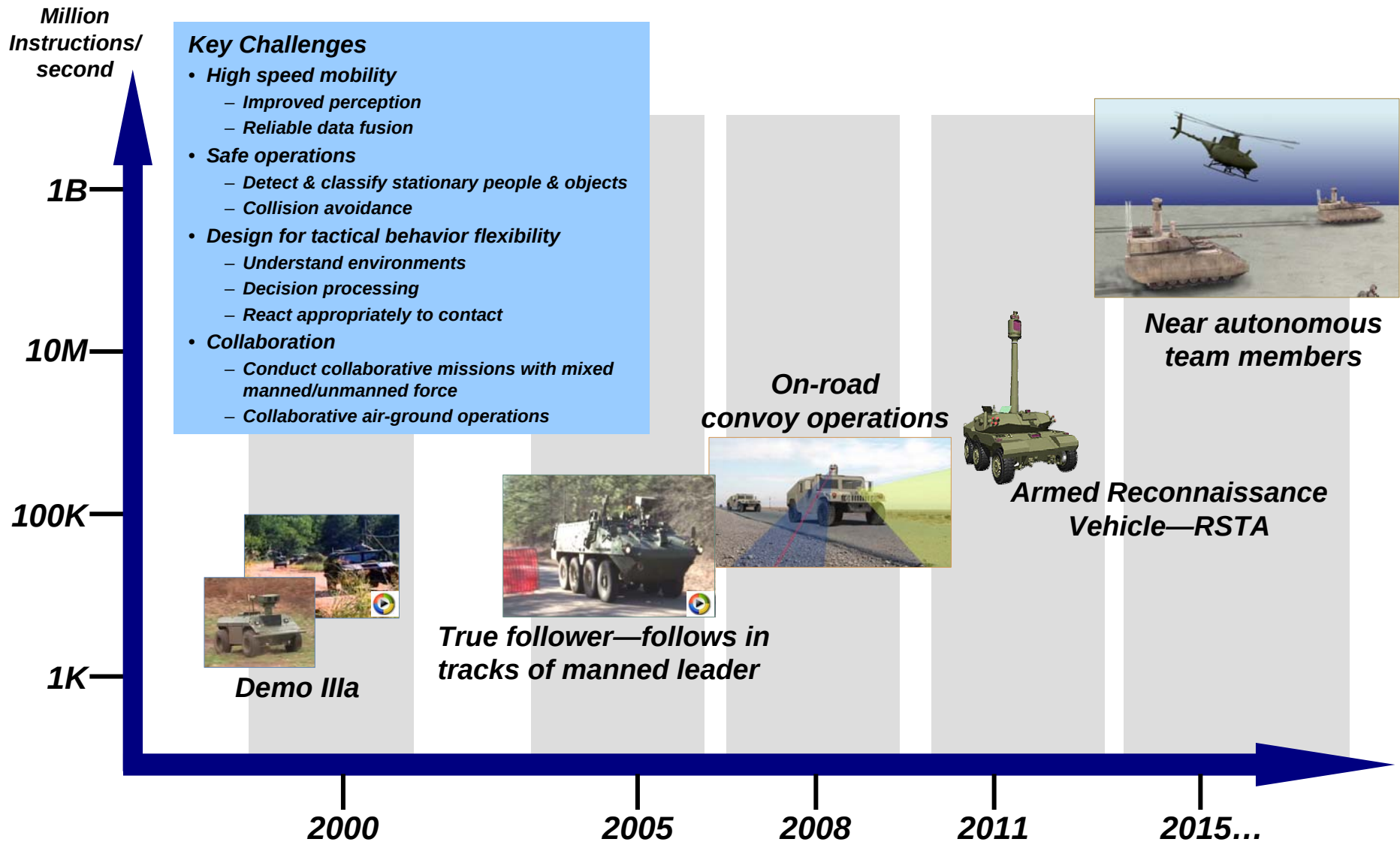
MIPS per \$1000 (1998 Dollars)



KurzweilAI.net



Progress in Autonomy & Cognition for Operational Capability





Micro Autonomous Systems—2020

- **Bio-inspired and bio-mimetic sensing for navigation & control**
- **“Environmental” data exploitation and understanding is more important in micro-scale systems than sensor performance (e.g., dynamic range, resolution, frame rate)**
- **Power generation for palm-sized platform**
- **Collaborative Technology Alliance between Army Research Lab, industry and university partners TBD**

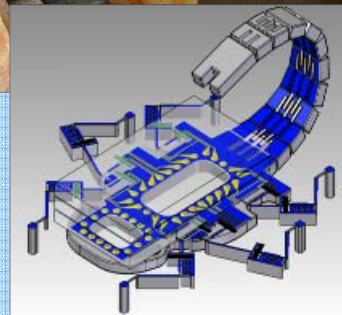
<http://www.arl.army.mil/main/main/default.cfm?Action=332&Page=332>

Swedish company Proxflyer has come up with an design of a tiny helicopter that weighs only 2.7 grams

Technology demonstrator for small, light self-contained system with control & propulsion



Bio-inspired design for MEMs based navigation and control of autonomous system





Combat Vehicle Crew Station Evolution

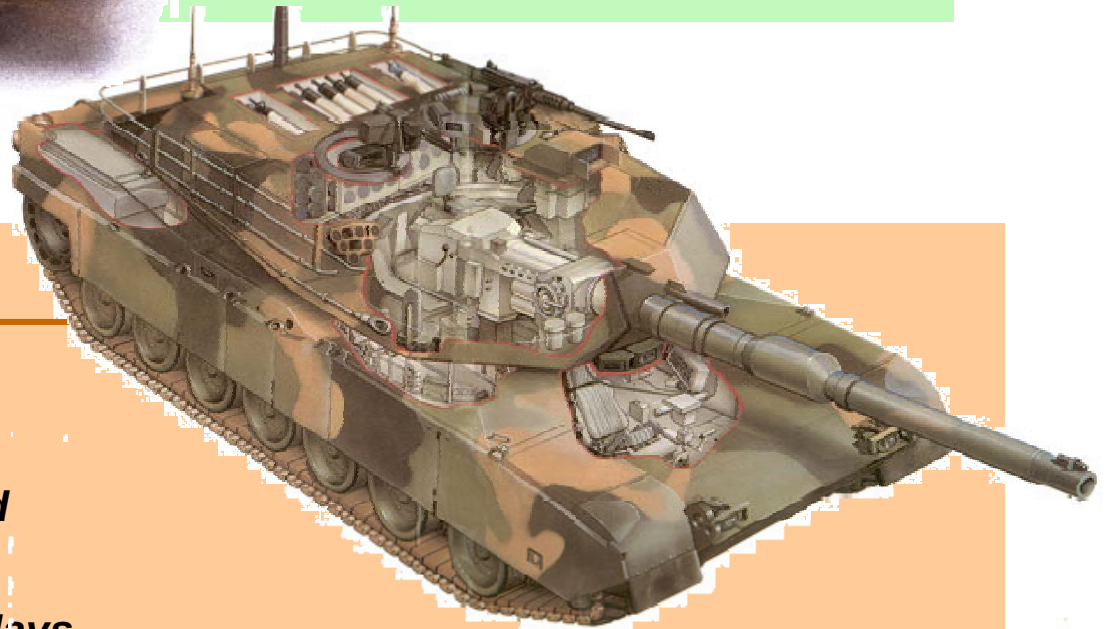


M47 Patton

- *FM Radio*
- *Direct View Optics*
- *Engine Gauges*
- *Ballistic Periscopes*

M1A2 Abrams

- *Secure data/voice radio*
- *Thermal Viewer*
- *FBCB2 Digital Battle Command*
- *Digital Fire Control*
- *1 Color/3 Monochromatic Displays*





Design Tools for Cognitive Display Interfaces

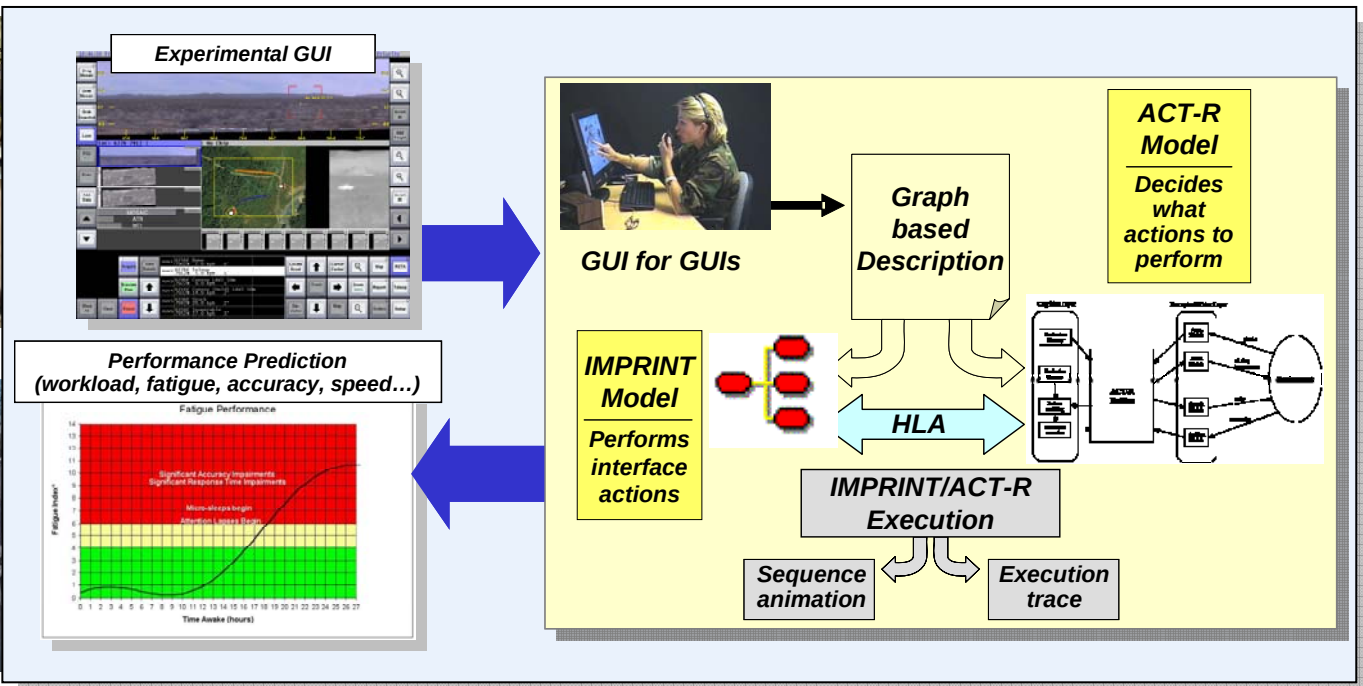
*Mid-size
multiple users
displays*



*Large displays,
Vehicles & command and control*



*Small individual
displays*





Flexible Displays



Convergence of Scientific Understanding



- Miniaturization
- Wireless Communications
- Processing Speed
- Computer Memory
- High precision printing technology

Portable & rugged displays



OLED-based Displays



1.1" diag (64x64)

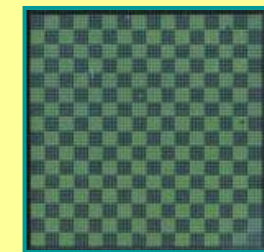
Current Prototypes

Electrophoretic-based Displays



4" diag (320x240)

Cholesteric LC-based Displays



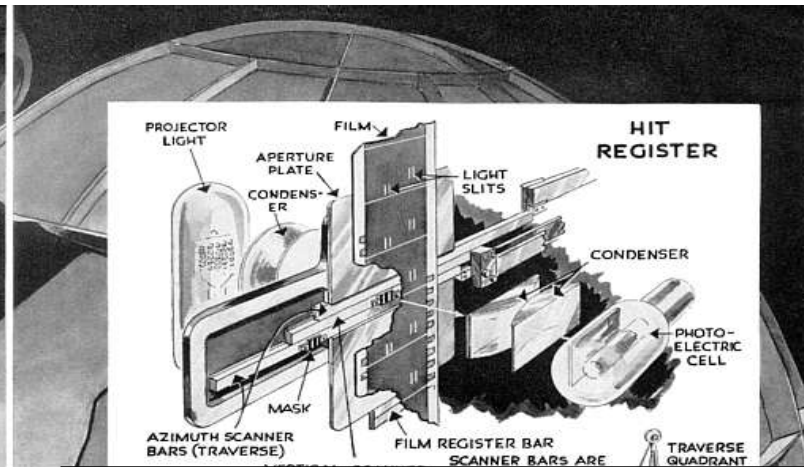
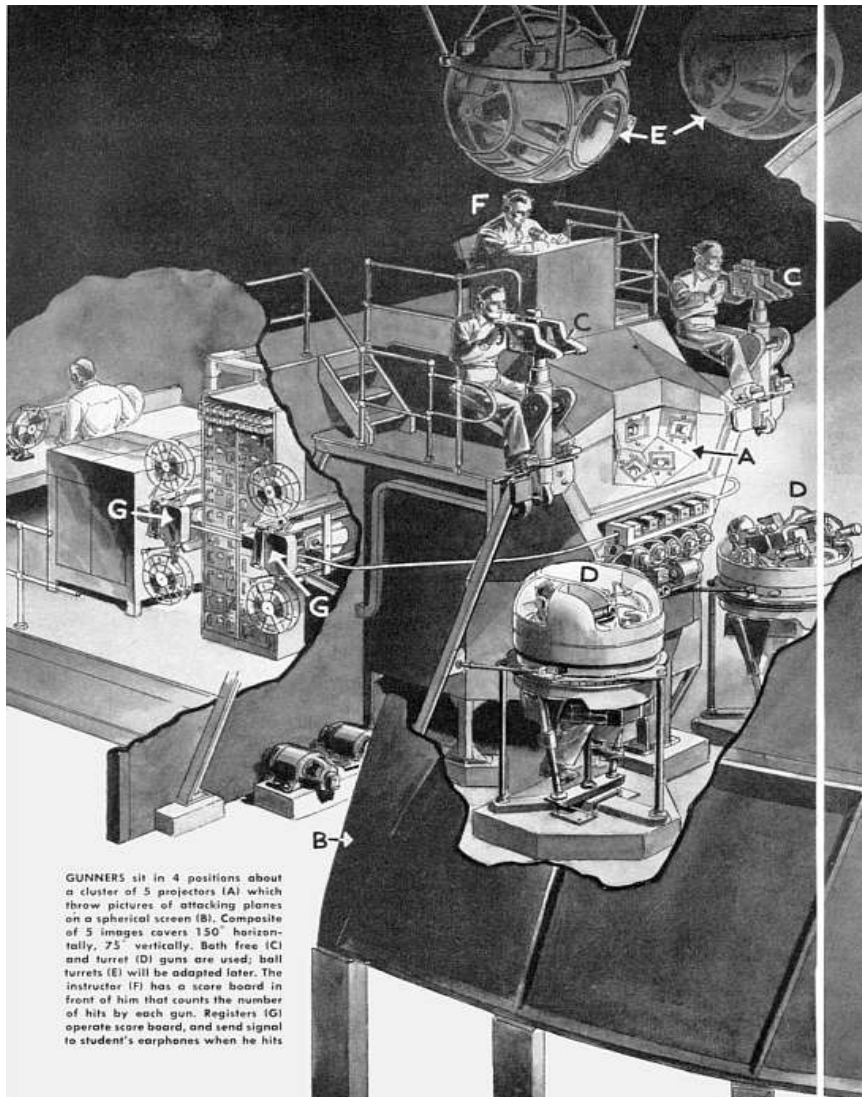
1.1" diag (64x64)

Technologies converging to enable next generation of displays—low power, lightweight, adaptable



Simulation and Training—WWII

Waller Flexible Gunnery Trainer





Joint Fires and Effects Trainer System

Urban Terrain

- Application of indirect effects in urban battlespace
- Cognitive proficiency for better decision-making



Fires & Effects Command (FEC)

- Testbed for system and human/machine interface requirements for Networked Fires Command node



Open Terrain

- Skill and cognitive trainer
- Mounted and dismounted
- Range of “individual” to “collective” tasks



Close Air Support (CAS)

- Movable flats for mixed reality environments
- 300-degree perimeter field-of-view
- 360-degree overhead field-of-view
- All rear projection





Enabling Human to Virtual Human Interaction

Incorporate dynamics of human thought process, communication and response

- ***Speech recognition***
- ***Natural language processing***
- ***Dialogue management***
- ***Cognition***
- ***Perception***
- ***Emotions***
- ***Animation***
- ***Cultural attributes***

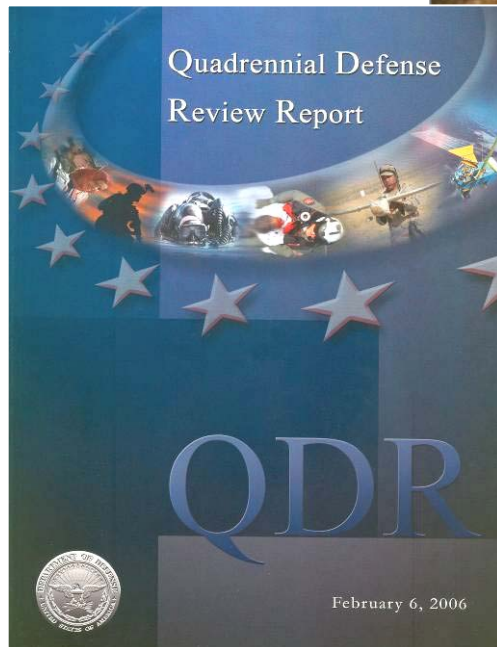


Soldier Avatar

Technology for realistic human representation



The Army... Transforming while at War



“Technological advances, including dramatic improvements in information management and precision weaponry, have allowed our military to generate considerable more combat capability with the same or, in some cases, fewer numbers of weapons platforms...”