

ARI Research Note 99-08

**Human and Organizational Issues in the Army After Next - II:
A Conference Held 24-26 June 1998**

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Michael Drillings, Chief

November 1998



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U.S. Army Research Institute
for the Behavioral and Social Sciences

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**U.S. Army Research Institute
for the Behavioral and Social Sciences**

A Directorate of the U.S. Total Army Personnel Command

**EDGAR M. JOHNSON
Director**

Technical review by

Tony Papa

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August 1998

Human and Organizational Issues in the Army After Next - II

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- Leadership and Technology in the 21st Century by MG (R) Lon Maggart
- Macro Trends in Information Technology: Myths, Realities and Challenges
 - by Dr. Steve Andriole
- Strategic Human Resources Management by COL (R) Ed Strong
- Future Personnel Resource Management by Dr. Bruce Orvis
 - and Dr. Brian Nichiporuk
- Quality Soldiers on a World Stage: The Leadership Challenge
 - by BG J. P. O'Neal

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- Division Army Warfighting Experiment Leader Development Findings -
 - Implications for AAN by LTC Steve Aude
- The Principles of War for the Information Age by LTC Robert Leonhard

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- Training Battlefield Critical Thinking Skills by Dr. Marvin Cohen
- What Emotional Intelligence (EQ) Tells Us About Selecting Future Leaders
 - by Dr. John D. Mayer

Chapter VI – Workgroup 3: Teams and Organizations

- Adaptive Architectures in Future C2 Organizations by Dr. Daniel Serfaty
- Examining Adaptation and Flexibility in Command and
 - Control Architectures by Dr. Kathleen Carley
- The Relationship between Organizational Design Considerations
 - and Organizational Effectiveness by MAJ Jake Biever

Human and Organizational Issues for Army After Next – II

Agenda

Start	End	Activity
Wednesday		
		24 June
1700	1710	Welcome: Dr. E. M. Johnson
1710	1825	COL (R) E. Strong: Strategic Human Resources Management
1830	1940	Dinner
1945		Dr. Gershon Weltman: Army Science Board Study of Human Behavior in Combat: Preliminary Results
Thursday		
		25 June
0630	0800	Breakfast
0815	0825	Information for the workshop
0825	0845	Dr. M. Drillings: Highlights of the the last AAN Workshop
0845	0940	COL Mark Gay: Battle Force and the Army of 2025
0940	1035	MG Lon E. Maggart: Leadership and technology in the 21 st century
1035	1055	Break
1055	1145	Dr. Steven Andriole: Macro trends in information technology: Myths, realities and challenges
1145	1245	Lunch
1245	1345	Dr. Bruce Orvis and Dr. Brian Nichiporuk: Future personnel resource management
1345	1405	Break
1405	1415	Dr. M. Drillings: Directions for the Workgroups
1415		Workgroups – presentations and discussions
1800	1930	Dinner
1935		BG J. P. O'Neal: Quality Soldiers on a World Stage: The Leadership Challenge
Friday		
		26 June
0630	0800	Breakfast
0815		Workgroup discussions
1100		Final preparation of reports
1200	1300	Lunch
1305	1500	Wrap-up reports
1500		Final Remarks

Workgroup Membership

Lessons Learned from AWEs

1. LTG (R) Brown
2. MG Melton
3. MG (R) Maggart
4. BG McWilliams
5. Dr. Simutis
6. COL Gay
7. COL Orr
8. LTC Aude
9. LTC Leonhard
10. LTC Bressler
11. LTC Reehm
12. LTC Whitlock
13. Dr. Black
14. Dr. Wightman
15. Dr. Siebold
16. Dr. Adelman
17. C. Leonhard
18. Cadet Dial

Future Personnel Management

1. LTG Vollrath
2. MG Garrett
3. BG Simms
4. BG (R) Ralph
5. Dr. Johnson
6. COL Monje
7. COL Stamilo
8. COL Murray
9. COL (R) Strong
10. COL (R) Grotegut
11. COL Tipa
12. COL Guild
13. LTC Alford
14. LTC Gibbons
15. LTC Faires
16. MAJ Swicord
17. MAJ Whaley
18. Dr. Orvis
19. Dr. Nichiporuk
20. Dr. Cohen
21. Dr. Mayer
22. Dr. Graham
23. Dr. Psotka

Teams and Organizations

1. MG Dean
2. Dr. Hiller
3. Dr. Berenson
4. COL (R) Shaler
5. COL Lewis
6. COL Keizer
7. COL Doton
8. COL Buckstad
9. LTC Durant
10. MAJ Hoffman
11. MAJ Biever
12. MAJ Echaverria
13. SGM Tyson
14. SGM Strickland
15. Dr. Carley
16. Dr. Serfaty
17. Dr. Halpin
18. Dr. Goldberg
19. Dr. Weltman
20. Dr. Killion
21. Dr. Zaccaro
22. Dr. dePontbriand
23. Dr. Lehner
24. Dr. Winston

General Officers/SES Attending

Active

GEN Dennis Reimer, Chief of Staff
LTG F.E. Vollrath, DCSPER
MG Thomas Garrett, CG, PERSCOM
MG Arthur Dean, ODCSPER
BG D. A. McWilliams, PERSCOM
BG Clayton Melton, ODCSPER
BG Earl Simms, PERSCOM
BG J. P. O'Neal, FORSCOM
BG Helmly, Deputy OCAR

Retired

LTG (R) F. Brown
MG (R) Lon Maggart
BG (R) Jim Ralph

SES

Dr. Jack Hiller, ODCSPER
Dr. Edgar Johnson, Army Research Institute
Dr. Zita Simutis, Army Research Institute

Paper Titles

Plenary

Dr. Michael Drillings, Army Research Institute: Highlights of the last AAN Workshop

Dr. Gershon Weltman, Perceptronics: Army Science Board Study of Human Behavior in Combat: Preliminary Results

COL Mark Gay, ODCSDOC, TRADOC: Battle Force and the Army of 2025

MG (R) Lon E. Maggart, Research Triangle Institute: Leadership and technology in the 21st century

Dr. Steve Andriole, Safeguard Scientifics Inc.: Macro trends in information technology: Myths, realities and challenges

COL (R) Ed Strong, ARS, Limited: Strategic Human Resources Management

Dr. Bruce Orvis and Dr. Brian Nichiporuk, RAND Arroyo Center: Future personnel resource management

BG J. P. O'Neal, FORSCOM: Quality Soldiers on a World Stage: The Leadership Challenge

Lessons Learned From AWEs

LTC Steve Aude, Center for Army Leadership: Division Army Warfighting Experiment Leader Development Findings - Implications for AAN

LTC Robert Leonhard, DCSCD, TRADOC: The Principles of War for the Information Age

Future Personnel Management

Dr. Marvin Cohen, Cognitive Technologies, Inc.: Training Battlefield Critical Thinking Skills

Dr. John (Jack) D. Mayer, University of New Hampshire: What emotional intelligence (EQ) tells us about selecting future leaders.

Teams and Organizations

Dr. Daniel Serfaty, Aptima Corporation: Adaptive Architectures in Future C2 Organizations

Dr. Kathleen Carley, Carnegie-Mellon University: Examining Adaptation and Flexibility in Command and Control Architectures

MAJ Jake Bieber, ODCSDOC, TRADOC: The relationship between organizational design considerations and organizational effectiveness

Lessons Learned from AWEs

Human and Organizational Issues
for
AAN

LTC Willie Whitlock

26 June 1998

Leesburg, VA

Lessons Learned From AWEs

Purpose

- Identify Lessons Learned from Previous AWEs that would provide insights for decision-makers as they plan for Army After Next (AAN)

Lessons Learned From AWEs

- Issues Based on the DOTLMS
 - TLS - Emphasis
 - Pertinent to AAN
- Policy Issues
- R&D Issues

Lessons Learned From AWEs

Policy Issues

- Need Balanced Focus Between Human Dimension (TLS) and Materiel Acquisition
- Develop Strategy to Resource AWEs and Follow-on Efforts (Access, Train, Distribute, Prof Devel) During Transition Period - Considering Competing Army Priorities

Lessons Learned From AWEs

Policy Issues

- Approve Virtual and Constructive Simulations as Viable Alternatives to Live Simulation in the AWE Process
 - Cost Effective Way to Meld CD,TD,DD, etc to Determine AAN Requirements

Lessons Learned From AWEs

Policy Issues

- Modify OT&E Community's Charter to Include Emphasis on other DOTLMS Elements
- Capture Lessons Learned for How Digitized Improvements were Implemented for Future Use: What Worked, What Improved, and How Long it Lasted

Lessons Learned From AWEs

R&D Issues - Training

- What Skills will be Required of Future Soldiers?
- How Best to Train Digital Soldiers?
- What Fall-Back Skills When Digital Breaks?
- How well are Digital Skills Retained?

Lessons Learned From AWEs

R&D Issues - Leadership

- How Do We Ensure the Leader's Adaptability in New Environments?
- How to Create and Sustain Unique (Ad Hoc) Organizations at Different Echelons?

Lessons Learned From AWEs

R&D Issues - Soldier

- How Do We Attract & Retain the Digital/AAN Soldier?
- What Should The MOS Structure Be?
- How to Include Human Behavior Issues in Virtual, Live, and Constructive Simulations
Morale, Stress, Audacity, Cohesion, etc.?

Lessons Learned From AWEs

DOTLMS - Based Issues

- MOUT and Civilian Operations
- Future AWEs - Phased with virtual AWEs
- Simulation Reform - to include human behavioral factors (Live, Virtual, and Constructive)

Lessons Learned From AWEs

DOTLMS - Based Issues

- Benefits of AWEs - Are they worth it?
- Resourcing AWEs - Train & fill requirements PERSCOM and Force
- Organizational Change - Involve Industry
- Digital Soldiers - Total Soldier - System Design /Quality Soldiers/Training

Lessons Learned From AWEs

DOTLMS - Based Issues

- Leadership/Stability/Maturity/Adaptability and Rotation
 - New Skills

Future Personnel Management

(AAN Sound Bites)

- **“Vision without action is only daydreaming”**
- **“Mission without funding is Hallucination”**
- **“How little do you need until how late?”**

1

Future Personnel Management

- **“Emotional Intelligence” - Dr. Mayer**
 - Important part of personality; personality has potential for helping identify AAN leaders
 - Motivation and personality profile models place to start...
 - Important implications for testing and selection...
- **“Training Battlefield Critical Thinking Skills” - Dr. Cohen**
 - Process/ Content? Focus: “How to think vs. What to think”
 - Use of “stories” to help understanding and reduce uncertainty
 - What are Action Orientations: Reactive; Proactive; & Predictive (What action orientation am I using?)
 - Get folks to see opportunities to shape/influence the outcome

2

Future Personnel Management

Discussion Topics / Issues:

- Institutional Policy Review (Strategies) to support HRS in AAN
 - Personnel Systems can support the Army now. To change means to review our Business Processes (e.g., PD; Promotions; Replacement)
 - Individual vs Unit Replacement Systems. Redefine our view of readiness
How to enhance unit / task cohesion -- What's the cost?
- Does anyone see a unique MOS or type of soldier for AAN?
 - No. But...Reduce Branches/CMF; increase flexibility to task organize on the fly to meet mission continuum (ANN is dynamic, uncertain, ...)
 - Increase attention on Manprint
 - Similarities in Officer and NCO duties/responsibilities (e.g., high tech)
 - Considerations: Compensation; Training; etc.
 - Stay the course on OPMS XXI

3

Future Personnel Management

- Can we place greater responsibility on the soldier in future vs current paternalistic model?
 - Need a balance of co-dependence to enhance commitment / retention
- Must correctly focus the person to the “right” job to maximize potential (achieves job satisfaction; retention and cohesion)
 - Need an instrument to measure motivation. Must reduce attrition
 - Examine Mental Category “profile” to ID motivated Cat IV (NGB)
- Implications of soldiers w/cell phones; video; internet access
 - Must go paperless
 - Provide interactive access to information (Department <-> field users)

4

Future Personnel Management

- What kind of HR transition plan do we need to get to AAN?
Evolutionary...
 - Stay the course and keep compensation (Benefits) package
 - Keep military connected to society
 - Soldier responsibility to take on Distance Learning, etc. opportunities
 - Develop and validate models / simulations to assess impact of HR policy changes...
 - Leverage AC/RC experiences (e.g., 4 ID redesign, Symposium on Barriers to Integration)
 - Recognize that Army culture must change/adapt to AAN

TEAMS AND ORGANIZATIONS

ARMY AFTER NEXT
CONFERENCE

LEADERS/TEAMS/ORGANIZATIONS FOR AAN

<u>CRITICAL ENVIROMENTAL CHANGE</u>	<u>RESPONSE</u>
MISSION DIVERSITY	ADAPTIVE ORGANIZATIONS
INCREASED TEMPO/ LETHALITY	SMALLER, MORE AGILE TEAMS
INCREASED COMPLEXITY	LEADERS/UNIT CAPABILITIES

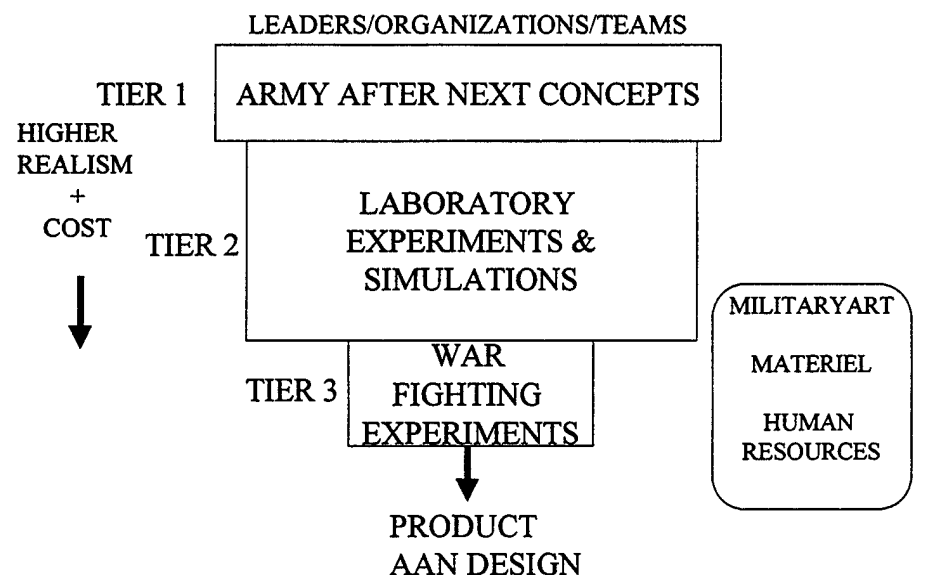
IMPROVING ORGANIZATION PERFORMANCE

TWO KEY ISSUES

- DESIGN ADAPTIVE/LEARNING ORGANIZATIONS
 - HUMAN-CENTERED, TECHNOLOGY SUPPORTED
 - IMPROVED SUPPORT FROM HR SYSTEMS
 - INCREASED CAPACITY TO LEARN
- DEVELOP FUTURE LEADERS ANCHORED IN ARMY VALUES
 - DOCTRINE DRIVEN-CONCEPTUAL, INTERPERSONAL, TECHNICAL AND TACTICAL SKILLS
 - TRAIN COMPLEXITY EARLY

**TRAIN LEADERS AND UNITS TO OPTIMIZE PERFORMANCE
THRU CHANGE AND ADAPTATION**

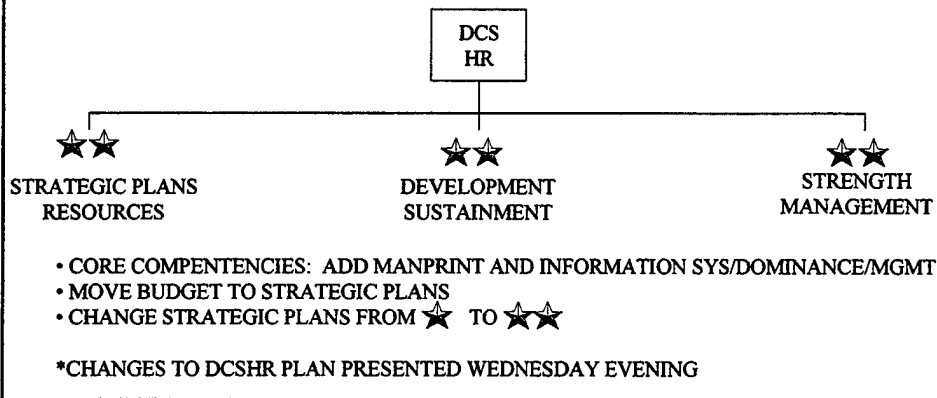
PROPOSED APPROACH FOR INCREMENTAL DESIGN AND VALIDATION OF AAN ORGANIZATIONS



DCSHR ORGANIZATION

CHALLENGES: AAN, CIVILIAN & MILITARY, ACTIVE, RESERVE COMP.

- ONE ARMY
- PEACE-WAR
- IMPLEMENT VISION
- COHESION - ADAPTABILITY



RECOMMENDATIONS/PAYOFF

- GREATER EMPHASIS ON HUMAN DIMENSIONS OF COMBAT READINESS
(HR BATTLE LAB AND/OR HR INTEGRATION IN EXISTING BATTLE LABS)
- GREATER EMPHASIS ON SIMULATION-BASED INVESTIGATION AND EVALUATION OF HR ISSUES
- EXPLICITLY TRAIN ADAPTABILITY FOR LEADERS AND UNITS



Highlights of November 1997 AAN Workshop

Sponsored by
DCSPER and DCSDOC, TRADOC

U.S. Army Research Institute
Briefer: Dr. Michael Drillings
drillings@ari.army.mil

Highlights of November 1997 AAN Workshop

Integrating human resources

- Requires a model of the process
 - Selection/ Assignment/ Assessment/ Promotion/ Reenlistment/ Training/ Compensation/ Civilian utilization
- Requires a management system
 - Cannot be integrated outside of a management system to support the process



Integration results in more efficiencies,
more consistency, and quicker response

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Highlights of November 1997 AAN Workshop

Managing increased technical diversity

- More skills in each combat unit and increased number of different types of units
 - Implications for
 - training - more things to train
 - assignment - greater # of MOSs, smaller force
 - family life - changes in rotations?
 - Cohesion - institutional vs. occupational model



Large impact: will drive the Army's future

3

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Highlights of November 1997 AAN Workshop

Acquiring greater technical skills

- Enlist higher aptitude soldiers
 - Recruitment and pay issues
- Augment capability with civilians
 - Pay, discipline, cohesion and legal issues
- Enlistment at higher rank, rank without promotion
- Must always consider the trade-offs among training, selection, and processes and doctrine
 - Essence of MANPRINT



Performing future jobs

4

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Highlights of November 1997 AAN Workshop

Recruiting more effectively

- Diversity issues
 - racial
 - gender
 - sexual orientation
 - non-traditional upbringing
 - immigrants
- Linking social and demographic trends to recruiting
- Non-cognitive factors: Motivation/ emotion
- New cognitive factors: Practical intelligence/ multiple intelligences



Maintaining a representative, motivated force

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Highlights of November 1997 AAN Workshop

Instilling values and ethical behavior

- A smaller, more cohesive force can be the basis for development of the wrong values
- Leaders have to communicate moral values
- Cohesion without moral values is dangerous
- Institutional loyalty as a value
- Continual training and reinforcement throughout career



The Army starts with values

6 6/23/98

Highlights of November 1997 AAN Workshop

Leading small units

- Skill diversity in small units
 - leaders will not know all jobs
 - skill substitution may not exist
- SOF model is a beginning but...
 - SOF is not like the rest of the Army
- Opportunities for training
 - virtual reality
 - teamwork skills need to be trained
- Unit dispersal
 - trust/ stress/ initiative/ situational awareness



Leadership skills will be a premium

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Highlights of November 1997 AAN Workshop

Integrating the Reserve and Active Components

- Training
- Skill mix
- Integration in operations
- Non-traditional missions



RC and AC must work together

8 6/23/98

Highlights of November 1997 AAN Workshop

Real-time monitoring of personnel and unit status

- Requires personal monitoring of alertness and other physiological measures (stress, fatigue, etc)
- Requires monitoring of unit status on near real-time basis for unit cohesion and confidence



Dispersal of units increases need for monitoring

9 6/23/98

Highlights of November 1997 AAN Workshop

Improve individual and unit training

- Train as you fight
- Leverage tactical engagement simulation
- Increase use of simulation at all levels
- Incorporate mission rehearsal in simulation
- Integrate individual skill training and unit training
- Investigate new ways of speeding training
- Consider long term expertise as well as short term proficiency



Build on the 2nd revolution in training

10 6/23/98

Highlights of November 1997 AAN Workshop

Training mental agility

- Includes thinking skills, creativity, adaptability, analytic and non-analytic skills
- Developing self-learners
- Can we train creativity?
- Role of virtual environments and distributed interactive simulations
- Understanding relationship between training feedback and performance
- Making the Army a learning organization



Developing more adaptable leaders

11 6/23/98

Highlights of November 1997 AAN Workshop

Using information effectively

- Cognitive requirements of decision makers must drive technology insertion
- Reorganize command posts around the decision maker
- Augment human ability to plan with AI technologies
- Better understand the organization/technology interface
- Need more information on the effectiveness of different organizational structures
- Effective decision making is ultimately dependent on the experience and training of the decision maker



Information dominance is basis for AAN

12 6/23/98

Highlights of November 1997 AAN Workshop

Fighting asymmetrical wars

- Define and describe notional missions
- Increase use of modeling and simulation
- Consider mission-dependent command structures
- Stress flexibility and adaptability in training and preparation
- Interorganizational coordination maybe fundamental



Forcing us to think differently?

13 6/23/98

Highlights of November 1997 AAN Workshop

Introducing new technology

- Needs extensive modeling, simulation, and experimentation
- Must address L, T, and S part of DOTLMS more than before
- Can we meet quality people requirements?
- Change in span of control and command
- Develop new command structures



Must build on what we learn from AWEs

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Highlights of November 1997 AAN Workshop

What have we missed?

- Officer development
- Organizations
 - communication
 - structure

-

-



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Plenary Presentation

Human Behavior in Combat Notes From the Army Science Board

Gershon Weltman
Perceptronics, Inc.

Workshop on Human and Organizational Issues
for the Army After Next

June 24, 1998
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ASB Study Sponsorship

- **Sponsor**

GEN William W. Hartzog
Commanding General
U.S. Army Training & Doctrine Command
Fort Monroe, Virginia

- **Facilitator**

Dr. Paul J. Berenson
Scientific Advisor to the CG
U.S. Army Training & Doctrine Command
Fort Monroe, Virginia

Preliminary

Sponsor's Rationale

- Human behavior characteristics are particularly important in determining the outcome of land combat.
- The Army does not adequately include the impact of human behavior in warfighting analyses or simulations.
- We currently do not have an adequate way of predicting or measuring human readiness; e.g. training and leadership.
- The potential gain is large from even small improvements in our ability to understand and model human behavior.

P R E L I M I N A R Y

Sponsor's Terms of Reference

- What *major applications* of human behavioral knowledge and modeling are important to the Army?
- What is the *current state of knowledge and modeling* of human behavior in combat?
- What aspects of human behavior can we *expect to understand and model*?
- What *current efforts within DoD, civilian R&D, or entertainment* have high payoff potential to help meet Army needs?
- What *current Army efforts* are worth *continuing*, and what *additional efforts* have the best potential for high payoff?
- Is the *current investment adequate* in human behavior research?

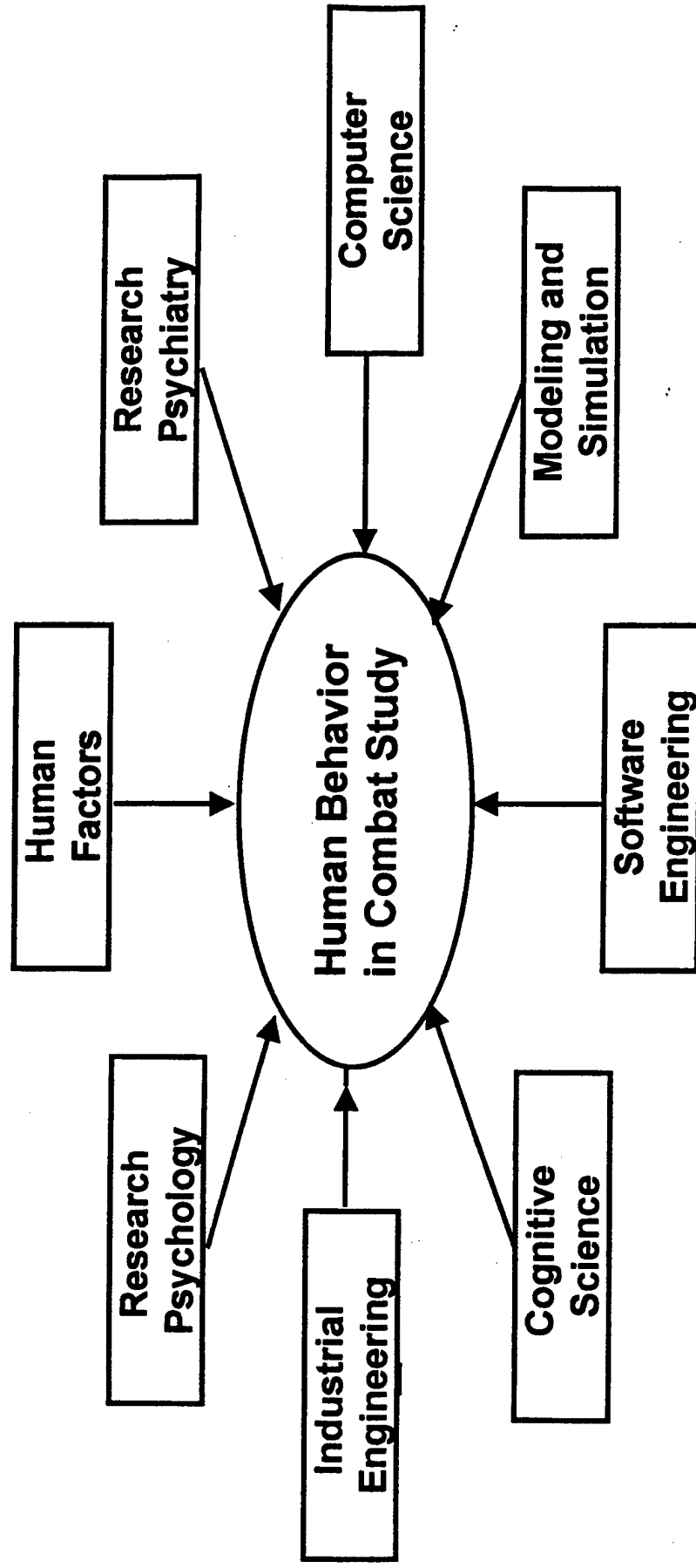
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Study Group Participants

- **Army Science Board Members**
 - Dr. Gershon Weltman, Chairman
 - Dr. Thomas Mastaglio, Associate Chairman
 - Dr. Thom Hodgson
 - Dr. Peter Lee
 - Dr. Warren Morrison
 - Dr. Kelly O'Brien
 - Dr. Irene Peden
- **Government Advisors**
 - COL Gregory Belenky, Walter Reed Army Institute of Research
 - Dr. Paul Berenson, TRADOC HQ
 - Mrs. Margaret Fratzel, TRADOC Analysis Center
 - LTC Kenneth Jones, Army Research Office
 - Dr. Dennis Leedom, Army Research Laboratory
 - Dr. Joseph Psotka, Army Research Institute
- **Staff Assistants**
 - MAJ Jacob Biever, Staff Officer, HQ TRADOC
 - Mr. Bruce Freeland, Operations Research Analyst, HQ TRADOC

P r e l i m i n a r y

A Multi-Disciplinary Group



Preliminary

Study Methodology

- **Initiation:** Review the charge, refine our understanding of the goals and TOR, set our expectations, and establish our milestones.
- **Investigation:** Visit as many relevant activities as possible to determine the current state of behavior knowledge and modeling and build a factual data base for our analyses and interpretations.
- **Rumination:** Formulate findings and conclusions in accord with the original goals and TOR. Begin to zero in on recommendations. Discuss and distribute for comments. Finalize.
- **Documentation:** Organize our information and recommendations into a concise report in form of annotated and appended briefing.
- **Presentation:** Submit report. Brief our TRADOC sponsor and whoever else ASB determines.

Fact Finding Visits

- May 1997 Institute for Defense Analysis & Army Research Institute, Washington, D.C.
- June 1997 TRADOC Analysis Command & National Simulation Center, Ft. Leavenworth, KA
- July 1997 Army Research Laboratory, Human Research and Engineering Directorate, Aberdeen, MD
- July 1997 Human Performance in Simulation Workshop, ARI & IDA, Washington, D.C.
- Sep 1997 Army Walter Reed Institute for Research, Division of Neuropsychiatry, Bethesda, MD
- Oct 1997 Army National Training Center & OPFOR Personnel, Ft. Irwin, CA
- Nov 1997 Israel Defense Forces Behavior Department & Combat Behavior Experts, Israel
- Dec 1997 Army John F. Kennedy Special Warfare Center and School, Ft. Bragg, NC

Findings

Israel: A Study In Opposites

- Observations
 - IDF believes human behavior a critical factor in battlefield success (15-85%)
 - General agreement regarding typical effects on attitude and performance
 - Human behavior warrants a special Department in the IDF
 - » Behavior Department reports to Head of IDF Personnel Department
 - » Behavior Department is central for both R&D and applications
 - » Behavior Department includes “combat ready” field psychologists
 - Well-defined conceptual models and principles guide programs:
 - » Leadership is the central element affecting human behavior in combat
 - » Modern “distance warfare” is changing the state of knowledge
 - » Changed relationship between Army and society is also important
 - Acquisition of new knowledge of higher priority than simulation of old
 - Israeli researchers familiar with U.S. activities and interests

• Findings Summary

- Human behavior concerns can be central to military operations
- Respect counts in overcoming barriers, and respect derives from
 - » **Command outlook**
 - » On-line performance of military psychologists

P r e l i m i n a r y

Findings

The Importance of Outlook

A Speculative Explanation For The IDF/USA Difference

- In the Israel Defense Forces

- Central myth:

We were a nation of victims, attention to human factors and psychology made us into the best fighting force in the world.

- Prototypical human-related R&D project:

Joint IDF and university study of The Effects of Recent Societal Changes on Soldier Selection and Combat Effectiveness.

- In the U.S. Army

- Central myth:

We have always been a nation of gun fighters, with bigger and better guns, we can lick anyone in the world.

- Prototypical human-related R&D project:

Land Warrior soldier system integrating advanced computer-based sensors with advanced small arms weaponry

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Conclusions

Human behavior is of major battlefield importance

- Verified historically and currently
 - acknowledged within military literature
 - affirmed for today's conflicts by international experts
 - critical to future doctrinal concepts
- But frequently dismissed as conventional wisdom or extraneous to military decision making
 - soldiers believe personal experiences are adequate
 - leaders not versed in behavioral science or technique
 - behavioral problems perceived as negative reflections
 - human behavior neglected in models and simulations

Conclusions

(Continued)

Human behavior can be modeled and simulated

- Putting human behavior into models and simulations has been considered 'too hard', today it is feasible
- Knowledge base exists today that is directly applicable to modeling and simulation of DOTLMS, including
 - physical, cognitive and emotional effects of combat stresses
 - performance effects associated with unit cohesion & morale
 - leader style effects
- But current knowledge base inadequate in a number of areas, including
 - universal measurements of unit cohesion
 - impact of isolation and dispersion
 - idiosyncratic resistance to failure
 - interaction of variables

P R e l l m i n a l R Y

Conclusions

(Continued)

Human behavior in combat can be positively influenced

- Training improves reliability on the battlefield
 - reduces incidence of human failure
 - improves ability to think and act decisively while under stress
 - improves unit cohesion/command outlook
 - occasionally facilitates creativity
- Interventions can offset negative behavioral effects
 - psychological
 - pharmacological
 - organizational and doctrinal
- Leadership is perhaps the biggest influence
 - leader affects soldiers' perception of risk and stress
 - leadership skills need behavior framework as well as training
 - selection must include modern conditions of battle

ARI AAN Workshop

Conclusions

(Continued)

Human behavior knowledge is not well directed or used

- There is no institutional process to consider what is known and what should be learned about human behavior
- Army lacks coherent way to apply effectively even its current knowledge about human behavior
 - models
 - simulations (constructive and virtual)
 - doctrine
 - training and training development
 - leader development (includes selection and training)
 - organizational design
- Behavior research and development programs need high level support, revitalization and greater visibility

P r e l i m i n a r y

Preliminary Recommendations

- **High-Level U.S. Army “Human Behavior Department”**
- **3-Year, 5-Year and 10-Year R&D/Transfer Strategies Based on Detailed Study of AAN Needs**
- **R&D and Applications Programs in Accord with Plans -- Modify Plans Continually**
- **1 or 2 Integrated Demonstrations/Evaluation of “Ripe” Combat Behavior Models in Existing Simulations**
- **Annual Symposium on Human Behavior in Combat, Including Presentations on Science and Practice**
- **Cooperative Contacts and Arrangements With Other U.S. and International Behavior R&D Groups**

Back-Up Findings

Human Behavior in Combat **Notes From the Army Science Board**

Gershon Weltman
Perceptronics, Inc.

Workshop on Human and Organizational Issues
for the Army After Next

June 24, 1998

ARI AAN Workshop

Findings

Important Applications of Knowledge and Modeling

- Observations
 - Personnel Policies (Recruitment, Selection, Assignment)
 - Training (Live, Virtual and Constructive Simulation)
 - Analysis of Weapon Systems, Threats and Doctrine
 - Leader Development and Profiling
 - Battle Command System Development
 - Command Outlook
 - Force XXI Planning, Development and Fielding
 - AAN Planning, Development and Fielding
- Findings Summary
 - Application areas have the status of conventional wisdom
 - There is little application detail under the surface
 - The need to integrate application areas is not well recognized
 - Application of human behavior modeling is probably least well understood and institutionalized of all

P r e l i m i n a r y

Findings

Army Practice in Behavior Knowledge and Modeling

- Observations
 - Long history of research effort and publication in the area
 - Broad spectrum of significant combat factors identified and studied, including
 - » leadership,
 - » cohesion and morale,
 - » physical stress factors such as sleep deprivation, fatigue, dehydration, etc.
 - » mental stress factors such as uncertainty, familial problems, etc.
 - Behavioral effects of selected factors modeled by isolated research groups
 - Modeling results generally not incorporated in major constructive or virtual simulations used for training or analysis
 - Behavior knowledge not systematically incorporated in Army programs
 - Behavior research at perhaps historical low in Army (and DoD) planning

- Findings Summary

- The study assumptions are valid:
 - » Human behavior in combat is being neglected by Army
 - » The Army's combat simulations are woefully incomplete
- There is much material, and some activity, upon which to build
- It is not too late to remedy the situation for Force XXI and AAN

JP JF e l i nm i m al J Y

Findings

What We Can Expect to Understand and Model

- Observations
 - Knowledgeable expectations of understanding include
 - » Bases for and effects of individual decrements under combat conditions
 - » Bases for and effects of unit decrements under combat conditions
 - » Effects of leadership on individual and unit performance
 - » Useful measures of individual and unit training levels
 - » Relationship of behavioral factors to unit readiness and likely performance
 - Knowledgeable expectations of modeling (and simulation) include
 - » Cognitive and psychomotor effects of combat stressors
 - » Decision making effects of combat stressors
 - » Overall unit performance effects of cohesion and leadership in addition to accumulation of individual and unit decrements

- Findings Summary

- We are certainly not limited by expectations
- Modern cognitive science and modeling and simulation technology provide useful frameworks for organizing and applying current and new knowledge

P r e l i m i n a r y

Findings

High Payoff Potential Efforts Outside the Army

- Observations
 - DoD efforts include
 - » Air Force human systems programs
 - » Navy decision research and decision aiding programs
 - » **DMSO-Sponsored NRC 1998 Report on Modeling Human and Organizational Behavior**
 - Civilian R&D includes
 - » University psychology, social, decision sciences
 - » Sports psychology
 - » Education industry
 - » Consumer research and marketing
 - Entertainment includes
 - » Multi-person, on-line networked gaming
 - » Digital actors: avatars and intelligent beings
- Findings Summary
 - **NRC report is a comprehensive State-of-the-Art guide**
 - Army may be lagging other DoD activities in several areas
 - Most basic research and theory development is in civilian segment
 - **One of the most important findings is that the Army is creating a potentially useful “parallel universe” to DoD’s Advanced Distributed Simulation**

Findings

High Payoff Army Initiatives

- Observations

- Current initiatives with high payoff potential include:
 - » Modeling of individual combat stress decrements
 - » Modeling of unit performance and informational combat factors
 - » Modeling of command decision making
 - » Individual and collective factors in combat performance
 - » Human Performance in Simulation Workshop
- New initiatives that are likely to yield high returns include:
 - » Immediate Insertion of best models in constructive simulations
 - » Simulation contests to promote better behavioral representations
 - » Effects of changing combat and societal environments
 - » Behavioral science and methodology in leadership training
 - » Leveraging of NTC OPFOR expertise and “combat” data base
 - » Leveraging of Special Forces field research opportunities
 - » Field psychologists revisited in modernized form
 - » Opportunities from international cooperation
 - » Methods for building respect and attention

- Findings Summary

- There are high quality Army programs despite general neglect
- There is no shortage of ideas for new initiatives
- New initiatives will have to be selected from a variety of several types

Findings

Current Army Investment

- Observations

- Investment in human behavior research is a small fraction of total R&D
- Low investment reflects a overall diminishment of concern within DoD
- Research is not adequate to cover Force XXI and AAN requirements
 - » Most analyses of human organizational and behavioral factors are intuitive, general, and not supported by rigorous studies or hard data.
 - » The Army is basing very large, complex and important new human-centered systems on guesswork regarding the key human factors.
- Research and applications are not promoted, coordinated or disseminated

- Findings Summary

- The Army needs a central point of responsibility for human behavior, including modeling, simulation and other applications
- The issue of barriers is serious, it must be addressed and solved
- Deeds need to replace lip service in this area; a notable and existential deed is increased monetary investment, but top-level attention may come first
- Optimal management of investment is a thorny issue, compounded by the issues of (a) measurement of results, and (b) keeping pace with planners
- Dissemination of results should be ensured via institutionalized processes

NRC 1998 Report

Modeling Human and Organizational Behavior

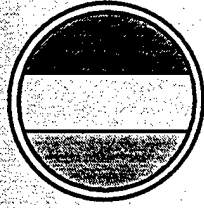
- Findings Summary
 - Modeling of human and organizational behavior is in its infancy
 - Need for improved modeling is critical to all military simulation
 - Behavior is what is *observable* to other simulation participants
 - Realism requires that modeled behavior be based on psychological, organizational and sociological theory
 - Added realism is achieved via empirical behavior “moderators”
 - Integrative Architecture is required to encompass all contributors
 - Several viable candidate Architectures currently exist
- Recommendations Summary
 - Collect and disseminate military human performance data
 - Create accreditation procedures for human behavior models
 - Support sustained model development in focused areas
 - Support theory development and basic research in relevant areas
 - Promote collaboration among modelers, experts and scientists
 - Fund more conferences on Human Behavior in Military M&S
 - Expand inter-service communication

The Army After Next

Battle Force and the Army of 2025

COL Mark Gay
ODCSDOC, TRADOC

The Army After Next Project

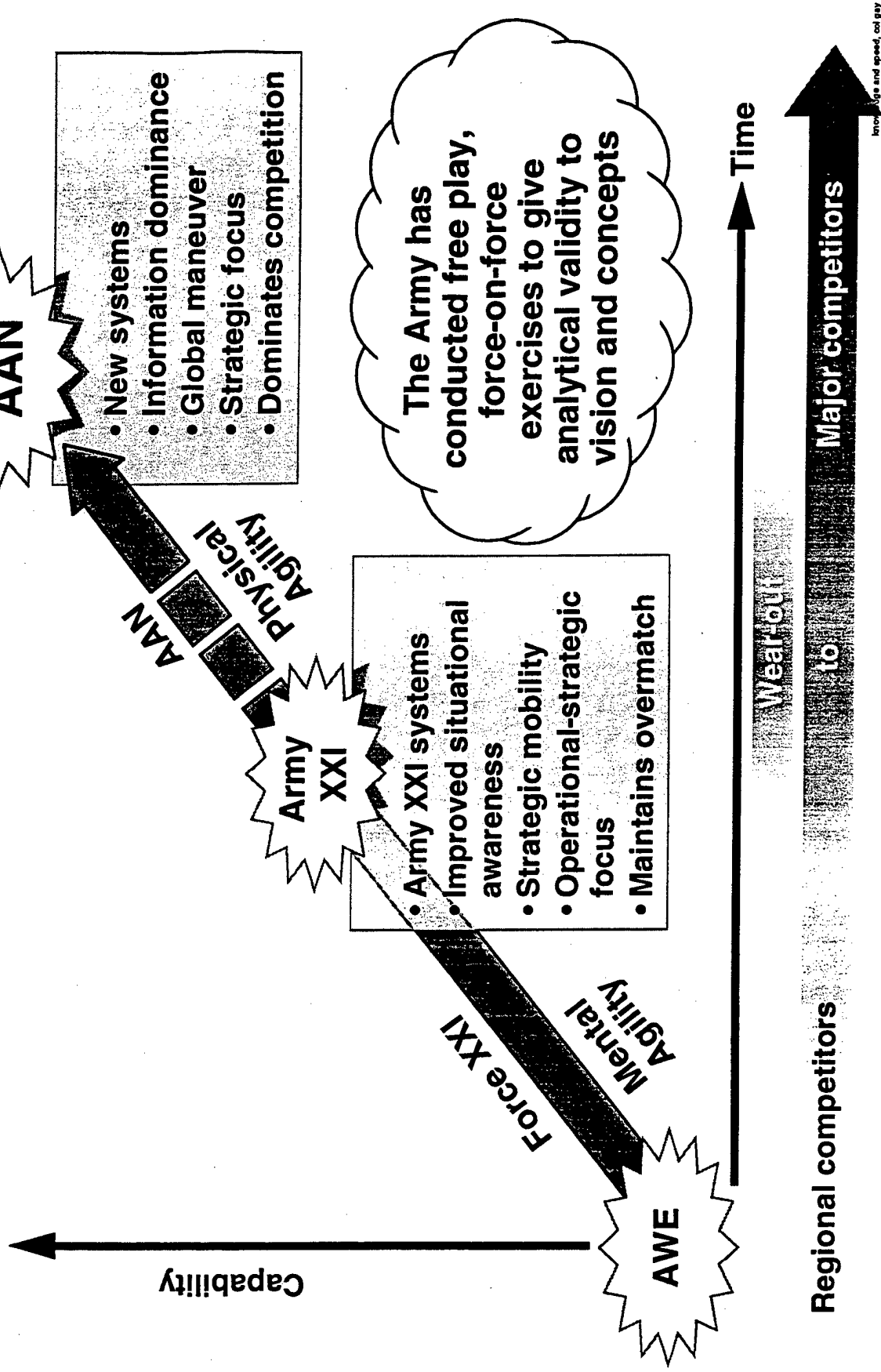


Knowledge and Speed

Deputy Chief of Staff for Doctrine
United States Army Training and Doctrine Command

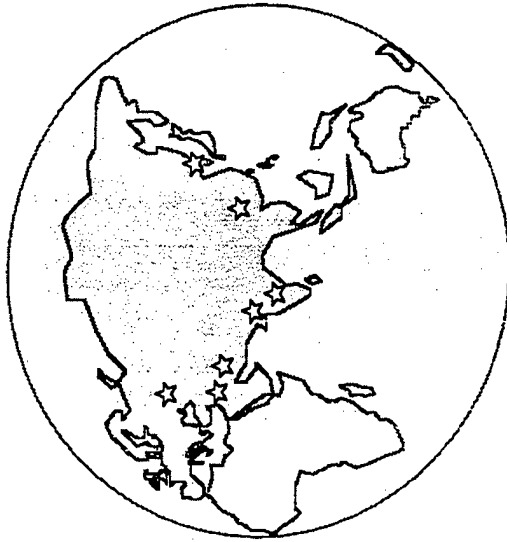


The Path to AAN Begins With the Advanced Warfighting Experiments and Passes Through Army XXI





Seven Years into the 21st Century We See a Rising Pattern of Asymmetry



Among our potential foes there's a common, almost spontaneous movement to posture themselves for asymmetric competition

- Streamlining current forces
- Education/professionalization
- Regional focus on local hegemony
- Shifting operational concepts —deflect air and sea power to preserve standing armies

Army		Asymmetric Investments					
India	980,000	Missiles (Ballistic and Cruise)	Submarines	WMD	Fighters	Missile Ships	Missile Ships
North Korea	1,000,000	Missiles (Ballistic and Cruise)	Submarines	WMD	Fighters	Missile Ships	Missile Ships
Pakistan	520,000	Missiles (Ballistic and Cruise)	Submarines	WMD	Fighters	Missile Ships	Missile Ships
Iran	345,000	Missiles (Ballistic and Cruise)	Submarines	WMD	Fighters	Missile Ships	Missile Ships
Iraq	350,000	Missiles (Ballistic and Cruise)	Submarines	WMD	Fighters	Missile Ships	Missile Ships
Russia	670,000	Missiles (Ballistic and Cruise)	Submarines	WMD	Fighters	Missile Ships	Missile Ships
China	2,200,000	Missiles (Ballistic and Cruise)	Submarines	WMD	Fighters	Missile Ships	Missile Ships

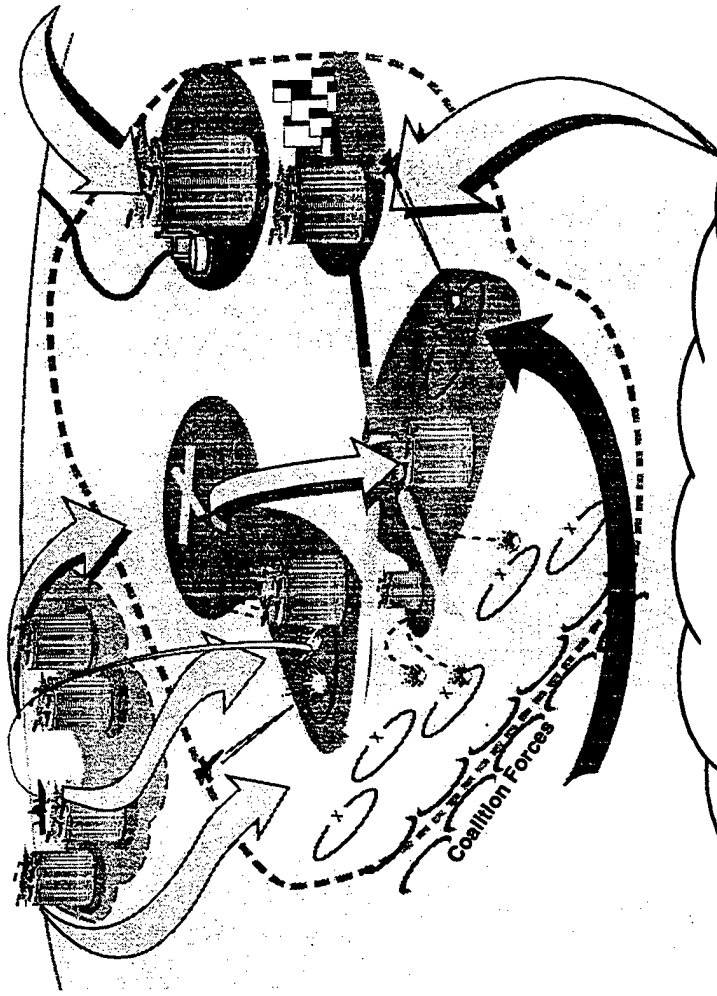
Legend:

- Missiles (Ballistic and Cruise)
- Air Defense
- Submarines
- C⁴/IW
- WMD
- Fighters
- Missile Ships



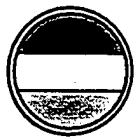
How Landpower Might Be Applied

- Strikes directly at strategic and operational centers of gravity
- Speed, reach and overwhelming tempo = physical and psychological domination
- Merges heavy and light
- Establishes and assures control; long-term sustained staying power
- Hybrid force: mix of mature Force XXI units and AAN units
- Organic integration of air and ground capabilities at lowest level



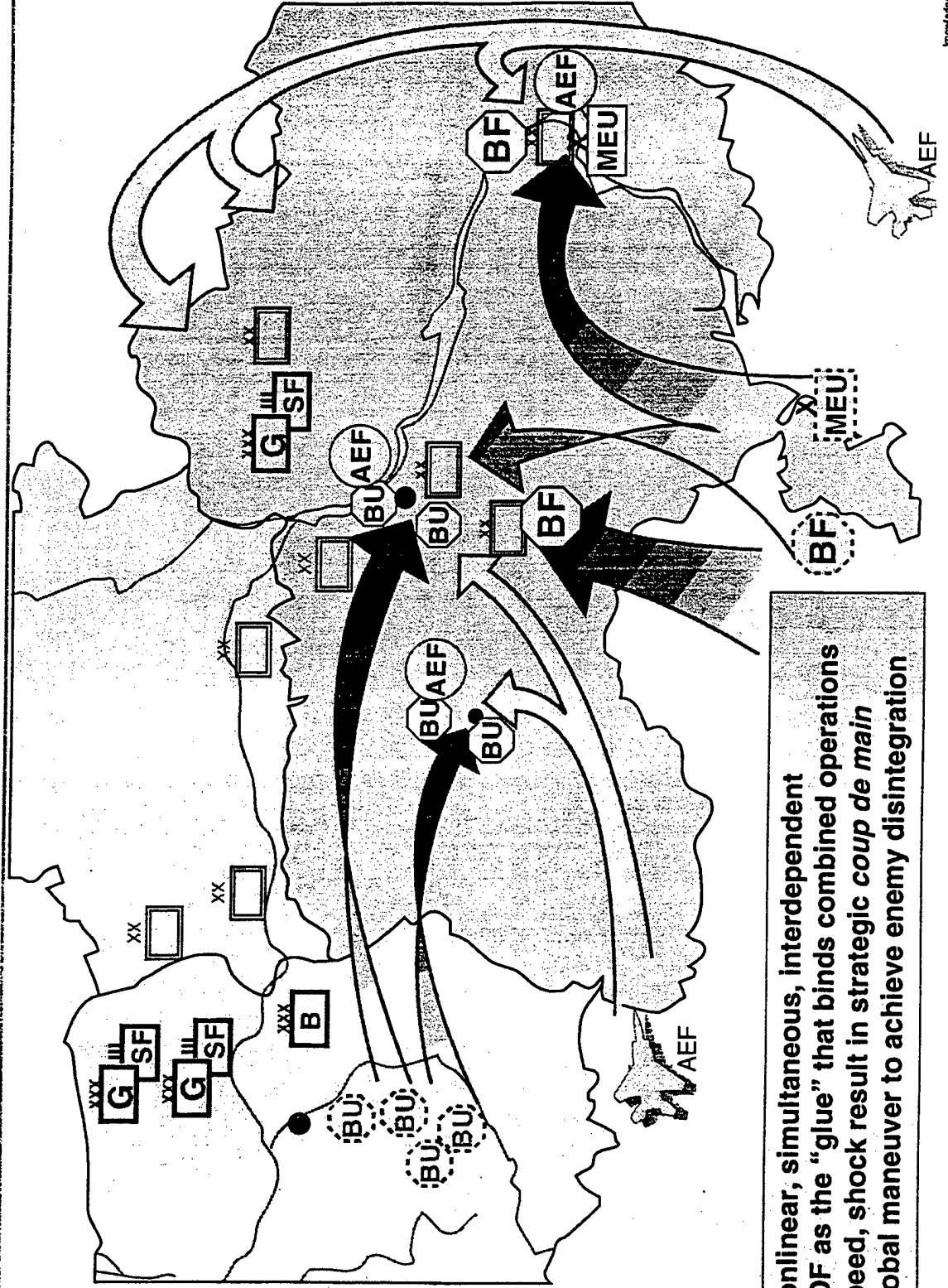
Controls center of gravity.

Forces enemy to come to us and either fight and lose, or abstain and concede.



Theater Operations circa 2020

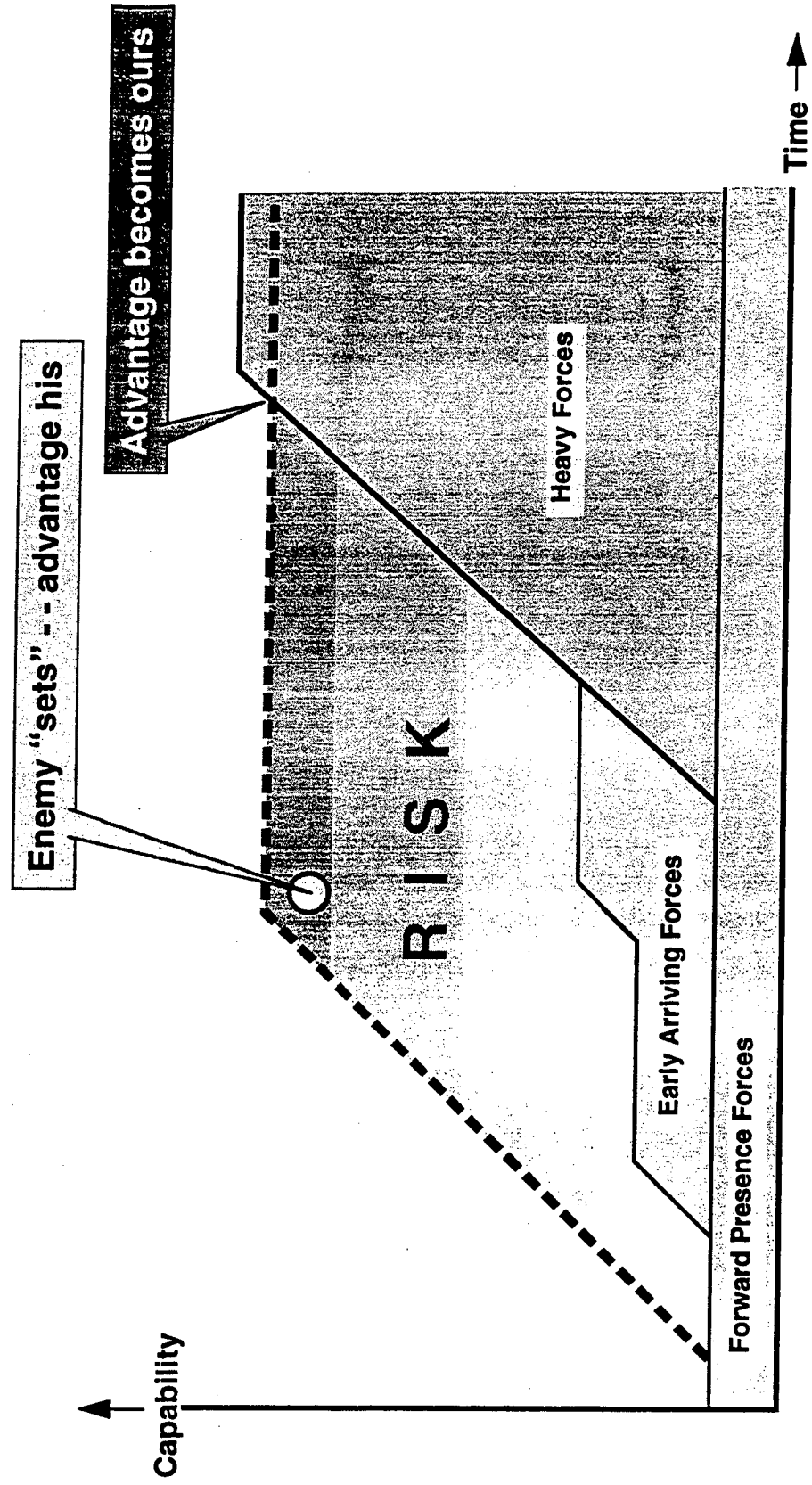
WWG Game Turn 6



- Nonlinear, simultaneous, interdependent
- SOF as the "glue" that binds combined operations
- Speed, shock result in strategic *coup de main*
- Global maneuver to achieve enemy disintegration

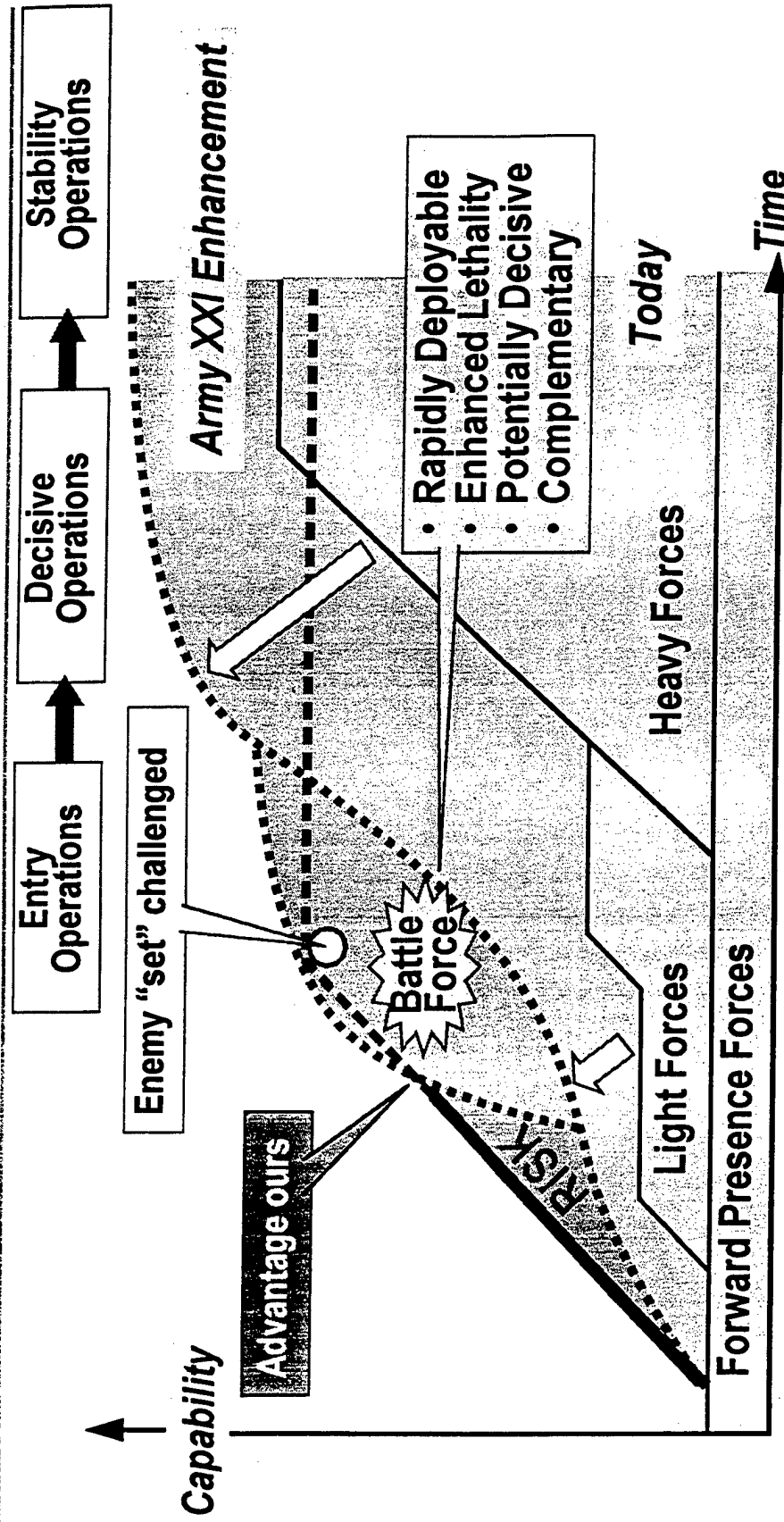


Power Projection Today: Slow Arrival Allows Enemy to "Set": Reaction *vice* Preemption





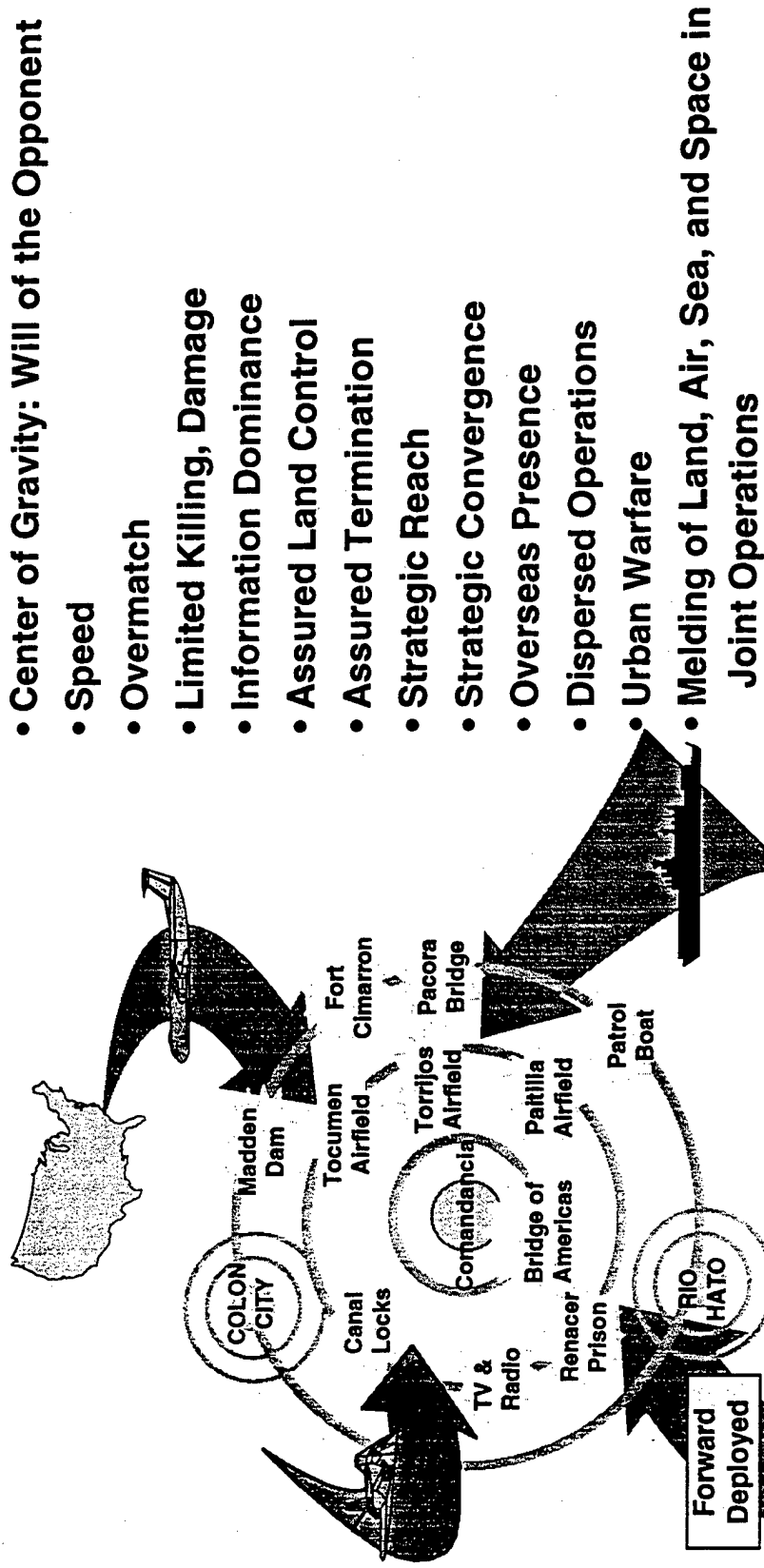
Initial Examination of Battle Force



- Designed for early entry intervention – can deter, stabilize, influence, and shape by leveraging improved strategic mobility and lethality
- Optimized for maneuver warfare
- Capable of decisive action
 - Joint to interdependence
 - Establishes information dominance
- Maneuverable and lethal
- Seizes operational initiative



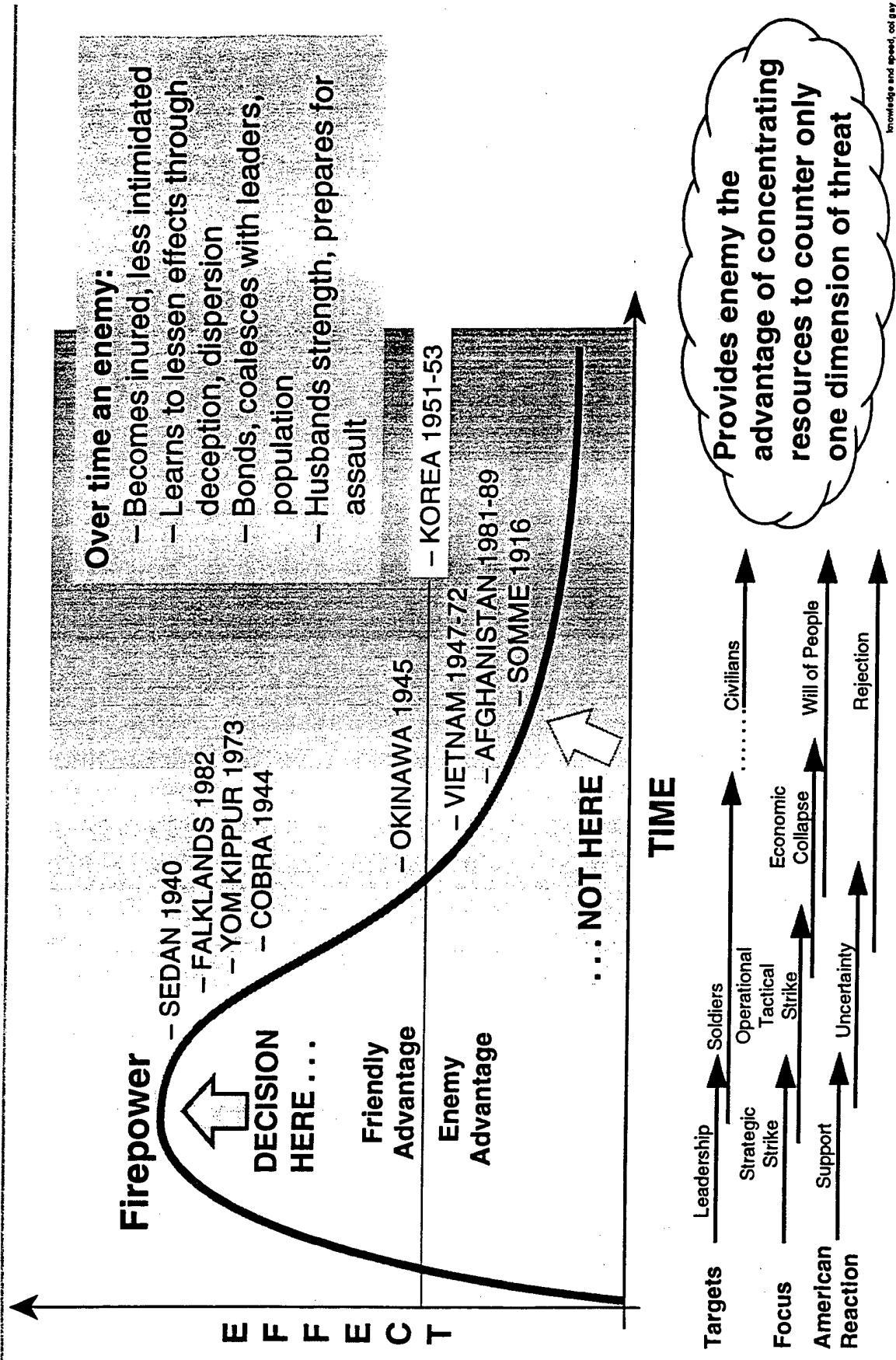
Back to Patterns and Cycles . . . *Just Cause As a Window Into the Future*



In a swift, overwhelming campaign the objective is the enemy's will – not overwhelming destruction

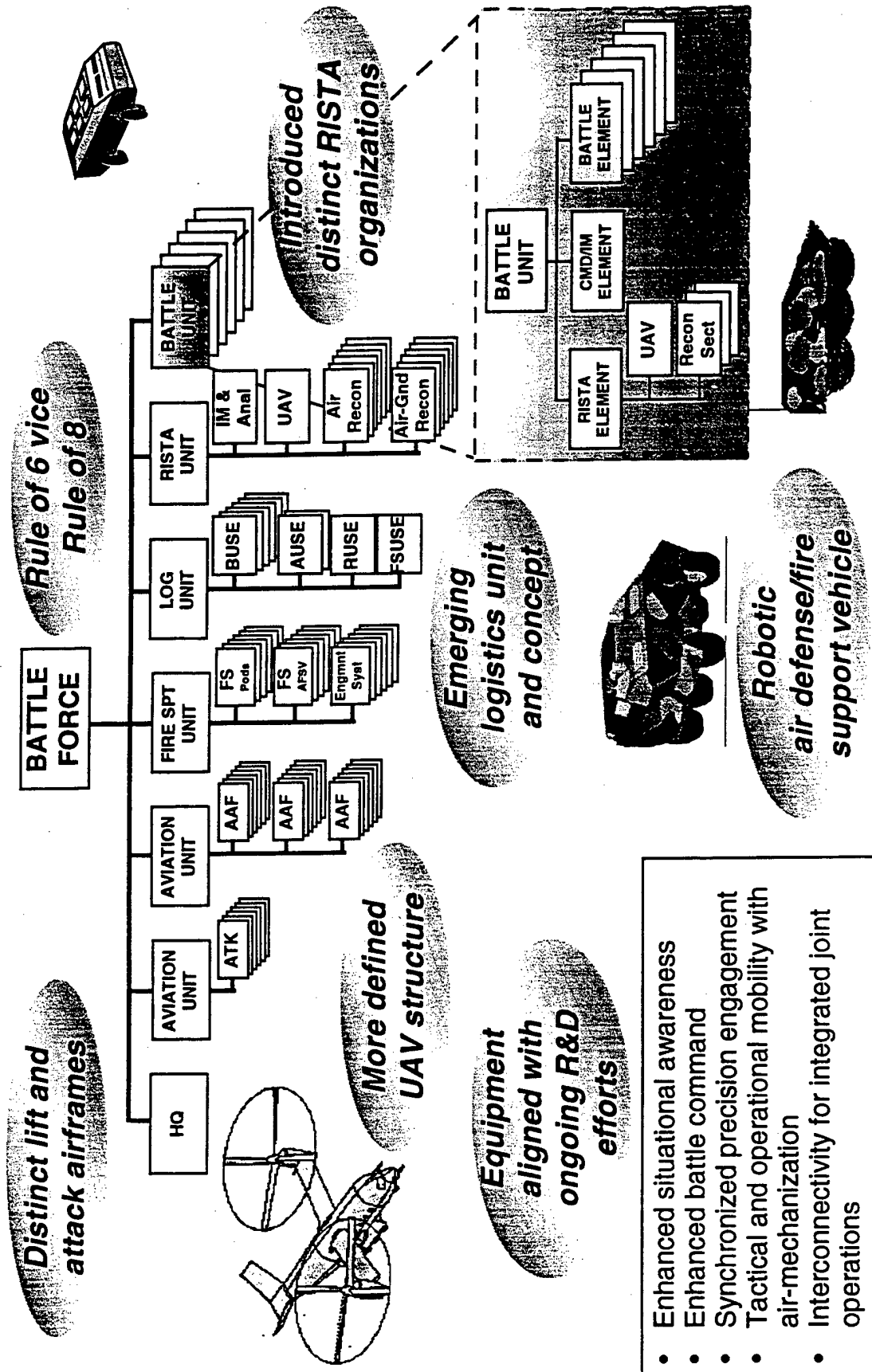


Firepower-Centered Approach: Unnecessary Risk. Firepower Effect Declines Over Time





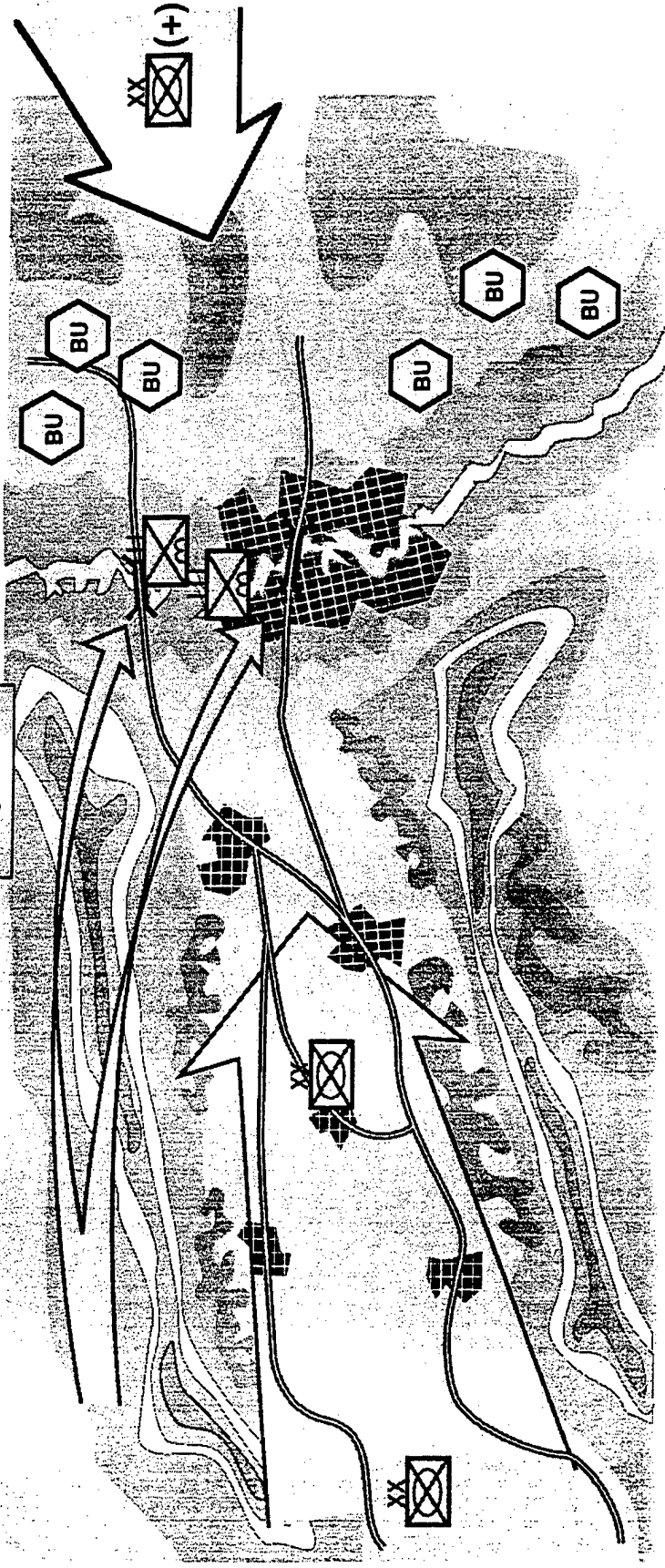
Battle Force



THE ARMY AFTER NEXT Battle Force

Tactical Operations, Operational Results

Vignette



Deputy Chief of Staff for Doctrine
United States Army Training and Doctrine Command



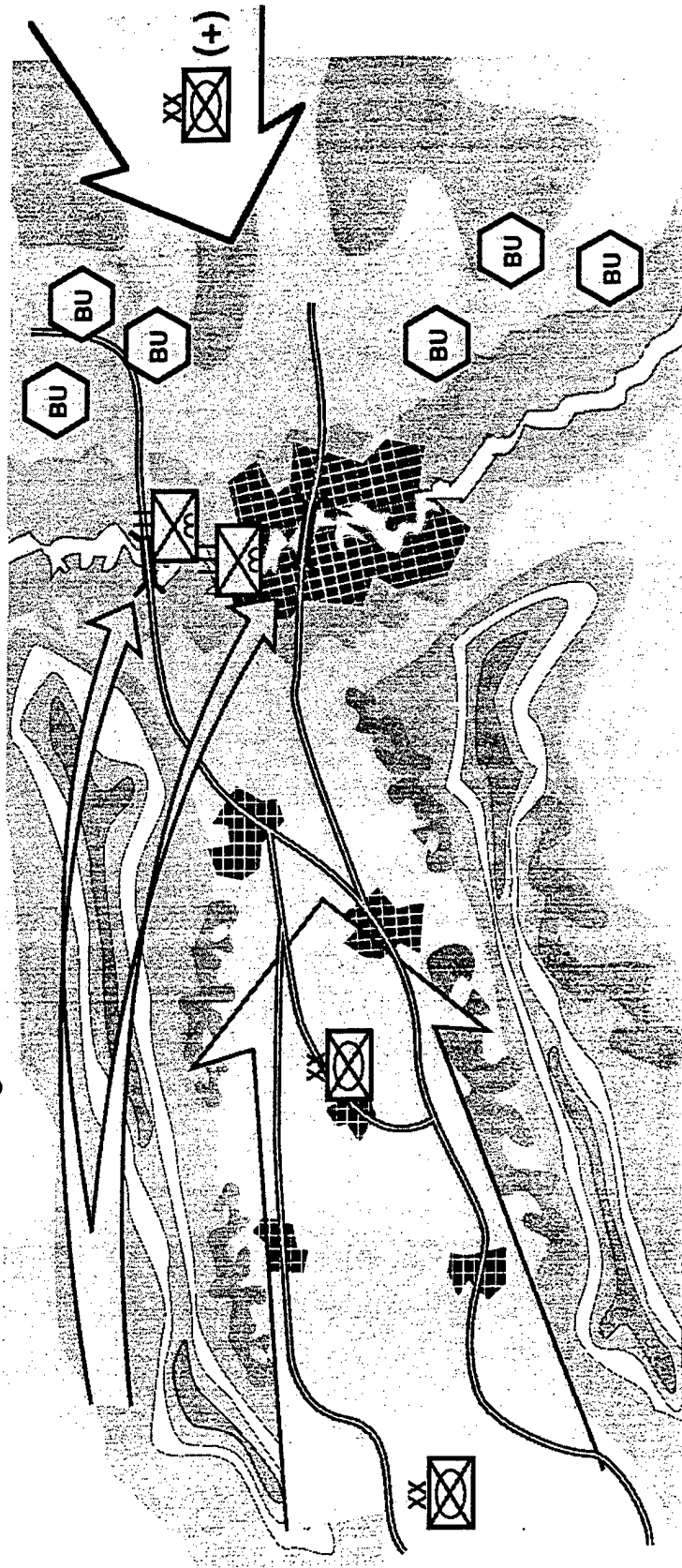
Red Holds the Initiative

Situation

- Red is exploiting a penetration
- Attempting to link-up with airmobile units
- Lead elements will link up in 12 hours
- Blue Battle Force only force available
- Blue receives mission to destroy lead division and prevent a river crossing

Challenges

- Radically compressed timeline
- Ambiguity at tactical level
- Must gather and process data from multiple sources for maneuver and precision fires
- Abundant complex terrain





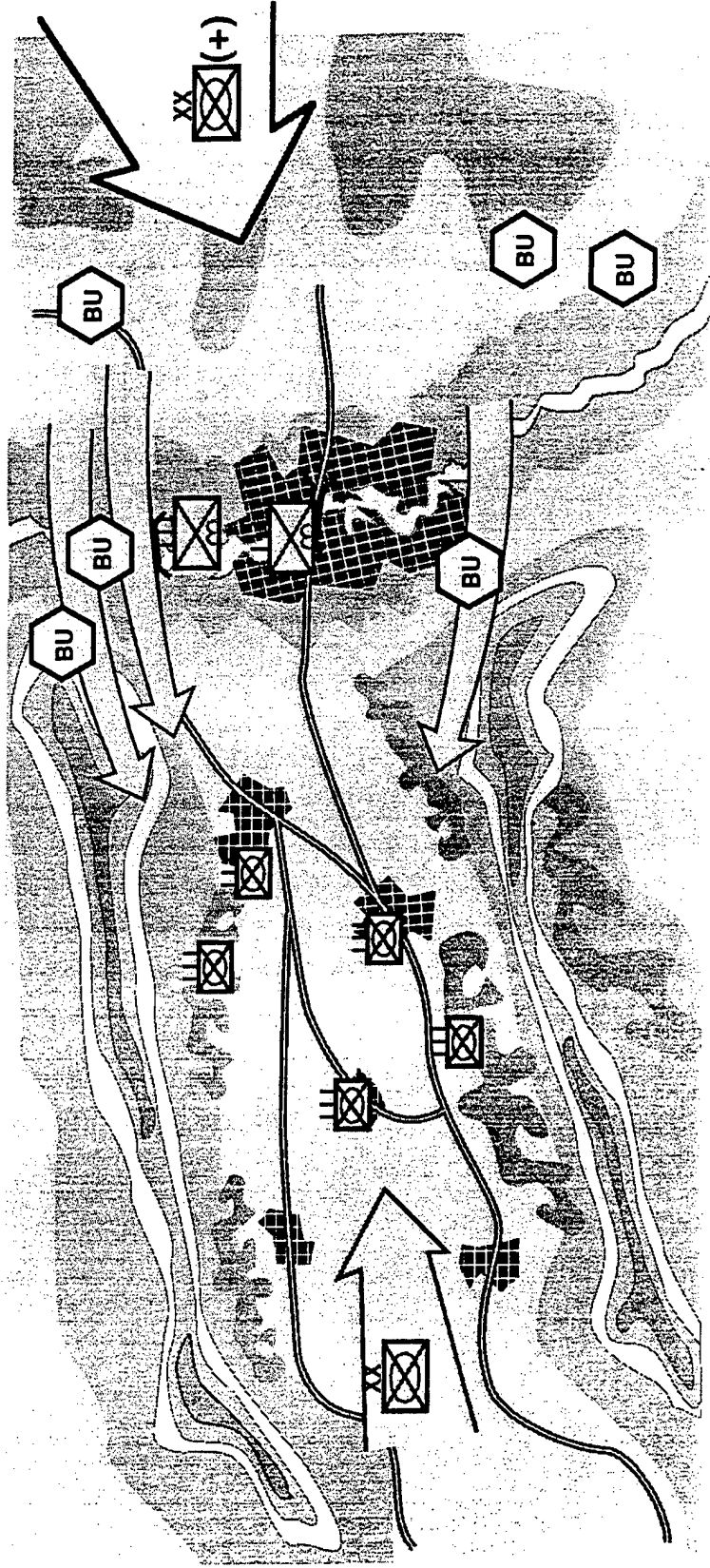
Red Reads Blue Attack - - Red Reacts

Situation

- Blue attacks to destroy lead division while in column
- Red anticipates Blue attack and lead division halts in urban areas
- Red follow-on division prepares to pass through lead division

Challenges

- Blue must alter, disseminate, and execute a new plan "on the fly"
- Must re-focus intel assets upon new targets
- Mission orders based upon intent is imperative





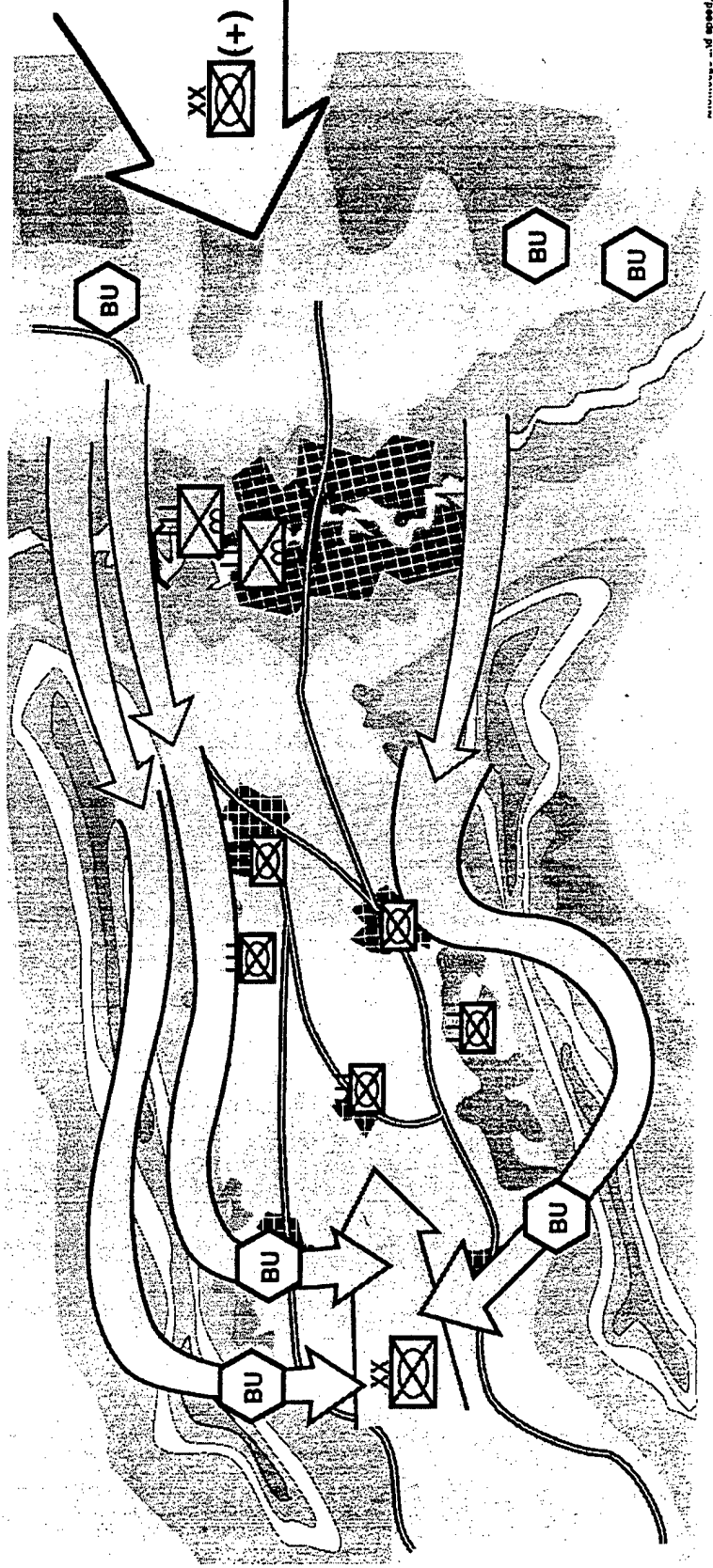
Blue Adjusts -- Destroys Red

Situation

- Blue attacks and destroys Red follow-on division
- Red lead division isolated
- Blue prepares to defend against next echelon
- Approaching Green force destroys remaining Red

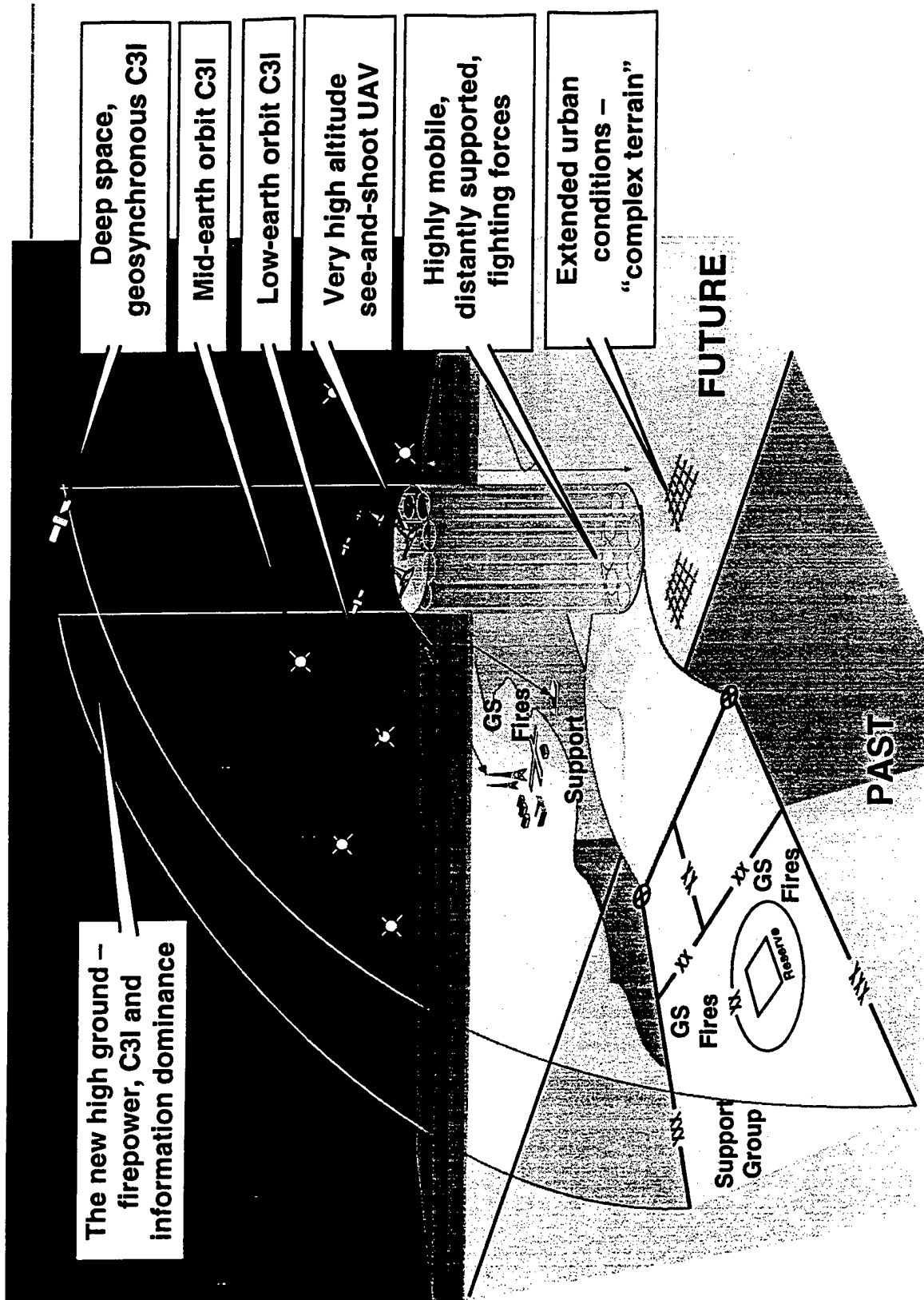
Challenges

- Blue attack must be quick and precise
- Blue soldiers and leaders must rely upon "just in time" planning information
- Battle drills and teamwork must be superlative





AAN – from Linear to Vertical





Tactical Wargame Emerging Impressions

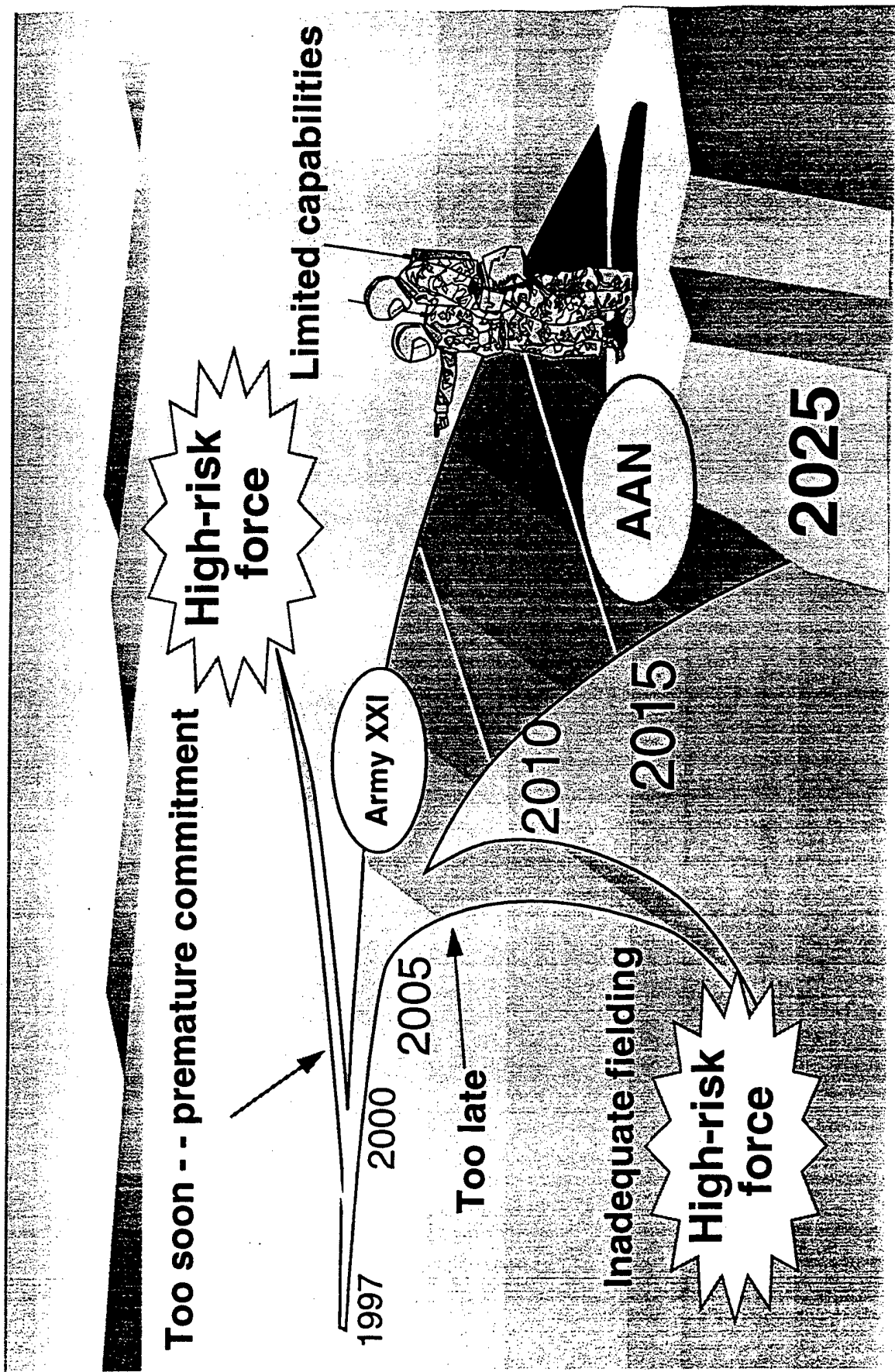
- Future battle against resourceful enemy is tough - particularly in the recon-counterrecon fight
- Interdependence of air, land, sea, space operations
- Piecemeal employment compromises air-mech capabilities . . . must be able to move and fight as one
- Logistics still the "long pole"
- Anticipatory planning and adaptive execution key
- Premium enabling technologies - fuel efficiency, non-lethal capabilities, advanced air frame
- Complex terrain requires progress with penetrating munitions and non-lethal capabilities
- "Reach-out" remains central to future effectiveness

Information dominance is a necessary precondition to enforced disintegration - must fight for it!

Engage and lose or abstain and concede

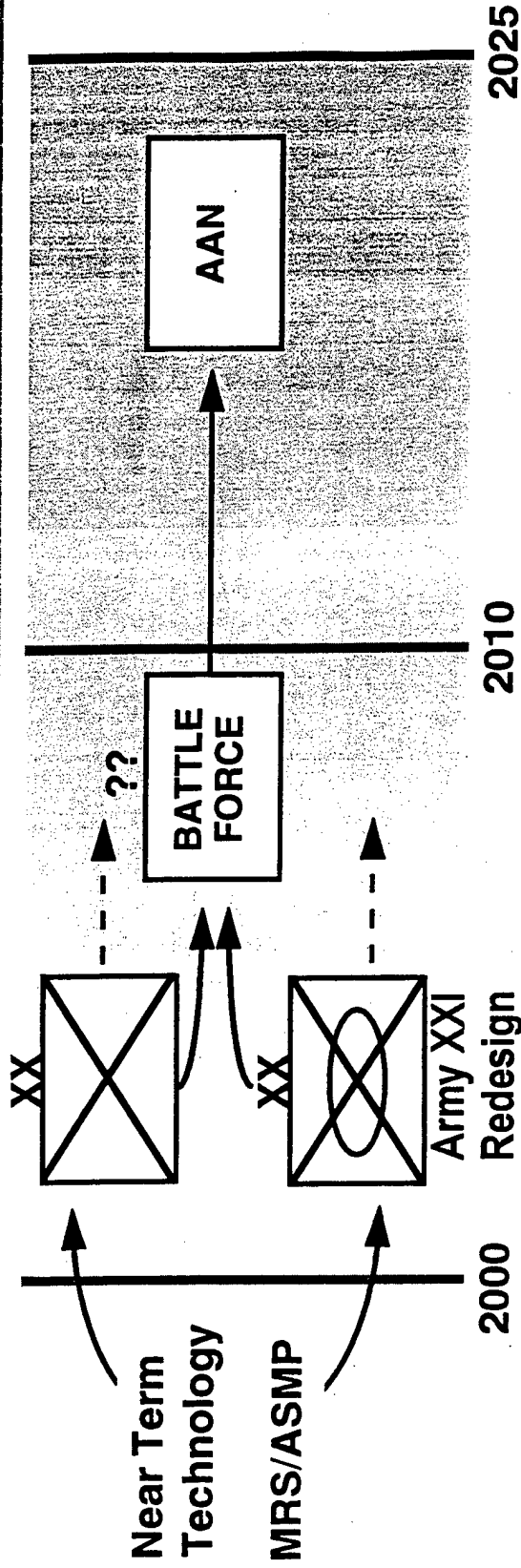


Looking Back from the Future





Battle Force Design



- Carrier for Army XXI transformation to AAN
- Fieldable with assured technologies within expected budget
- Seeks synergy between

Lethality

Mobility

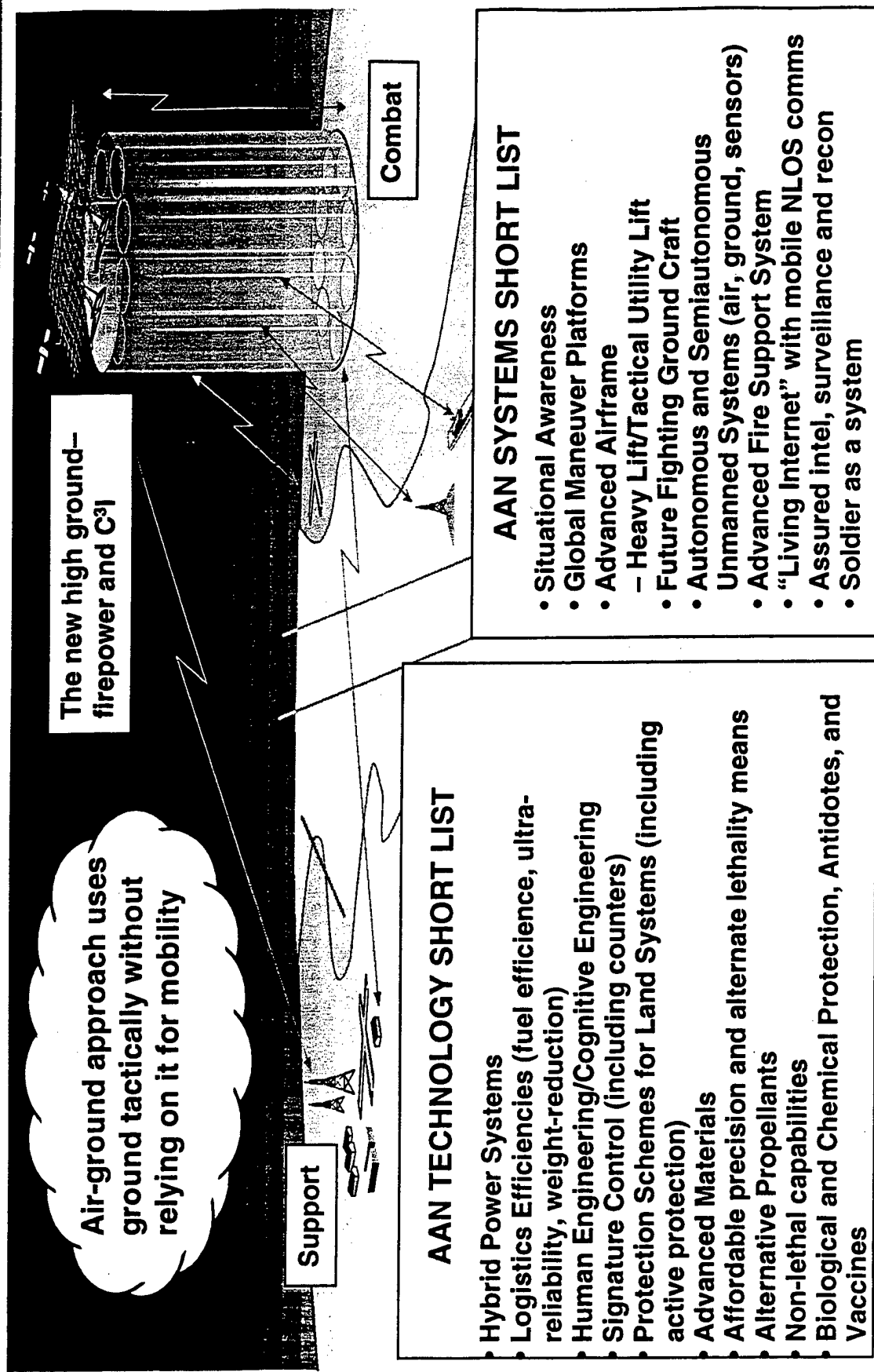
Survivability

Empowered By

- Information Dominance
- Logistics
- Force Protection

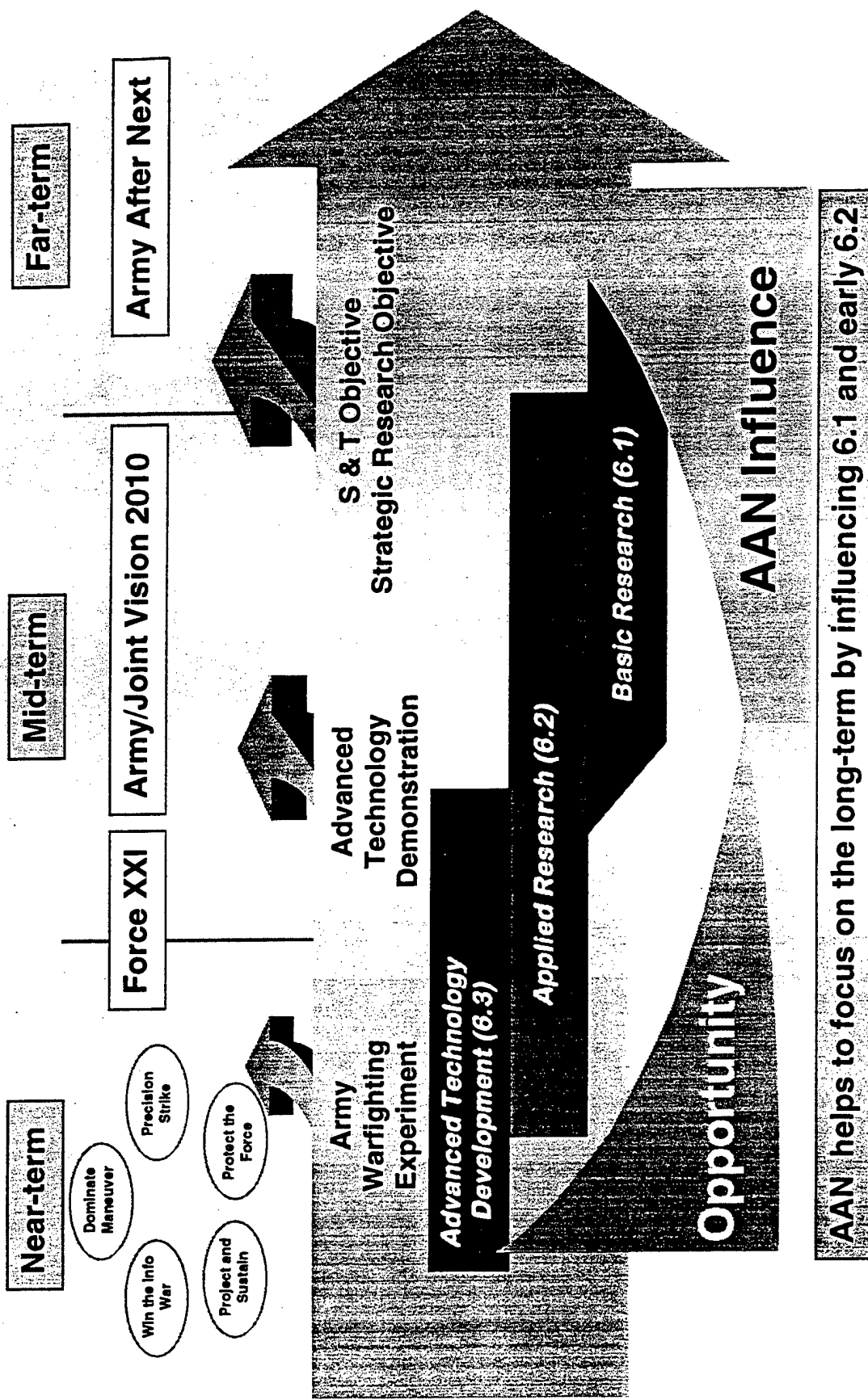


To Set the Stage for AAN, the Army Should Augment Its Existing Research and Development Effort by Further Exploring These Systems and Technologies. (updated)



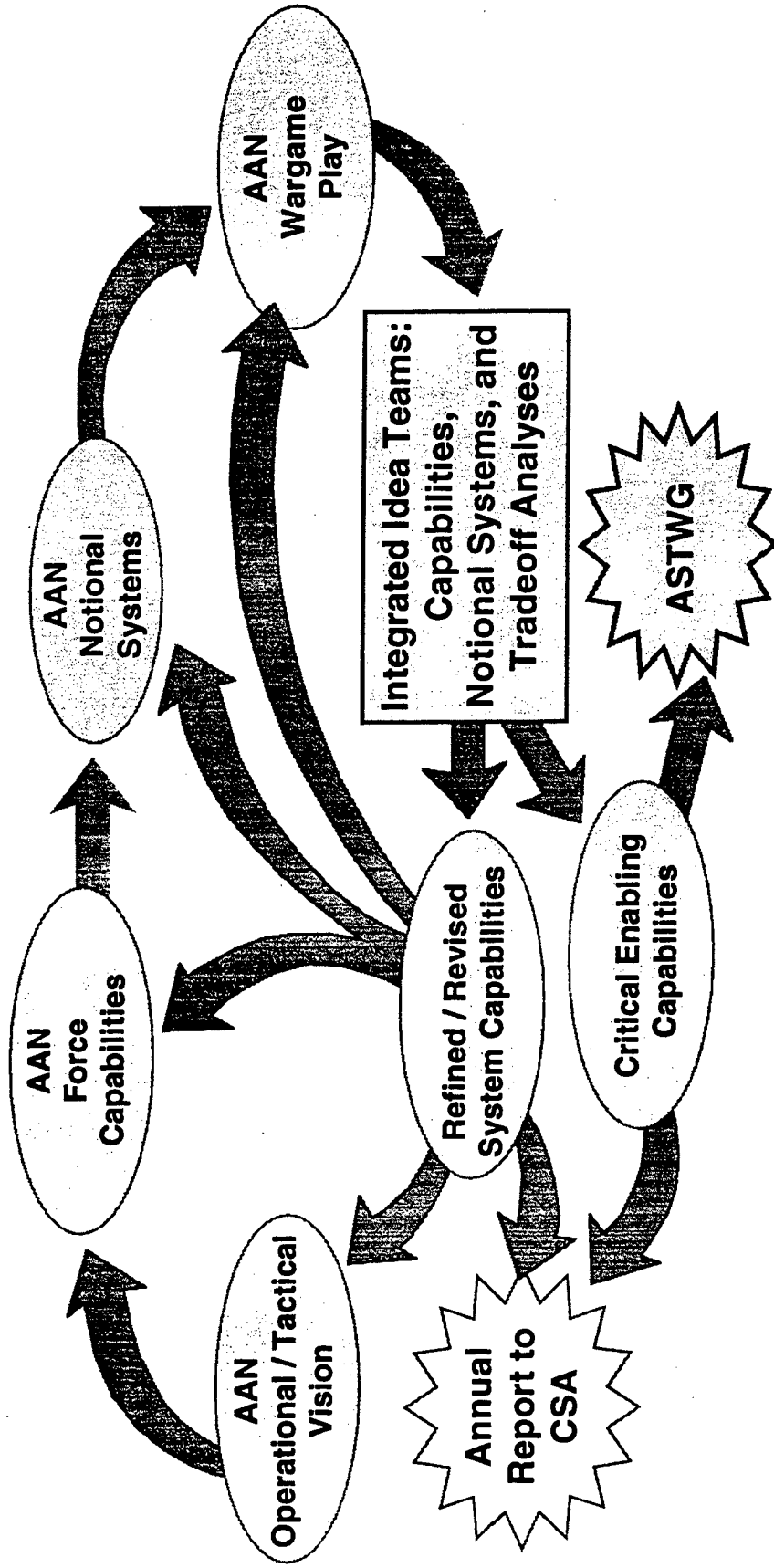


AAN Influence on S&T Investment Strategy





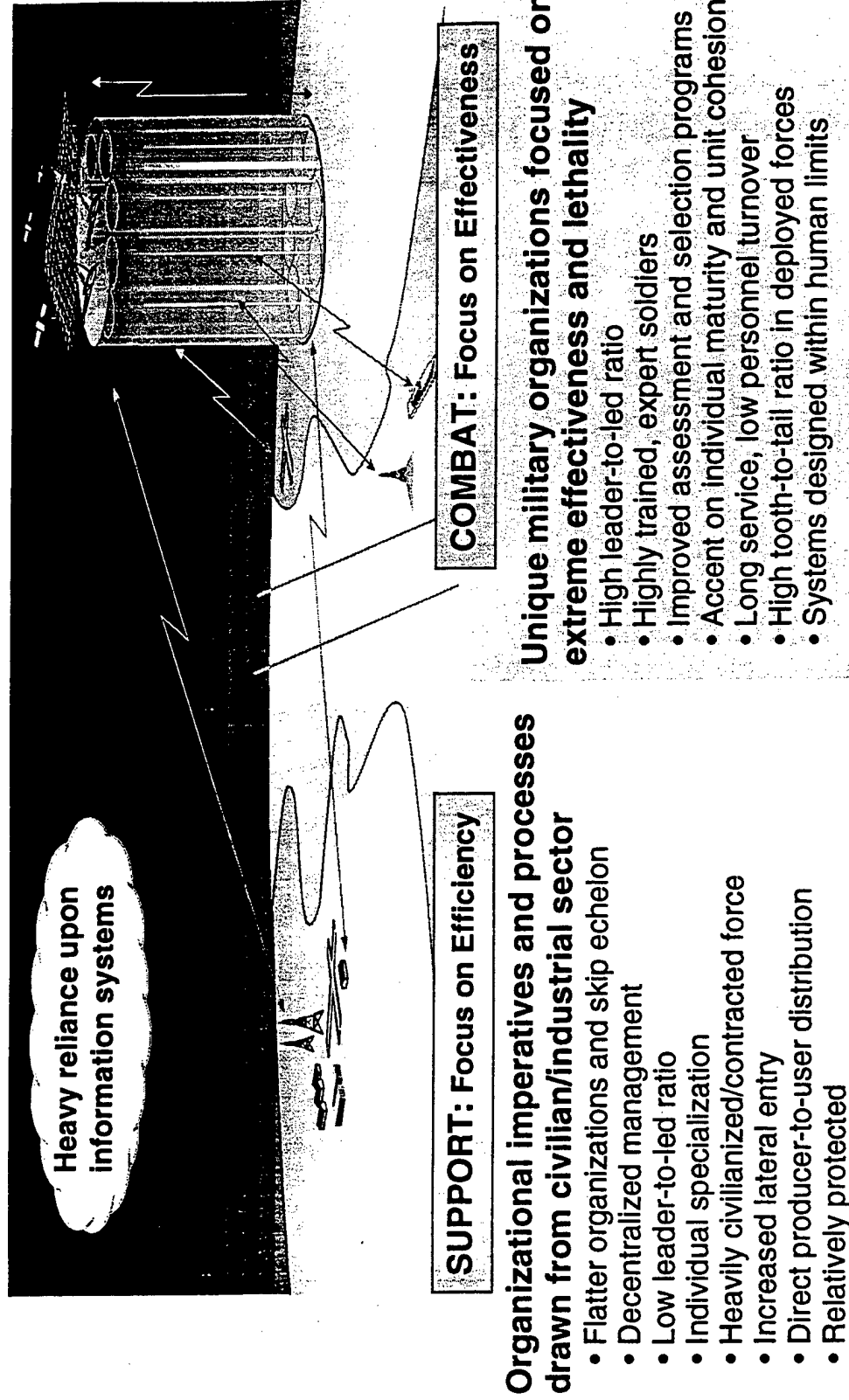
Integrated Idea Teams (IIT): Focus of Army S&T Effort

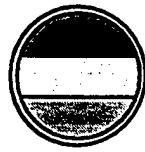


- Initiative of AAN Project Office and ARL begun in 1997
- Process for the S&T community and the AAN/user community to collaborate
- Input to Army S&T investment strategy
- Mobility IIT in 1997; Fires IIT in 1998



Human and Organizational Characteristics of AAN (2025)

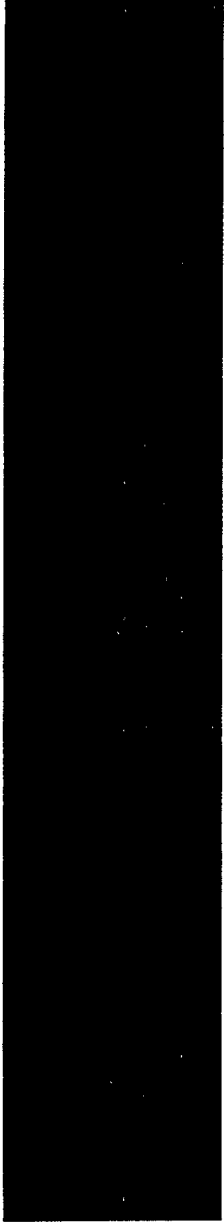




CSA Guidance

Define what we want in the Army After Next so that . . .

- **Force XXI expands to link Army XXI and Army After Next**
- **Force XXI does not get disjointed from long term vision**
- **Also, we must**
 - Focus our R&D efforts
 - Narrow the gap between heavy and light forces
 - Improve mobility, enhance firepower
 - Leverage the work already done in OSD's RMA studies
 - Identify organizational concepts that better integrate AC & RC
 - Revolutionize logistical concepts . . . continue developing total asset visibility & velocity management
 - Institutionalize AAN concepts & process
 - Think joint and involve other services in AAN process



Major General (RET) LON E. MAGGART

RTI

RTI



**Moving to the sound
of the guns . . .**

The Future Environment



HUMAN CHARACTERISTICS OF ARMY XXI OPERATIONS

- Faster decision-making and operations (mental and physical agility)
- Much more information, but not necessarily less uncertainty (information overload)
- Dispersed operations
- Increased lethality
- 24 Hour operations (sleep management and fatigue)
- Increased stress



AAN THE HUMAN DIMENSION

Requires Leaders Who:

- Can cope with:
 - Ambiguity
 - Complexity
 - Compressed planning and operating cycles
 - Physical and emotional stress
- Are highly mature and experienced
- Have mental agility and psychological resilience
- Can make fast decisions based on indeterminate and ever-changing information



AAN THE HUMAN DIMENSION

Requires Units that:

- Can fight in Isolation with all associated psychological demands
- Are resilient enough to operate in discrete, Self-reliant, well informed, autonomous units
- Cohesive, capable, and adaptable



AAN THE HUMAN DIMENSION

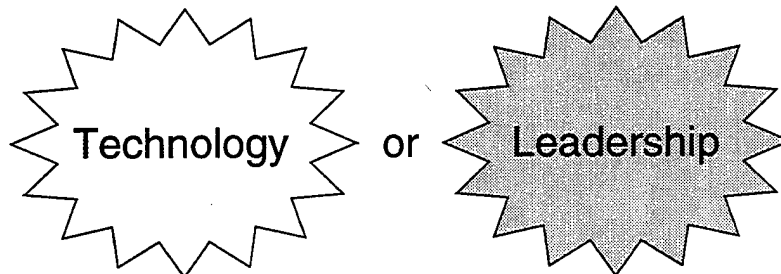
**Based on
A Philosophy of Decentralized Action
Professional Trust**

Requires an Army that:

- Can change
- Can achieve speed at the tactical, operational, and strategic levels
- Promotes confidence between the leader and the led



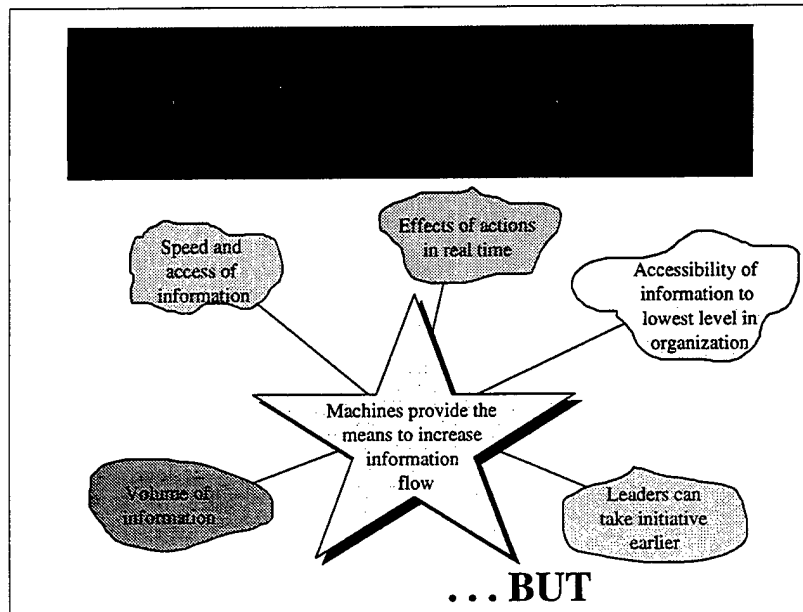
Where do We Start?



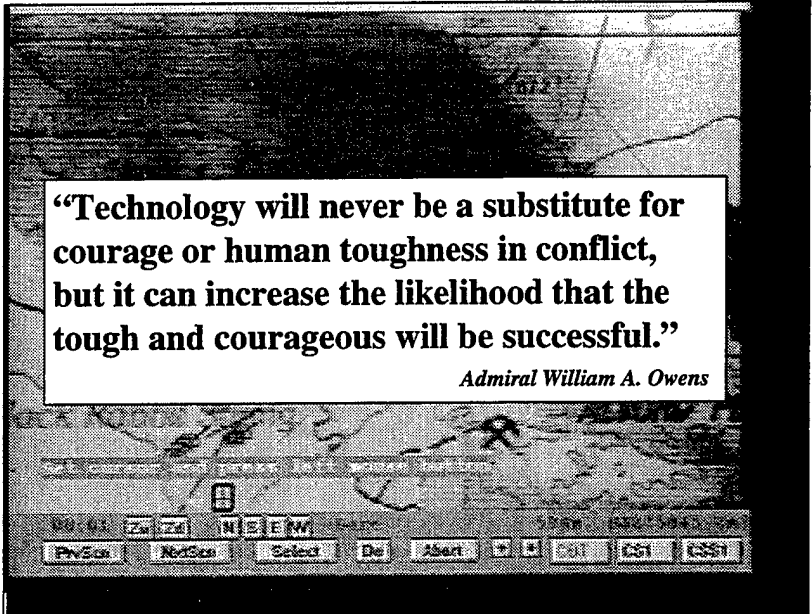
BATTLE COMMAND AND LEADERSHIP

- Battle command is the single most important determinant of victory in ground warfare
- The RMA is principally a revolution in battle command
- Battle command is an art form where vision, innovation, intuition, audacity, creativity, tenacity, will, and courage equal success!

RTI



RTI



"Technology will never be a substitute for courage or human toughness in conflict, but it can increase the likelihood that the tough and courageous will be successful."

Admiral William A. Owens



Technology Paradox

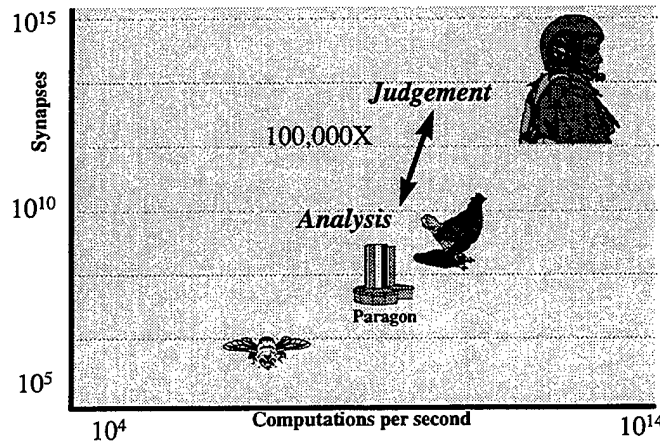


We can never forget that sometimes one must dismount one's computer box with tracks and emplant one's entrenching tool in someone's head...

-- Maggart

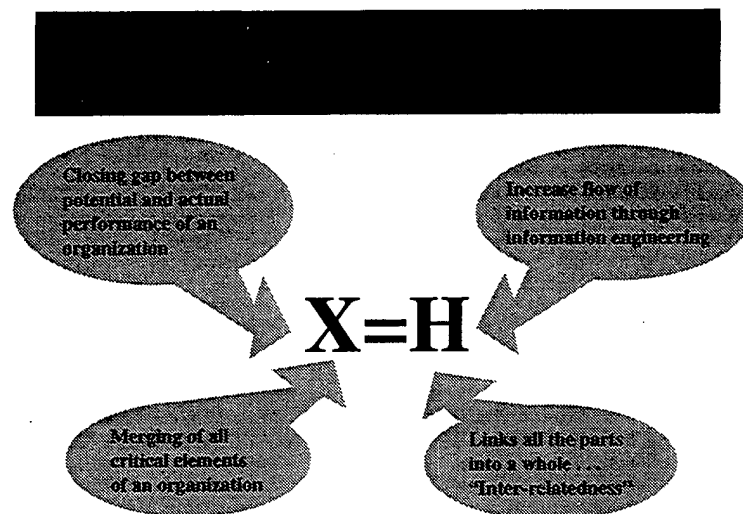


Leadership Decision Making



Humans make decisions...Machines do analyses.

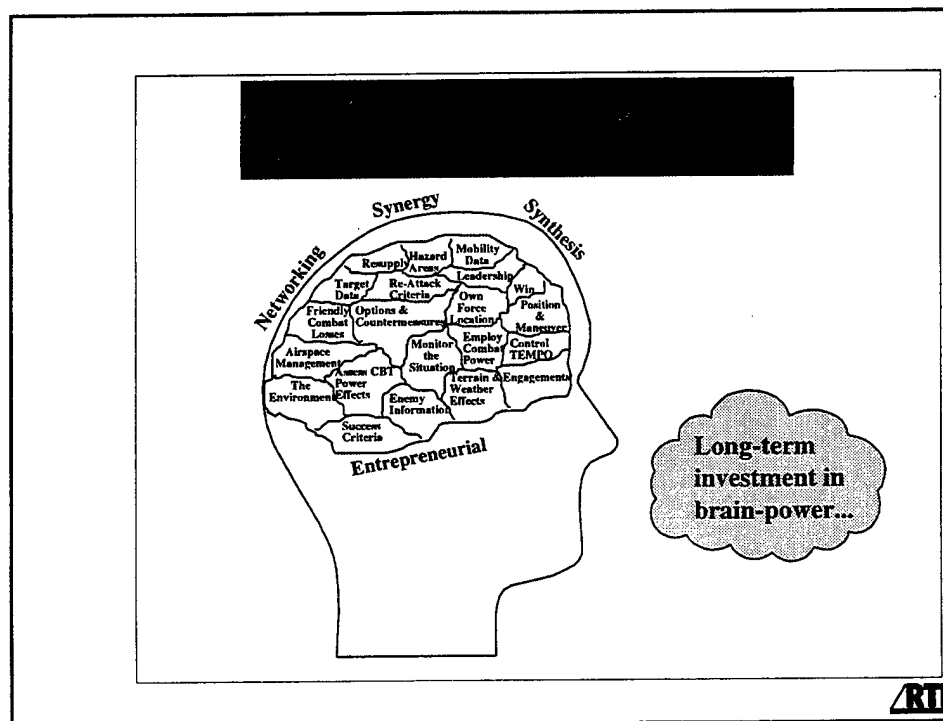
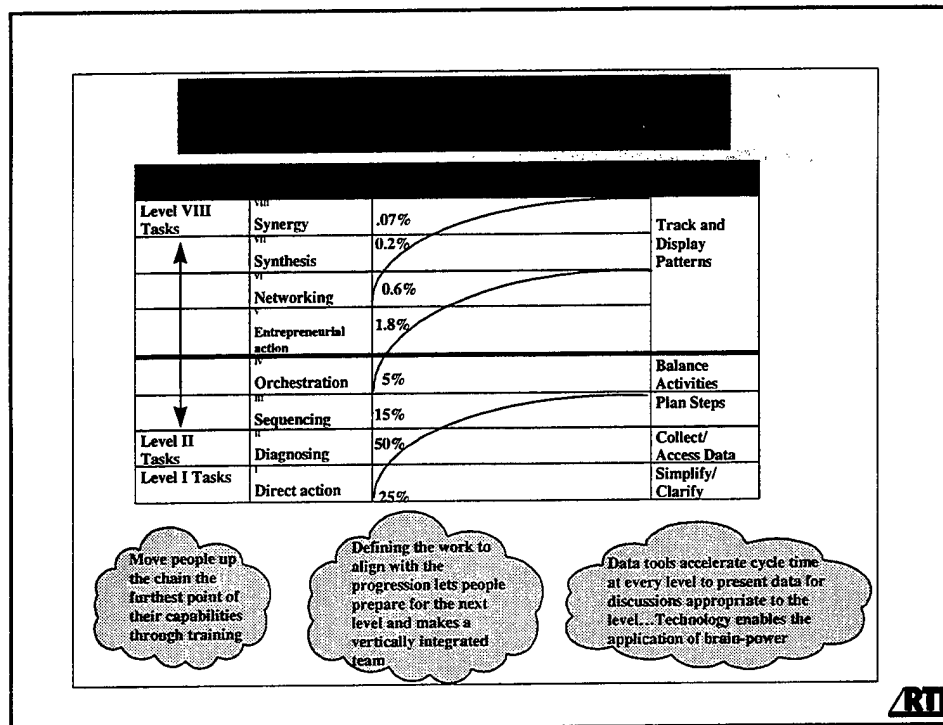
RTI



X: Having to work through people, how can we manage systems to create change?

H = Information flow

RTI



In What Leadership Skills Must We Invest??



New Skills



in Addition to . . .

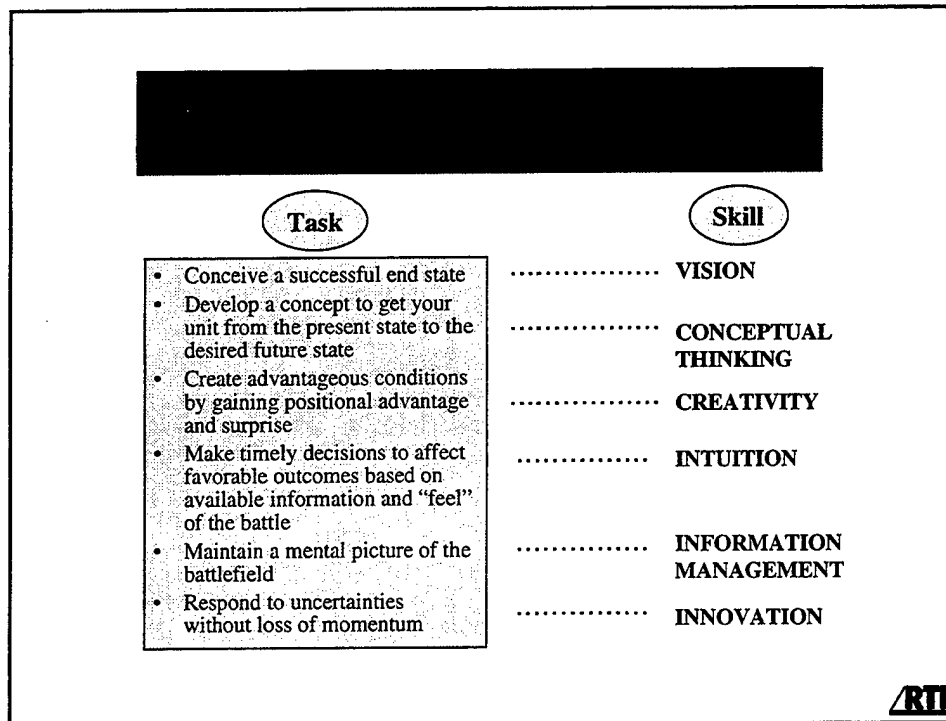
**Traditional
Skills**



- ✓ Intuition
- ✓ Versatility & Adaptability
- ✓ Vision & Imagination
- ✓ Innovative Thinking
- ✓ Information Age Competence
- ✓ Sense of Humanity
- ✓ Creativity
- ✓ Conceptual Thinking

- ✓ Problem Solving
- ✓ Organization
- ✓ Tactical Proficiency
- ✓ Physical and Mental Stamina
- ✓ Decisiveness
- ✓ Work Ethic
- ✓ Self Discipline & Confidence
- ✓ Communication
- ✓ Judgment





Having the Skill is Not Enough...

The Catalyst is...

COHESION!!!

RI

**"Throughout the war you were
always on my mind. I knew that
if I were in trouble and you were
still alive . . . You would come to
my assistance."**



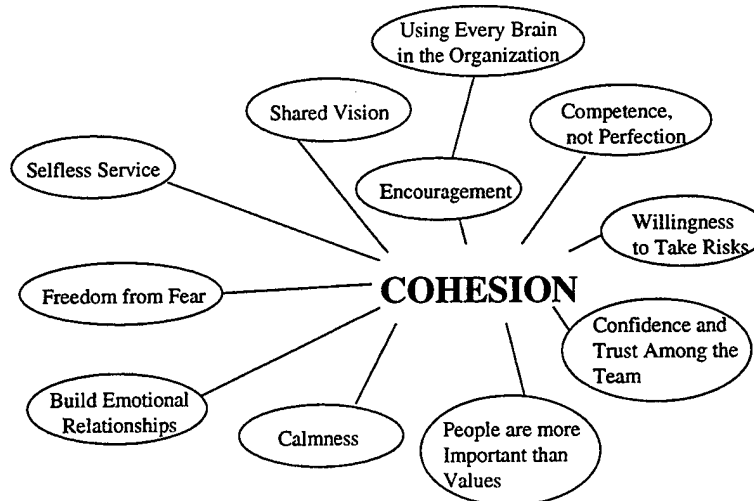
-- Grant to Sherman --

Trust Through Cohesion

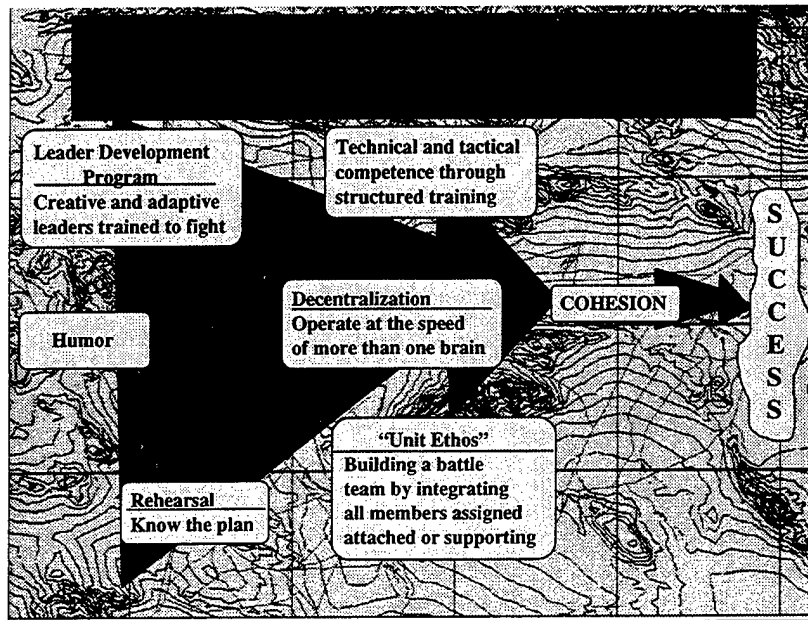


RTI

THE ART OF COMMAND

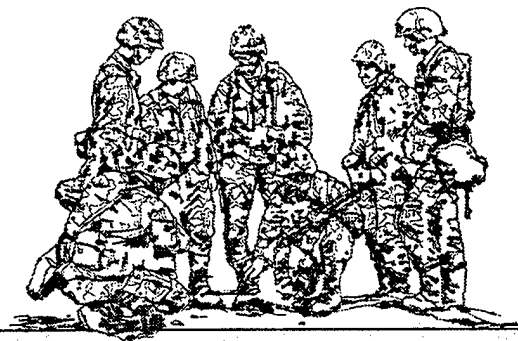


RTI



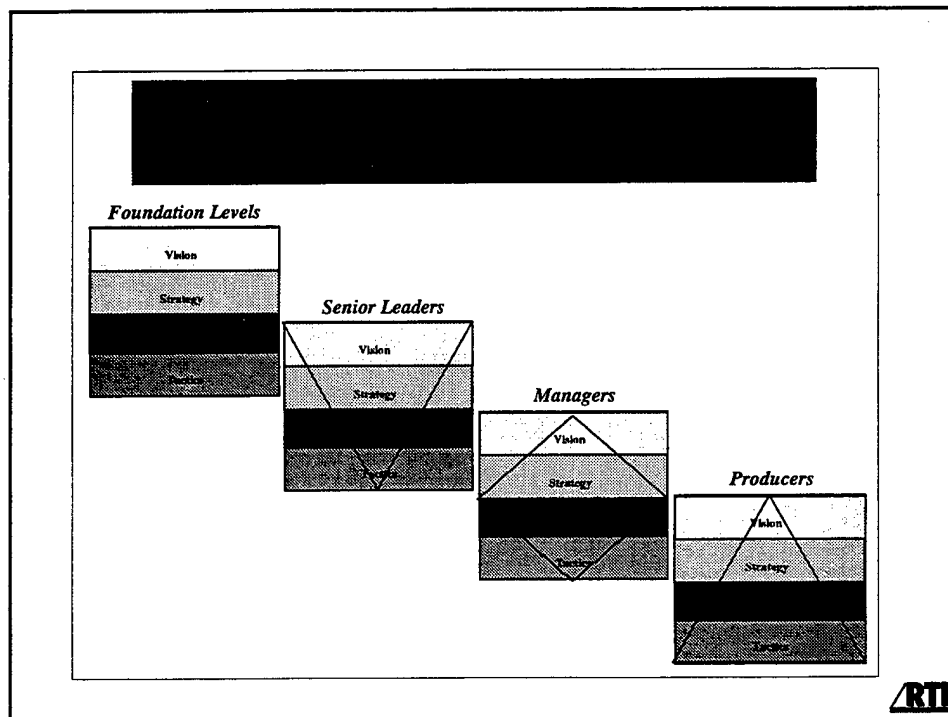
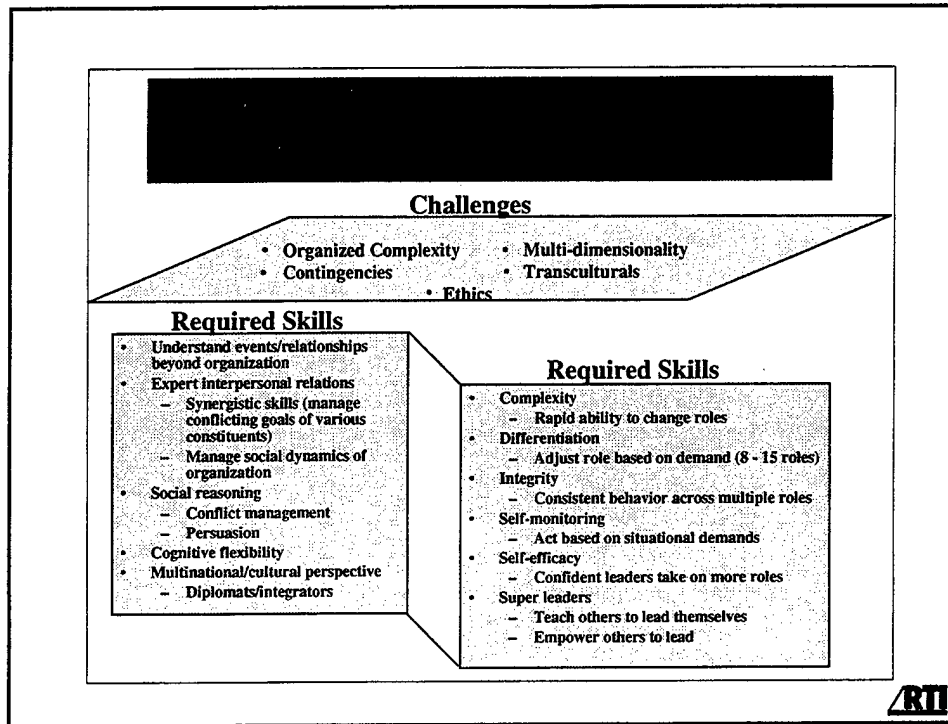
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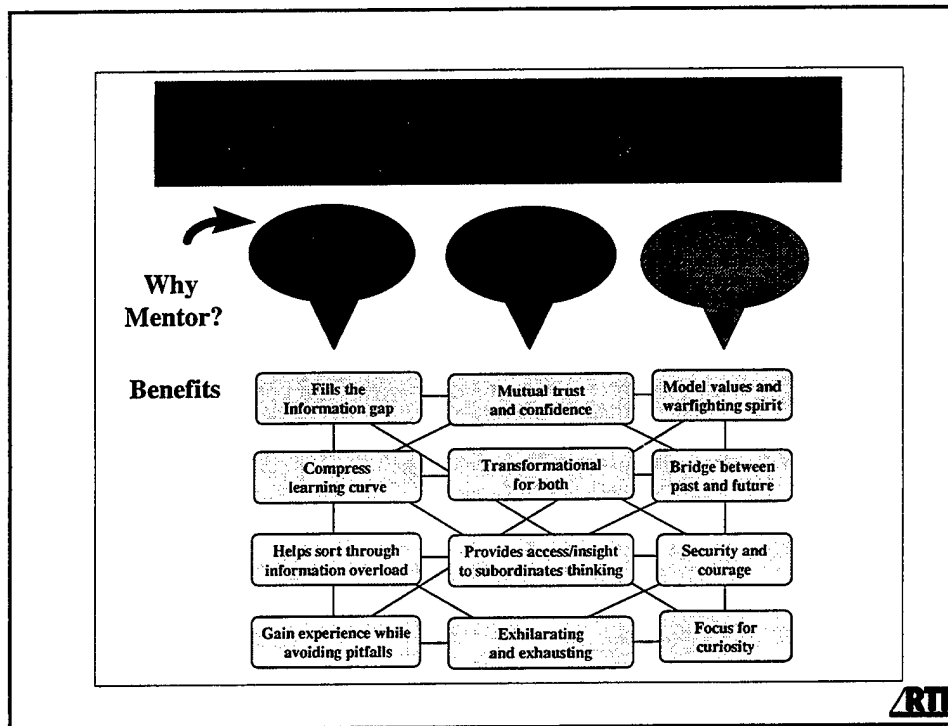
Preparing for Success



"The senior leader is responsible for ensuring all components that lead to cohesion take place . . ."

RTI





Roadblocks to the Future

- Branches
 - Sub-optimize skills!
 - Stereotype?
 - Important in 2025?
- Institutional Gender Bias
 - High performance organizations cannot/do not tolerate discrimination
 - Army cannot afford to waste or lose precious talent
- Failure to recognize the significance of Man/Machine division of labor
- Failure to understand that “how to think” is infinitely more important than “what to think”

RTI

Women in the Army

Institutional gender bias may be the most significant preventable human resource issue today that will absolutely negatively impact on future battlefield success!!

"I didn't know I had to salute female officers!"

"Please don't open the door for me....please don't seat me."

"Go ahead honey, just close your eyes and squeeze the trigger!"

"Men don't know the difference between a woman/lady and a female/soldier!"

"I was the senior officer present, but he didn't even address me. He didn't even look at me. He assumed the male LTC was in charge!"

"He didn't make me prove I was good enough to be in a man's world."

"We just wanted to talk over the problem but all the guys thought we were plotting."



The Problem

There is no shared understanding that exclusion and differential treatment is not only unacceptable, it destroys unit cohesion...

and

Male soldiers do not know what gender discrimination is....

and

That it will not be tolerated!



Solution

- Understand that gender discrimination exists!
- Build on Army program that addresses it just like we did for race issues
- Build an environment today that does not tolerate it -- anytime, anywhere!
- Recognize that the Army cannot be a high-performing organization and tolerate gender bias as it does today:
 - Publish mental and physical standards for each branch, then open all branches to both genders if the standards are met!
- Understand that in the future, success will depend on brain-power and skills, regardless of gender -- One of the Best tankers I know is an Army nurse

We can't have an Army where half of the force is disenfranchised!!

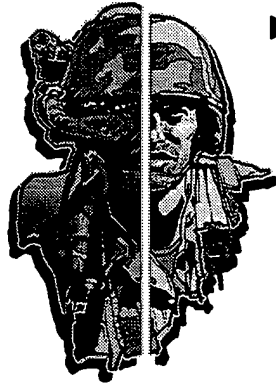


Future Leader Selection

- ARI identifies essential qualities and skills required for battlefield success
- Use OER/EER to identify initial leader candidates
- Develop instruments that can identify individuals with the required skills
- Select future leaders based on verifiable skills...not OERs/EERs, branches, school attendance or gender!



Future Leader Training



We Must Teach:

- ▶ New technical-tactical skills
 - ★ Network management
 - ★ Information age C²
- ▶ How to deal with emotionless nature of digital operations
- ▶ Leaders and soldiers to trust in information
 - ★ Currency
 - ★ Accuracy

It requires new ways of thinking and operating, as elements relatively low in an organization have the information to make and execute decisions

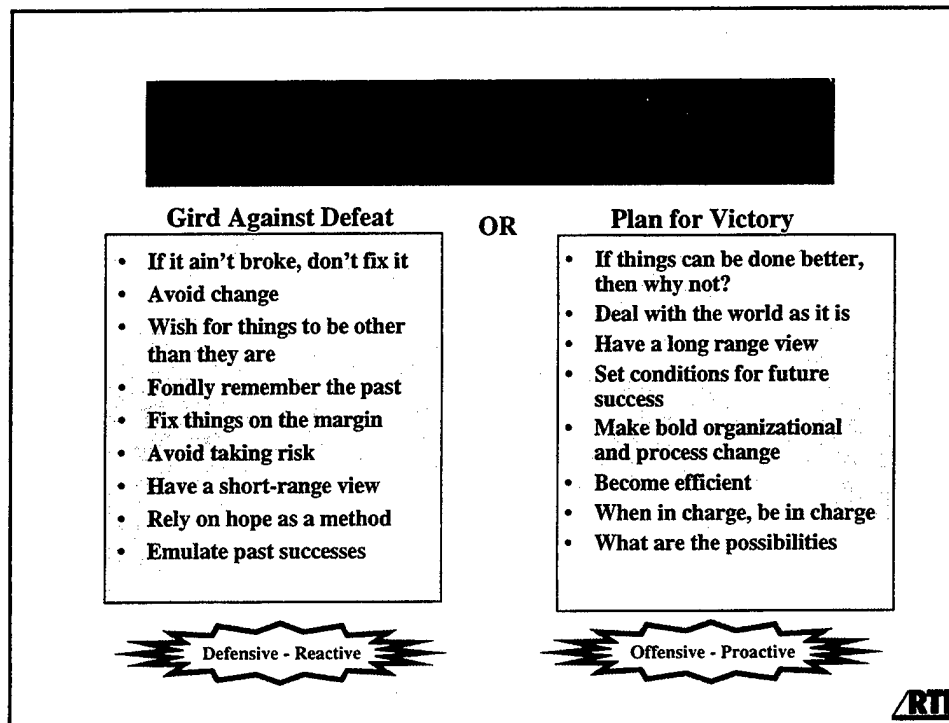


Future Leader Training (continued)

- ▶ New divisions of labor between leaders in digital units
- ▶ New Training Methodology
 - ★ Competence in the basics
 - ★ Proficiency in TCS for digital hardware and software
 - ★ Develop hyper-proficient individuals and units

It requires new ways of thinking and operating, as elements relatively low in an organization have the information to make and execute decisions





FM22-103 Leadership & Command at Senior Levels June 1982	
HEALTHY	UNHEALTHY
16. There is a high degree of trust among soldiers and a sense of freedom and mutual responsibility. People generally know what is important to the organization and what isn't.	16. The leader tightly controls new ideas and demands excessive justification. He allows little freedom to deviate
17. Risk is accepted and valued for growth and development.	17. Minimizing risk has a very high value.
18. "We don't like mistakes but what can we learn from them?"	18. "One mistake and you're out."
19. Poor performance is confronted and a joint solution sought.	19. Poor performance is glossed over or handled arbitrarily.

RTI

FM22-103 Leadership & Command at Senior Levels (continued)

June 1982

HEALTHY	UNHEALTHY
20. Organizational structure, procedures, and policies are fashioned to help soldiers get the job done and to protect the long-term health of the organization. They are changed as the situation demands. 21. There is a sense of order, yet a high rate of innovation. Old methods can be changed and often give way. 22. The organization itself adapts swiftly to the opportunities or other changes in the situation because every pair of eyes is watching and every soldier is anticipating.	20. Organizational structure, policies, and procedures stifle the team. Subordinates take refuge in policies and procedures and play games with the unit structure. 21. Tradition is the only answer. 22. Innovation is not widespread but consolidated in the hands of a few.

RTI

COMBAT LEADER SELECTION

- Army XXI will be more Demanding on Combat Leaders...Unfortunately, Traditional Army Education and Training Programs *May* not be Adequate to Ensure Success on Future Battlefields.

RTI

LEADER SELECTION SOLUTIONS

- Maybe the Army Needs to Identify the Essential Qualities and Skills Needed for Success in Combat and then *Select* Leaders Based on this Criteria rather than...



WOMEN IN THE ARMY It is a Human Resource Issue.....

- Success in the Future Will Depend on Brain Power...
Regardless of Gender
- Cannot be a High Performing System and Foster Institutional Gender Bias As It Does Today
 - Specify Standards, Both Mental and Physical, for each Branch (if they are still around), then Allow either Gender to Serve if the Standards are Met
- Conduct Additional Research to Determine Which Tasks are Best Accomplished by Which Gender, then Assign Accordingly
- Don't Let Branch Affiliation be the Major Determinant for Assignment...One of the Best Tanker's I Know is an Army Nurse

...We Can't Afford to Waste Brain Power!



THOUGHTS

- Will Branches be Important in 2025?
- Understand the Difference Between Sophistication and Complexity!
- Context is Everything in a Digital Environment!
- Having Technologically Advanced Equipment and Systems **Does Not** Mean that One Can Use Them Effectively!
- How to Think is Infinitely More Important than What to Think!

Optimize for the Future Without Regard for Ego, Branch or Tradition....
Very Small Strategic Air Force and Navy. Tactical Fighters and Air and Sea Lift Belong to the Ground Command. The Army Does the Long Haul and USMC the 911.



BIOLOGICAL ROOTS OF HUMAN BEHAVIOR Compiled by Paul Berenson, Ph.D., 1998

There is a proven genetic component (propensity) for the following human behaviors and feelings; all at least 30% heritability, i.e., inherited.

- | | | |
|----------------------------------|------------------------------|----------------------------|
| • Personality | • Language Development | • Dominance (Power) |
| • Extroversion* | • Vocational Interests | • Aggression (Male) |
| • Friendliness | • Intelligence | • Violence (Male) |
| • Sociability | • Cognition | • Rape (Male) |
| • Happiness | • Reasoning | • Adult Criminality (Male) |
| • Agreeableness * | • Scholastic Achievement | • Harm Avoidance* |
| • Self-Esteem | • Novelty Seeking* | • Shyness |
| • Self-Confidence | • Boldness (Audacity) | • Fearfulness |
| • Calmness | • Adventurousness | • Xenophobia |
| • Conscientiousness* | • Impulsivity | • Hostility |
| • Dependability | • Addition | • Pessimism |
| • Persistence (Willpower) | • Alcoholism (male) | • Inhibition |
| • Incest Avoidance | • Homosexuality (male) | • Anxiety |
| • Altruism | • Paranoia | • Anger* |
| • * Major Personality Traits | • Phobias | • Depression |
| | | • Neuroticism* |



Army After Next, Leesburg, VA, June 25, 1998

MacroTrends in IT

Myths, Realities & Challenges

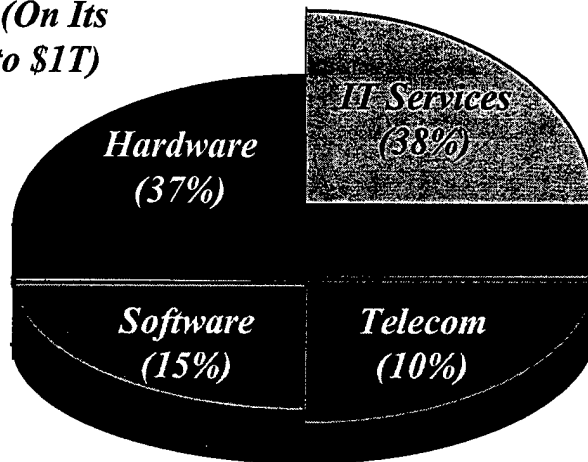
*Steve Andriole
Safeguard Scientifics, Inc.
TL Ventures*

I'd Like to Talk About ...

- Technology Adoption,
Acquisition & Deployment
Trends
- Impact & Implications
- So We Can Eat ...

But First, Some Context

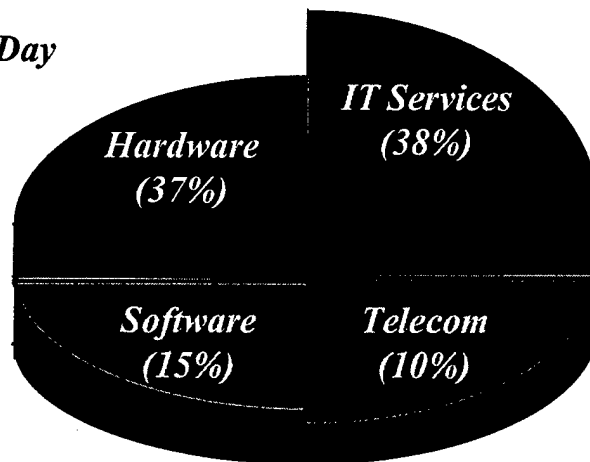
***\$785+ Billion (On Its
Way in 1998 to \$1T)***



Source: Dataquest/Gartner

Context ...

\$1B Per Day



Source: Dataquest/Gartner

More Context ...

IT spending is on an upswing

Analysts say federal systems budgets will grow by 8 percent in fiscal 1999

By Jennifer M. Galloway
Staff Writer

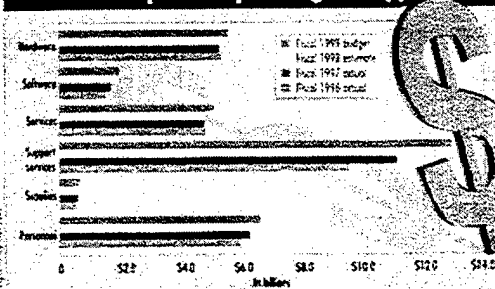
Government information technology spending will increase by at least 8 percent to more than \$25 billion in fiscal 1999, according to a Federal Systems Inc. study.

The numbers likely to be even larger, possibly 12 percent, said officials of the Migration, Inc. industry tracking group. Last year the Office of Management and Budget estimated a 3 percent increase in IT spending, but growth accelerated 5 percent, said Thomas J. Hewitt, Federal Systems' chairman and chief executive officer. Federal Systems was in the predictions during an annual spending director conference.

"I think you can back up 10 percent growth in fiscal 1999," Hewitt said, adding that it could reach 12 percent. Most growth will occur in civil agencies, which account for more than half of all IT spending.

Congressional government services will also increase as the government shifts more to the private sector. That also is expected, said a Federal Systems official, because agencies often wait until the last minute to

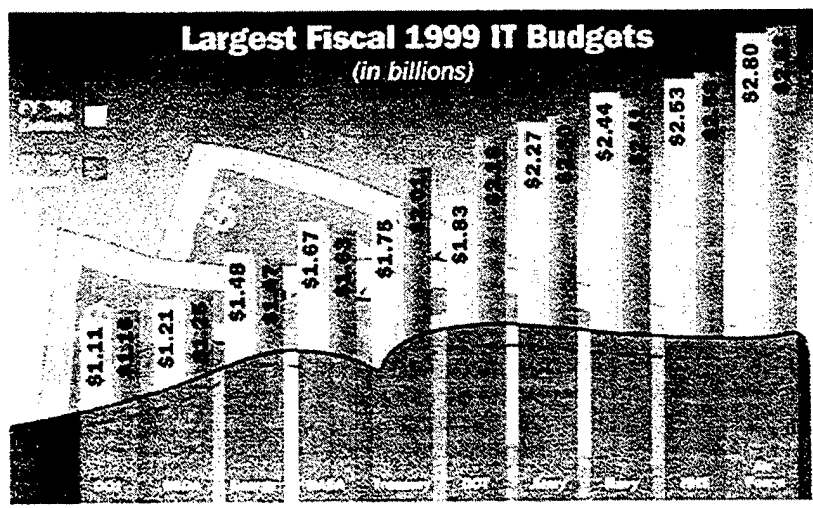
Feds expect to spend big on support



Based on agency budget submissions for fiscal 1999, Federal Systems Inc. estimates that support services will continue to be the biggest IT budget item governmentwide.

Context ...

Largest Fiscal 1999 IT Budgets (in billions)



Trends

Army After Next - June 25, 1998

Trends ...

- Move to Packaged Applications
- Increased Reliance on COTS
- More Outsourcing
- Workload Reduction & Redistribution Via IT
- “Smart” This & That
- Technology Upgrade Treadmill
- Information-Driven Doctrine ...

Applications Trends

<i>Custom</i>	<i>Custom</i>	<i>Custom & "Packaged"</i>	<i>Custom & "Packaged"</i>
<i>Host-Based</i>	<i>Host-Based & Distributed</i>	<i>Host-Based & Distributed</i>	<i>Host-Based & Distributed & Virtual</i>
<i>Home-Grown</i>	<i>Home-Grown & Outsourced</i>	<i>Outsourced & Home-Grown</i>	<i>Outsourced & Home-Grown</i>
<i>Vertical</i>	<i>Vertical</i>	<i>Vertical & "Core"</i>	<i>Vertical, Core, Vertical/Core "Component- Based"</i>

Reliance on COTS

- **Commercial-Off-the-Shelf: The Darling of the Procurement World**
 - Saves Money
 - Gets Away from the Dreaded "Milspec"
 - Enables Technology Integration
 - Keeps Us High on the Technology Curve
 - Facilitates Interoperability
 - Decrease Support Costs
 - But ...

Outsourcing

- It's Got to Be Cheaper!
- It's Got to Be Better!
- It's Got to ***Be***!

*We've Adapted Our Expectations Based
on Real-World Experience: We Now
Outsource Because It's Often Politically
Correct & Because We Haven't a Clue How
to Support All This Stuff ...*

Workload Reduction & Redistribution Via IT

- "Machines Can Do It!"
- "We Can Reduce Defense Spending &
Increase Efficiency at the Same Time"
- We Can Endow Our Computing &
Communications Infrastructures With
Reconstitutability, Survivability, Reliability
& Scalability -- & Intelligence ...

“Smart” This & That ...

- Bombs
- Platforms
- Networks
- Architectures
- Decision Aids
- Even People ...

Technology Upgrade Treadmill

- Ethernet → Fast Ethernet → Gigabit Ethernet
- Routers → Switches → IRouters
- Hierarchical Databases → Relational Databases → Object Databases → Data Warehouses → Data Mining → Universal Data Access
- Windows 3.1 → Windows 95 → Windows 98 ...

Cool Technology We Like

- **Natural Interfaces**

- Continuous, Semantic Speech Recognition
- Conversational Speech Output
- Handwriting Recognition
- Fingerprint Recognition
- Facial Recognition ...

Cool Technology We Need (But Don't Understand)

- **Middleware**

- Integrated Messaging
- Distributed Transaction Processing
- Systems Management
- eMail, Workflow & Collaboration
- Data Warehousing/Mining
- Remote Database Access
- Distributed Database Management
- Transactive Content ...

Really Cool Technology (We Don't Need Yet ...)

- **Components**

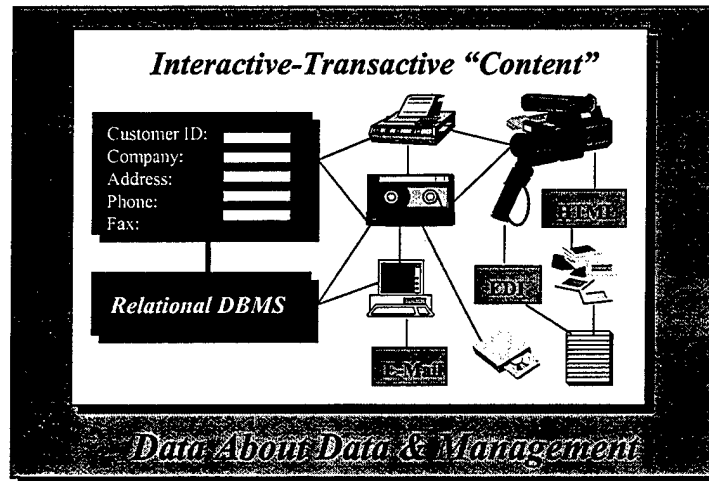
- Vertical, Reusable Components
- Business Rules & Processes
- Component Repositories
- Component Management ...

The Coolest Technology (That Everyone Wants & Needs)

- **Universal Data, Information & Knowledge Integration**

- Automated Data Mining → OLAP
- Transactive Content
- Intelligent Document Management
- Knowledge Representation & Organization
- Anytime, Anyplace Access to Structured & Unstructured Stuff ...

The Coolest Technology



Source: Modified from Forrester

Who Makes the Technology Bets?

*By the Way ...
What the Hell is
"Knowledge
Management,
Anyway?"*

Information-Driven Doctrine

- C4I/AirLand Battle
- Information Warfare
- EW
- InfoSec ...

The Trends Again ...

- Move to Packaged Applications
- Increased Reliance on COTS
- More Outsourcing
- Workload Reduction & Redistribution Via IT
- “Smart” This & That
- Technology Upgrade Treadmill
- Information-Driven Doctrine ...

So What?

Impact

Implications

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So What?

Impact

Implications

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Applications Trends

<i>Custom</i>	<i>Custom</i>	<i>Custom & "Packaged"</i>	<i>Custom & "Packaged"</i>
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<i>Vertical</i>	<i>Vertical</i>	<i>Vertical & "Core"</i>	<i>Vertical, Core, Vertical/Core "Component-Based"</i>

Implications?

<i>Applications Trends</i>			
<i>Custom</i>	<i>Custom</i>	<i>Custom & "Packaged"</i>	<i>Custom & "Packaged"</i>
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<i>Vertical</i>	<i>Vertical</i>	<i>Vertical & "Core"</i>	<i>Vertical, Core, & Vertical/Core "Component-Based"</i>

- **Nothing Goes Away!**

More Complexity
More Integration
More Interoperability
More Maintenance
More Support ...

COTS

- More Complexity
- More Dependency
- More Vulnerability
- Less Design Options
- Some Cost Savings
- Some Cost Increases
- More Outsourcing ...

More Outsourcing

- **Inevitable**
 - Skills Shortage
 - Complexity of Our Computing & Communications Infrastructures (Not to Mention Our Applications)
- **The Significance of IT Management Abdication**
- **Dependencies & Points of No Return**
 - Hardware & Software Vendors
 - Contractors
- **Costs ...**

Workload Reduction & Redistribution Via IT

- Where is the Expertise?
- Do We Really Believe -- in 1998 (!) -- that Creative Problem-Solving Can Be Embedded in Autonomous Intelligent Agents Deployed Globally to Affect Our National Objectives?
- Still Lots of Work to Do Regarding Which (Organic or Digital) System Does What ...

“Smart” This & That ...

- The Well-Bounded, Low-Level Deductive Inference Domains Are Still Good Targets; Unbounded, Non-Deterministic, Inductive & Hybrid Domains are Still Very Tough (Sort of Like the Distinction Between Fixing a Tank & the Act of Creation)
- Adaptive Intelligent Systems Technology Might Provide the Learning Mechanisms for a Major Increase in Applicable Domains ...

Technology Upgrade Treadmill

- Requirements, Requirements, Requirements:
Who Owns the Requirements?
 - Trade-Offs
 - Standardized Versus Cool
 - Organized Versus Chaotic
 - Maintainable Versus You've-to-Be-Kidding
 - Back to Systems Engineering Basics
- ***But, If We've Outsourced the Jewels We've
Already Forfeited Lots of Control***

Information-Driven Doctrine

- **De-Engineering ...**
 - Technology Should Not Define Doctrine;
Doctrine Should Evolve Purposefully With
Technology as an Enabler
- **Point/Counter-Point Doctrine**
 - Technology Enables Process A, But Compromises
Process B ... Technology Accelerates Process C,
But Cascades onto Processes A & B that Can't Go
Any Faster ...

So What?

Impact

Implications

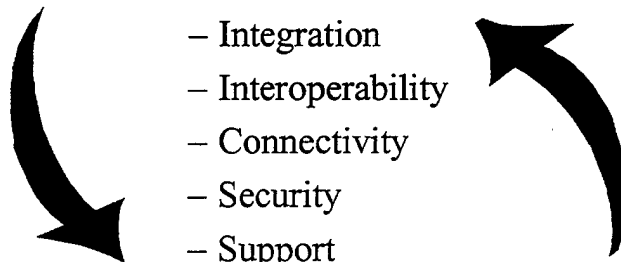
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Implications

- **Complexity**

- Integration
- Interoperability
- Connectivity
- Security
- Support

- **Vulnerability ...**



Implications

- **More Complexity, Resulting in ...**

- More Outsourcing
- Worsening of Skills Shortage
- Concentration of Skills in Providers (Not the Buyers)
- More Heterogeneity
- Less Standardization
- Strategic & Operational Dependencies
- New Vulnerabilities ...

Implications

- **Complexity = Threat?**

- Defense is Anchored in the Efficiency of IT
- IT as the Quintessential “Enabling Technology”
- But IT Expertise is Highly Specialized, Expensive & Not Always Timely or Dependable

- **Complexity = Vulnerability?**

- Instead of Investing in a Military Industrial Complex, Why Wouldn't Adversaries Just Invest in a World Class Digital Complex: It's Cheaper & More Effective

Implications

- **Complexity = Threat?**
 - Defense is Anchored in the Efficiency of IT
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 - But IT Expertise is Highly Specialized, Expensive & Not Always Timely or Dependable
- **Complexity = Vulnerability?**
 - Instead of Investing in a Military Industrial Complex, Why Wouldn't Adversaries Just Invest in a World Class Digital Complex: It's Cheaper & More Effective

Have We Unwittingly Levelled the Playing Field?

Implications

***How Do We Feel About a
Digital Arms Race?***

Implications

Is It Easier or Harder to Win?

What To Do ...

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What To Do ...

- **Invest in Public Integration, Interoperability, Connectivity & Security Centers of Excellence (PIICS)**

What To Do ...

- **Completely Re-Think the IT Acquisition Strategy to Focus on Functional Value Through “Standardization” (or Completely Decentralize & Pour the Money into PIICS)**

What To Do ...

- **Institutionalize the Point/
Counterpoint, Assess/Re-Assess
& Develop/Hack Process, Making
It Part of All Infrastructure &
Applications Development Projects**

What To Do ...

- **Create Mock CyberFoes,
Empowering Them With Existing
& Anticipated Capabilities**
- **Objectively Benchmark InfoWar
Threats**

MacroTrends in IT

That's It ..

Thanks ...

Questions?

Army After Next ...

Stephen J. Andriole is Senior Technology Officer, Safeguard Scientifics, Inc. and Principal, TL Ventures. He is formerly the Chief Technology Officer (CTO) and Senior Vice President for Technology Strategy at CIGNA Corporation, a \$20B global insurance and financial services company.

Dr. Andriole was the Director of the Cybernetics Technology Office (CTO) of the Advanced Research Projects Agency (ARPA). He is also formerly a Professor of Information Systems & Electrical & Computer Engineering at Drexel University in Philadelphia, Pennsylvania. He is was the George Mason Institute Professor of Information Technology and Chairman of the Department of Information Systems and Systems Engineering at George Mason University.

Some of his 28 books include *Interactive Computer-Based Systems Design and Development* (Petrocelli Books, Inc., 1983), *Microcomputer Decision Support Systems* (QED Information Sciences, Inc., 1985), *Applications in Artificial Intelligence* (Petrocelli Books, Inc., 1986), *Information System Design Principles for the 90s* (AFCEA International Press, 1990), *the Sourcebook of Applied Artificial Intelligence* (McGraw-Hill, 1992), a (co-authored with Len Adelman) book on user interface technology for Lawrence Erlbaum Associates, Inc. entitled *Cognitive Systems Engineering* (1995) and a book for McGraw-Hill entitled *Managing Systems Requirements: Methods, Tools & Cases* (1996).

Army After Next ...

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STRATEGIC HUMAN RESOURCES MANAGEMENT

**Deputy Chief of Staff for Personnel
Department of the Army
Requirements Analysis
15 June 1998**

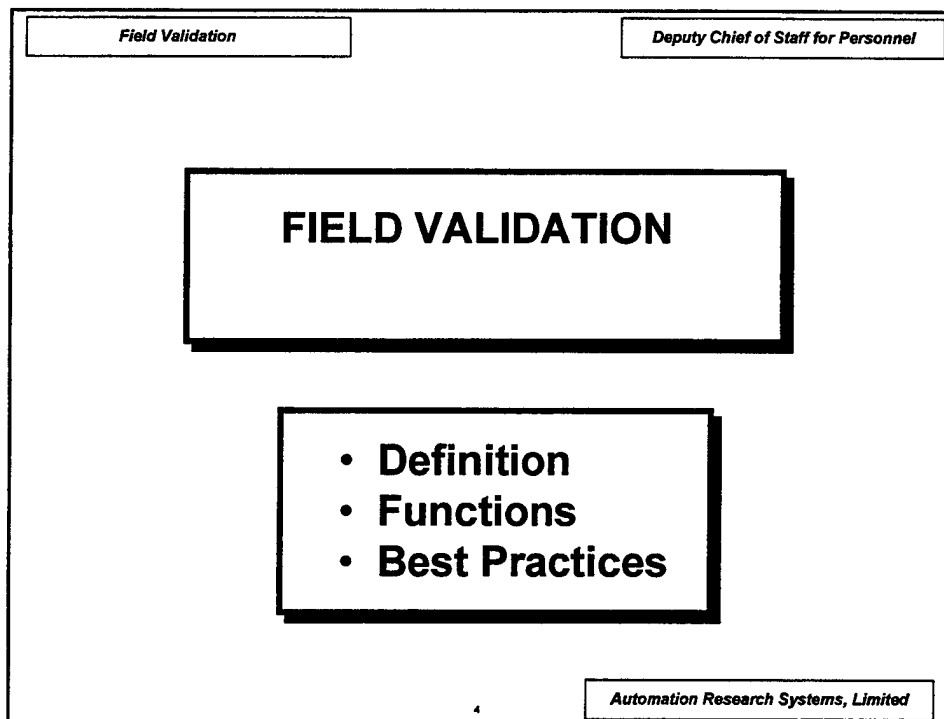
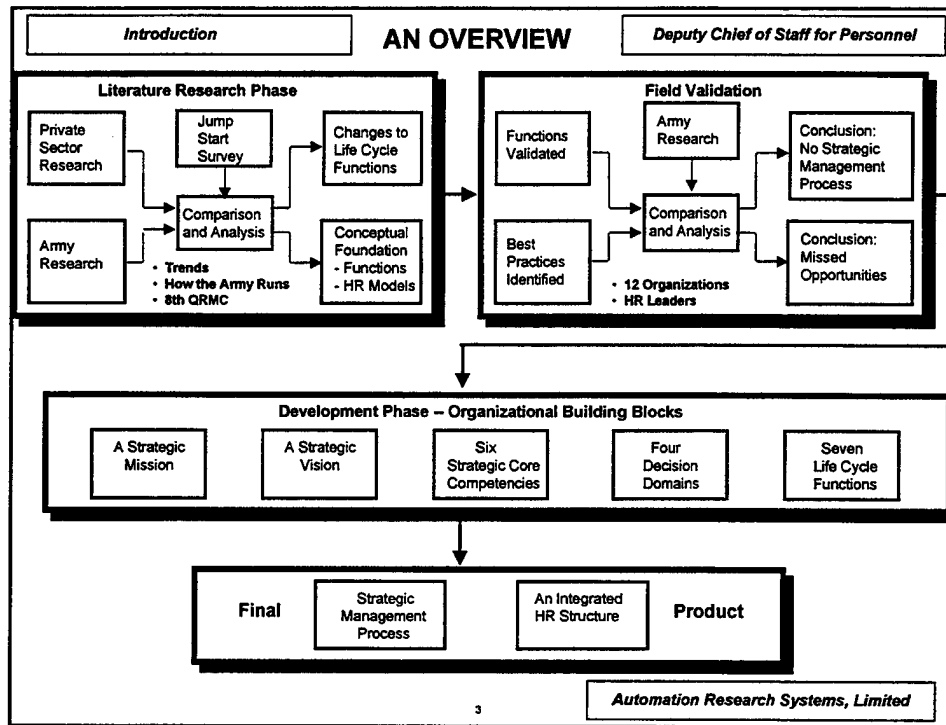
***Automation Research
Systems, Limited***

DECISION BRIEF

Deputy Chief of Staff for Personnel
Department of the Army
Requirements Analysis
15 June 1998

OBJECTIVE

- Examine Army personnel management.
- Examine private sector human resource management as a potential benchmark.
- Overlay private sector best practices on the Army.
- Develop recommendations for the Army leadership.
- Obtain DCSPER approval of ARS proposals --
 - HR concept and structure
 - Transition documents.



PRIVATE SECTOR HR INTERVIEWS

ORGANIZATION	WORK FORCE
Marriott (Lodging)	150,000
Delta Airlines	70,000
Bell South	50,000
UNISYS	32,000
American Red Cross	30,100
Coca Cola Enterprises, Inc	30,000
Giant Foods	28,000
NovaCare	20,000
Vinnell Corporation	5,500
Fannie Mae	3,600
University of Maryland	1,764
Human Resource Innovation	NA*

*Human resources Innovations is an *HR consulting firm* in the Memphis, Tn region. They *validated the evolving role of HR* in the private sector, as well as the *ARS conceptual foundation*.

EVOLVING ROLE OF HR LEADERSHIP IN INDUSTRY

Personnel
Administration



Human
Resources

"Human resources" is much more than a name change. HR as a name recognizes people as a resource and asset to the firms."

DRIVING FORCES –

- Hawthorne Experiments
- Motivational Theories
- Labor Unions
- Benefits
- New Laws
- Technology
- People as a Resource or Human Capital
- People as a Competitive Edge
- Diverse Work Force
- Social Challenges

Validated and
reinforced by interviews
conducted in the
private sector.

EVOLVING ROLE OF HR IN INDUSTRY

Human resources leadership as defined by today's HRM specialists: "a ***series of integrated decisions*** about the employment relationship that influences the ***effectiveness of employees and organizations.***"

Validated and reinforced by interviews conducted in the private sector.

HR FUNCTIONAL RESPONSIBILITIES (Private Sector)

Control

HUMAN RESOURCE FUNCTIONS	PRIVATE SECTOR
Strategic Goals and Objectives	Core
HR Plans and Policies	Core
Employment Law	Core

Operational

Organizational Structure	Variable
Recruitment	Core
Staffing	Core
Development and Training	Core
Retention and Well-Being	Core
Separation	Core

Integrating

Strategic Planning	Core
Deployment Planning	NA
Information Management	Core
Process Management	Core
Compensation and Benefits	Core
Health and Safety	Variable
Organizational Development	Core
Labor Relations	Core

OBSERVATION

HRM in the private sector and the Army perform the same basic functions -- only the names vary.

Field Validation

Deputy Chief of Staff for Personnel

COMPARISON OF HR EXECUTION RESPONSIBILITIES IN THE PRIVATE SECTOR AND THE ARMY

	FUNCTION	PRIVATE SECTOR	DCSPER	ACSIM	ASA(MRA) (CIVILIANS)	DCSOPS/ MACOMs	SURG GEN	TRADOC
Control	Strategic Goals and Objectives	HR	X	X	X			
	HR Plans and Policies	HR	X	X	X			
	Employment Law	HR	X		X			
Operational	Structure	HR	X			X		
	Acquisition	HR	X		X			X
	Distribution	HR	X		X			
	Development	HR	X	X	X			X
	Sustainment (Retention/QOL)	HR	X	X	X			
	Separation	HR	X		X			
Integration	Strategic Planning	HR						
	Deployment Planning	NA	X	X	X	X	X	
	Information Management	HR	X	X	X			
	Process Management	HR	X		X			
	Compensation and Benefits	HR	X		X			
	Health and Safety	HR	X		X		X	
	Organizational Development	HR	X		X	X		
	Labor Relations	HR			X			

Automation Research Systems, Limited

Field Validation

Deputy Chief of Staff for Personnel

BEST HR PRACTICES -- PRIVATE SECTOR

PRACTICE
A single HR leader
Responds to CEO
Participates in corporate strategic planning
Establishes integrated HR strategies and goals
Integrated strategies as the basis for objectives
Activities driven by integrated strategic decisions
Evolved from "supporter" to "strategic enabler"
Focused on leading -- not managing
Recognizes people as a resource (or capital)
Common HR functions (core)
Heavy emphasis on development programs
Process orientation
Customer sensitive
Structure alignment based on customer base
Strategies and goals linked to performance appraisal system
Well-being activities based on desire to recruit and retain people
Continually seeking a competitive edge.

OBSERVATION
Private sector
practices provide
a benchmark
for the Army

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BEST HR PRACTICES -- PRIVATE SECTOR (Applied to the Army)

PRACTICE	ARS ASSESSMENT
A single HR leader	Red
Responds to CEO	Green
Participates in corporate strategic planning	Amber
Establishes integrated HR strategies and goals	Red
Integrated strategies as the basis for objectives	Red
Activities driven by integrated strategic decisions	Red
Evolved from "supporter" to "strategic enabler"	Amber
Focused on leading -- not managing	Amber
Recognizes people as a resource (or capital)	Amber
Continually seeking a competitive edge.	Green

ASSESSMENT CRITERIA

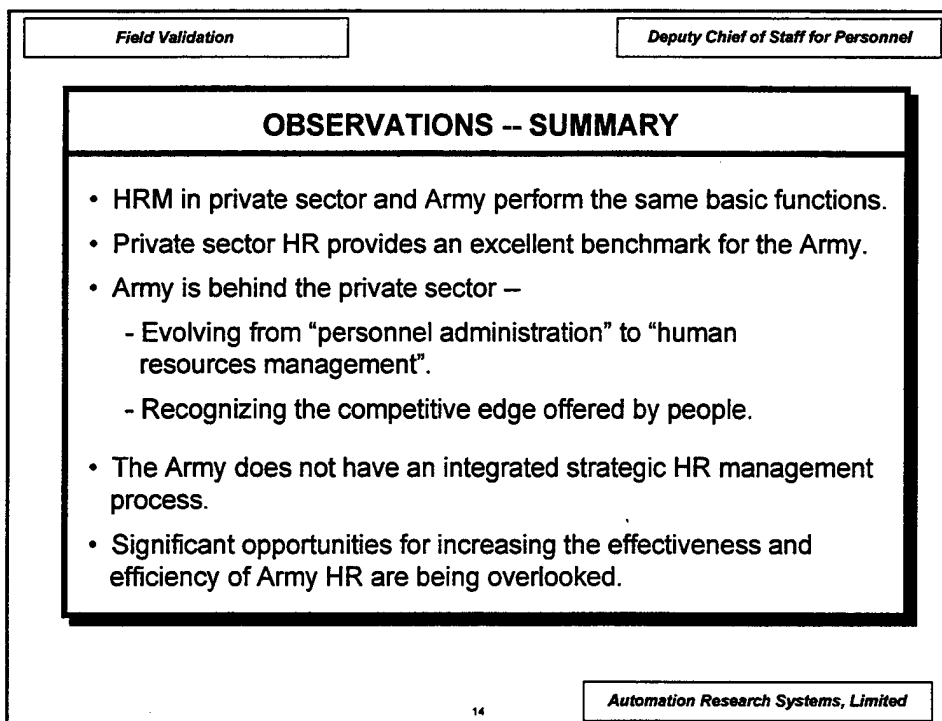
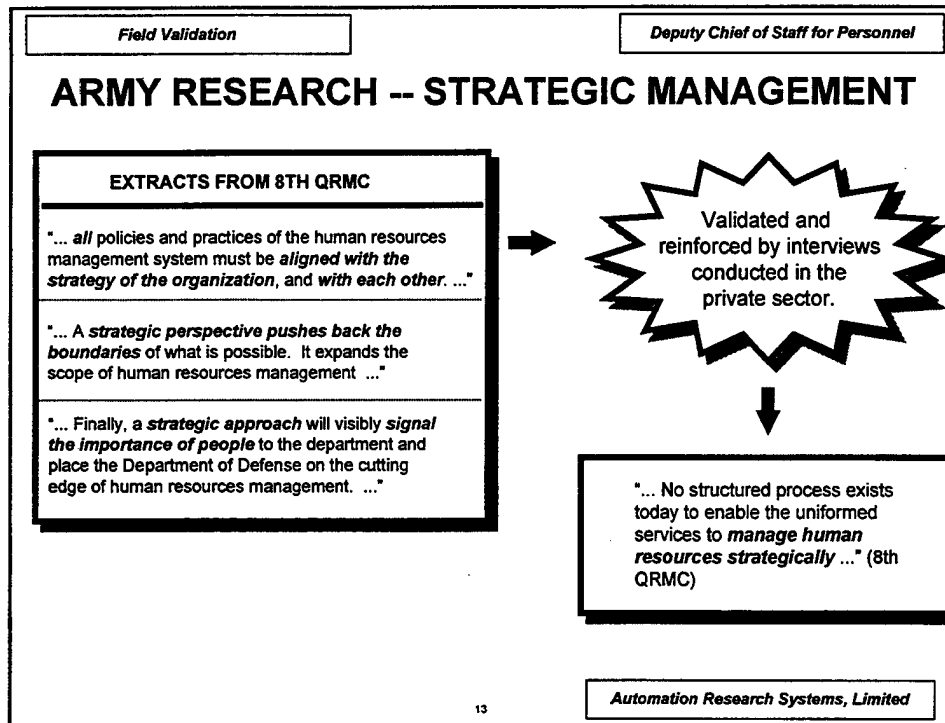
GREEN Practice exists fully in the Army.
 AMBER Practice exists to a degree -- could be more effective.
 RED Practice does not exist in the Army.

BEST HR PRACTICES -- PRIVATE SECTOR (Applied to the Army) (Continued)

PRACTICE	ARS ASSESSMENT
Common HR functions (core)	Green
Heavy emphasis on development programs	Amber
Process orientation	Amber
Customer sensitive	Amber
Structure alignment based on customer base	Red
Strategies and goals linked to performance appraisal system	Amber
Well-being activities based on desire to recruit and retain people	Amber

ASSESSMENT CRITERIA

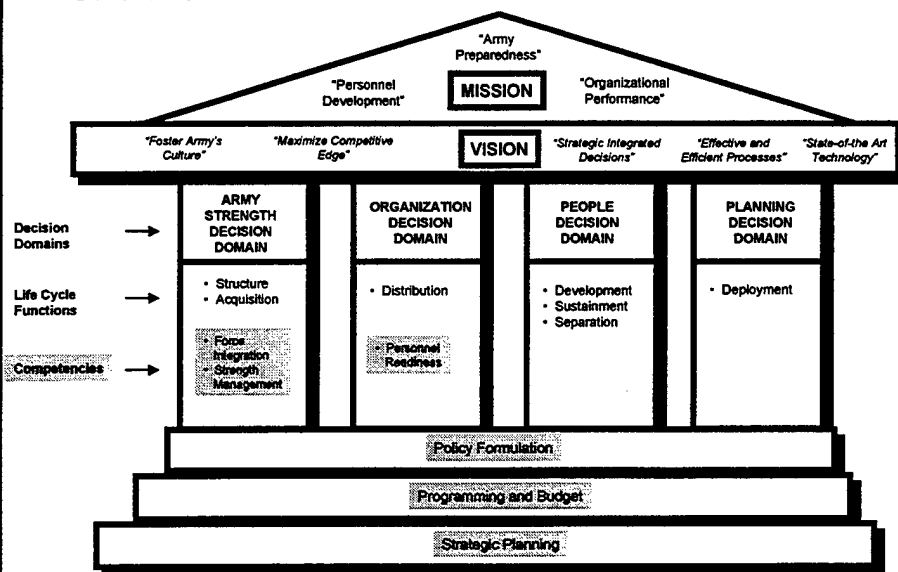
GREEN Practice exists fully in the Army.
 AMBER Practice exists to a degree -- could be more effective.
 RED Practice does not exist in the Army.



BUILDING BLOCKS FOR STRATEGIC HR MANAGEMENT

- Mission
- Vision
- Core competencies
- Decision domains
- Life Cycle Functions

STRATEGIC HR MANAGEMENT PROCESS -- BUILDING BLOCKS



A STRATEGIC HR MISSION -- ARMY

Develop integrated human resource **strategies** and make **decisions** to **acquire, distribute, develop, deploy, sustain, compensate**, and **separate** people enabling the **total Army** to prepare for and conduct military operations.

A recent study of Fortune 500 firms performing well – concluded that **high performers** have **more comprehensive mission statements** than low performers.

A clear mission statement describes the **values** and **priorities** of an organization. It compels strategists to think about the nature and scope of present operations and to assess the future.

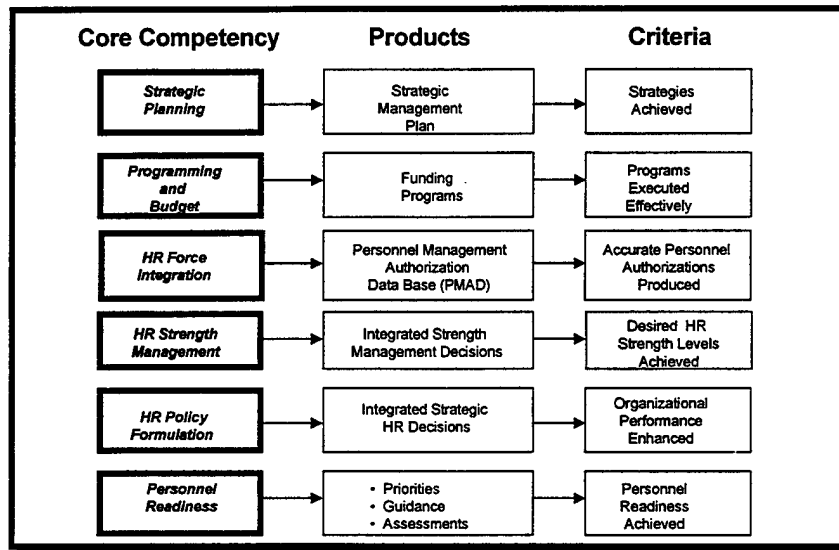
A STRATEGIC HR VISION

"The Army is People"

An organization that **promotes the Army's culture** and maximizes the competitive advantage offered by people... by producing integrated strategic human resources **decisions** for the **total Army**...culminating in **effective, efficient** human resource **processes**... supported by **state-of-the-art technology**... enhancing **human development, Army preparedness, and organizational performance**.

Vision statement answers the question: "What does an organization want to become?"

STRATEGIC HR CORE COMPETENCIES -- ARMY



Slide Revised 16 Jun 98

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A TOTAL ARMY HR FOUNDATION

HR will achieve this,

THE VISION

"The Army is People"

An organization that *promotes the Army's culture* and maximizes the competitive advantage offered by people... by producing *integrated* strategic human resources *decisions* for the *total Army*...culminating in *effective, efficient* human resource *processes*... supported by *state-of-the-art technology*... enhancing *human development, Army preparedness, and organizational performance*.

and accomplish this,

THE MISSION

Develop integrated human resource *strategies* and make *decisions* to *acquire, distribute, develop, deploy, sustain, compensate, and separate* people enabling the *total Army* to prepare for and conduct military operations.

by doing these things well,

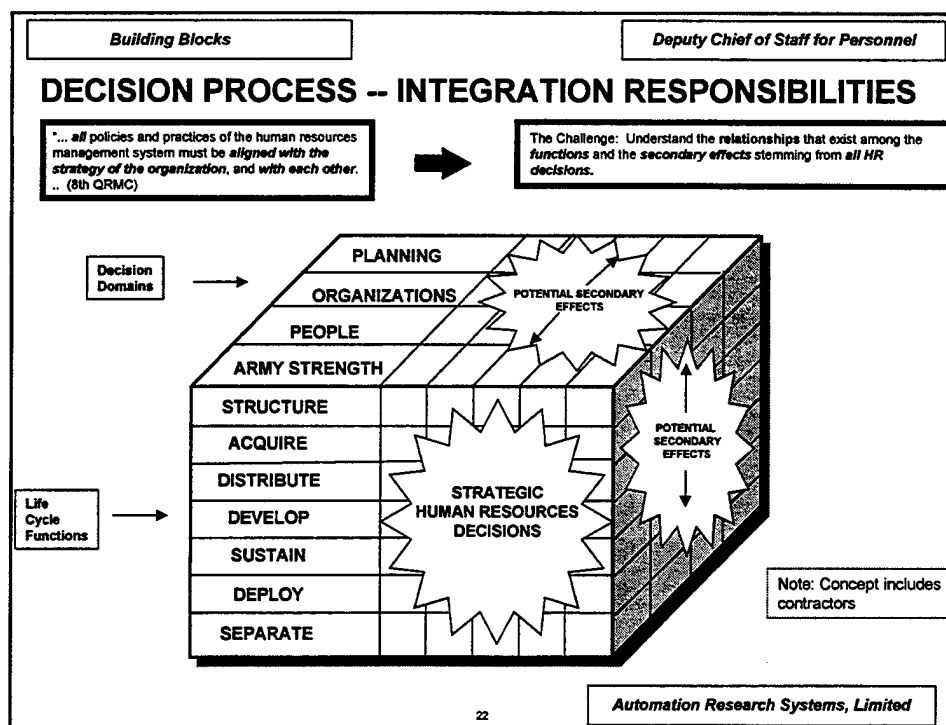
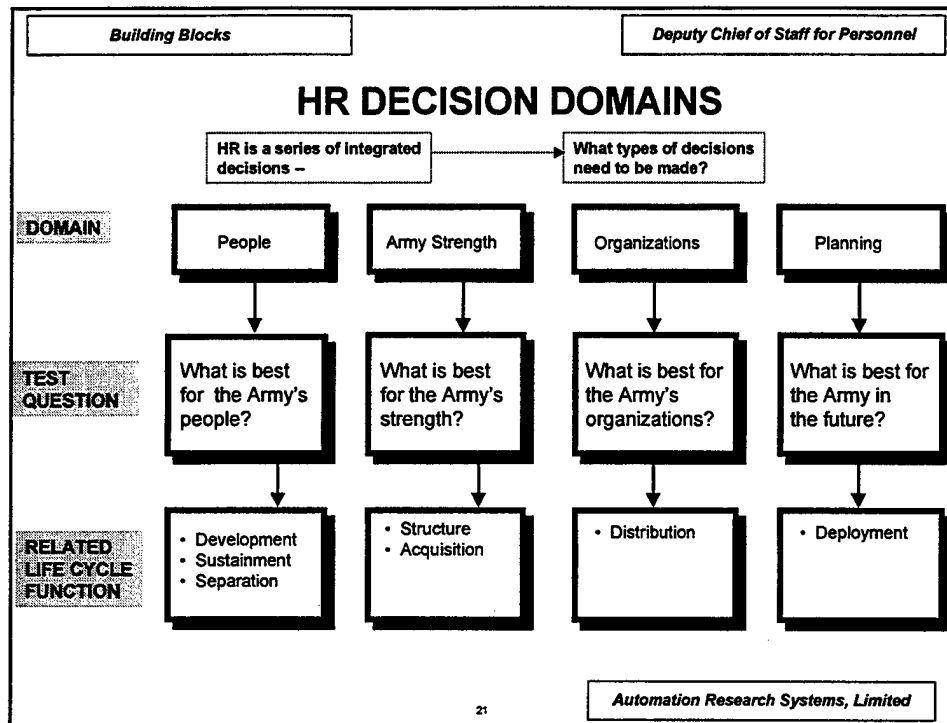
STRATEGIC CORE COMPETENCIES

- *Strategic Planning.*
- Human resources *Programming and Budget.*
- Human resources *Force Integration.*
- Human resources *Strength Management.*
- Human Resources *Policy Formulation.*
- *Personnel Readiness.*

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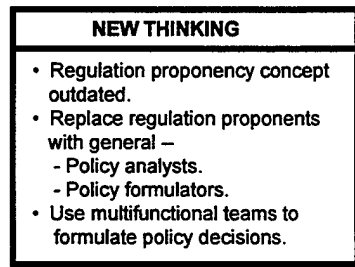
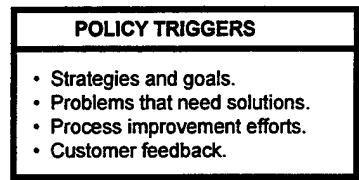
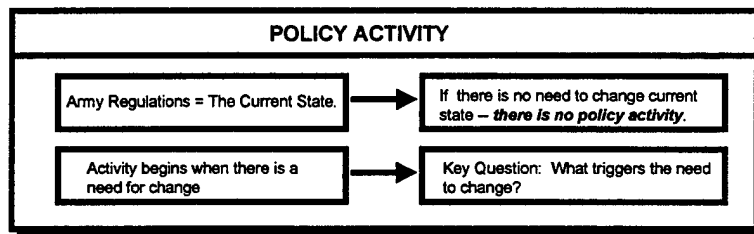
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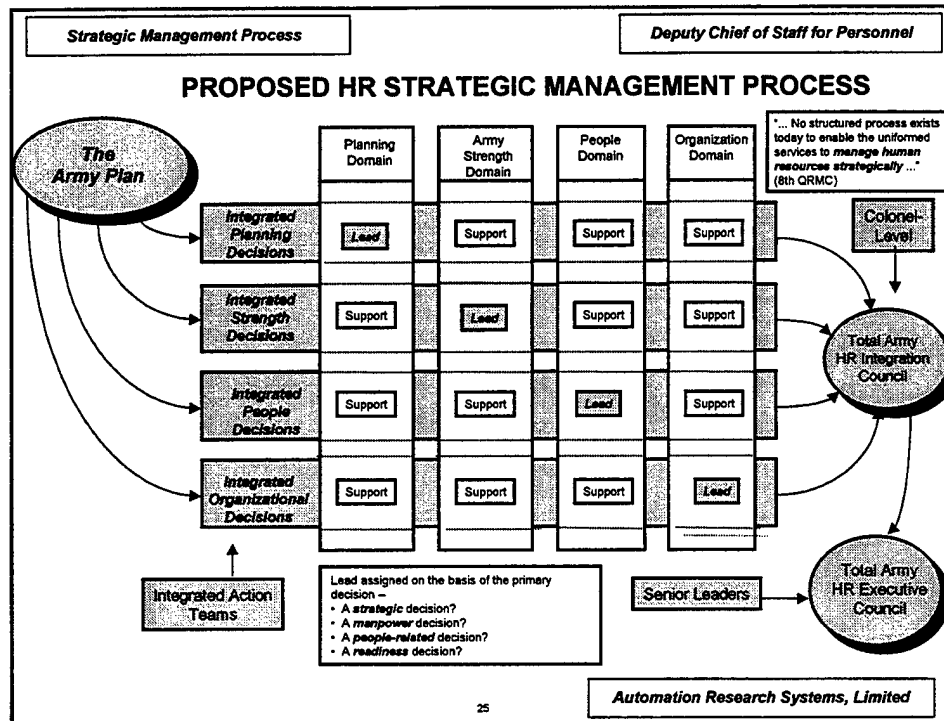
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AN HR STRATEGIC MANAGEMENT PROCESS

STRATEGIC POLICY FORMULATION





Strategic Management Process **Deputy Chief of Staff for Personnel**

HR STRATEGIC MANAGEMENT PROCESS (Examples)

PROBLEM	PLANNING DOMAIN	STRENGTH DECISION DOMAIN	PEOPLE DECISION DOMAIN	ORGANIZATION DECISION DOMAIN
Forecast indicates Army will be over its allowed end-strength	Secondary Effect	Primary Effect	Secondary Effect	Secondary Effect
Soldiers with convictions may not be issued weapons	Secondary Effect	Secondary Effect	Primary Effect	Secondary Effect
Sexual harassment continues to be a serious problem	Secondary Effect	Secondary Effect	Primary Effect	Secondary Effect
Army leadership plans a significant change to the Army's structure	Secondary Effect	Primary Effect	Secondary Effect	Secondary Effect
Structure changes have significantly increased the demand for an MOS	Secondary Effect	Secondary Effect	Secondary Effect	Primary Effect
Changing demographics	Primary Effect	Secondary Effect	Secondary Effect	Secondary Effect

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ARMY HR OPPORTUNITIES

- Strategic Management Process
- Power Projection Planning

HR STRATEGIC MANAGEMENT OPPORTUNITIES

Significant opportunities to increase the *effectiveness and the efficiency* of HR processes could be realized from a *strategic management process* with common strategies and objectives for all HR leaders.

CURRENT OBSTACLES

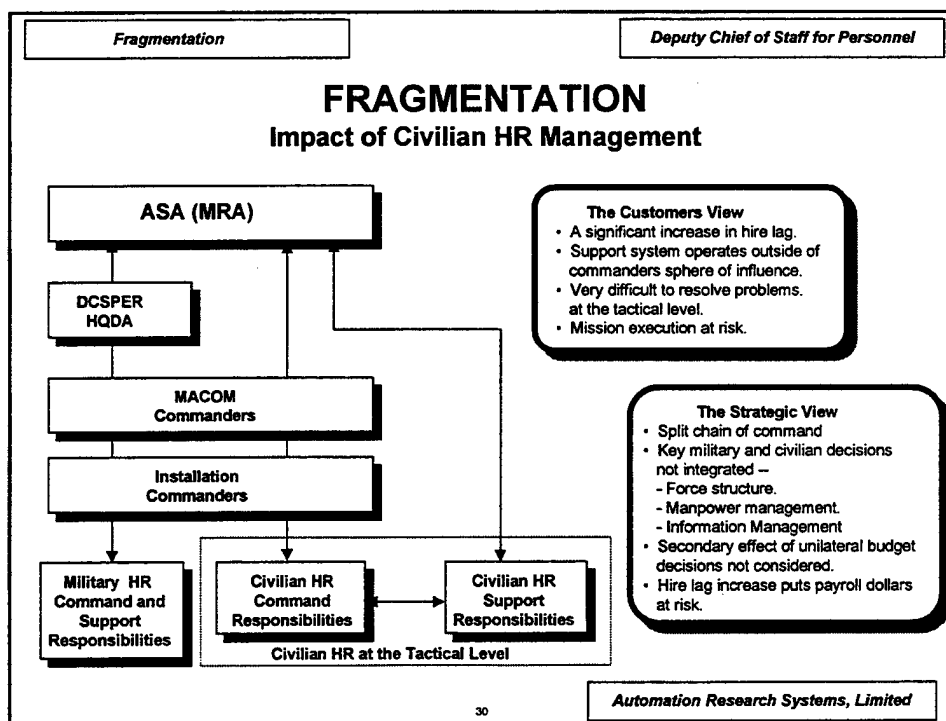
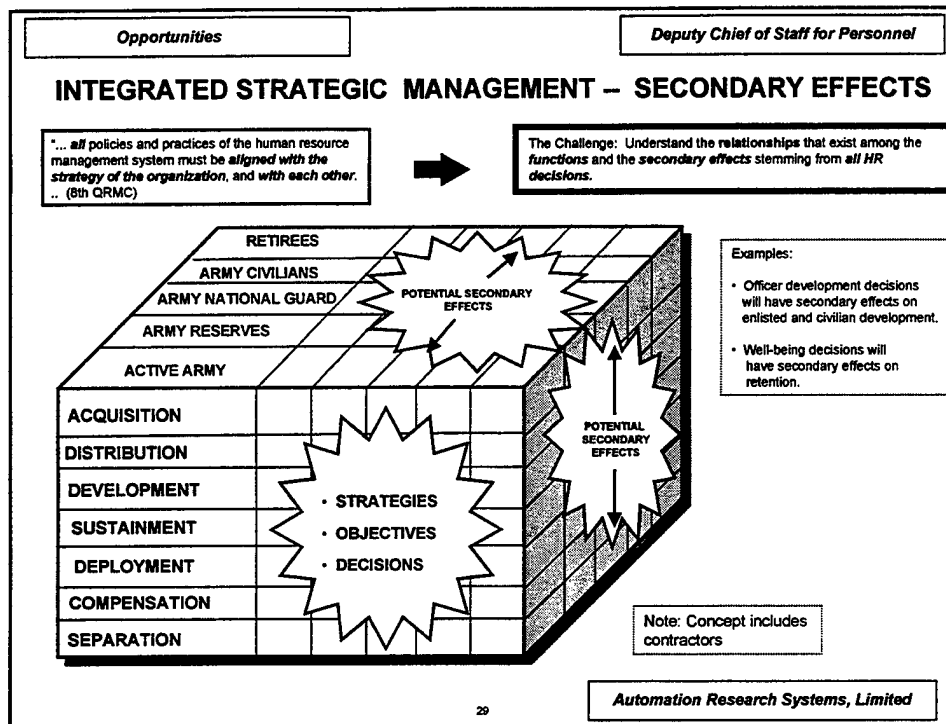
- HR responsibilities *fragmented* at departmental level.
- Leadership focused on the *parts* instead of the whole.

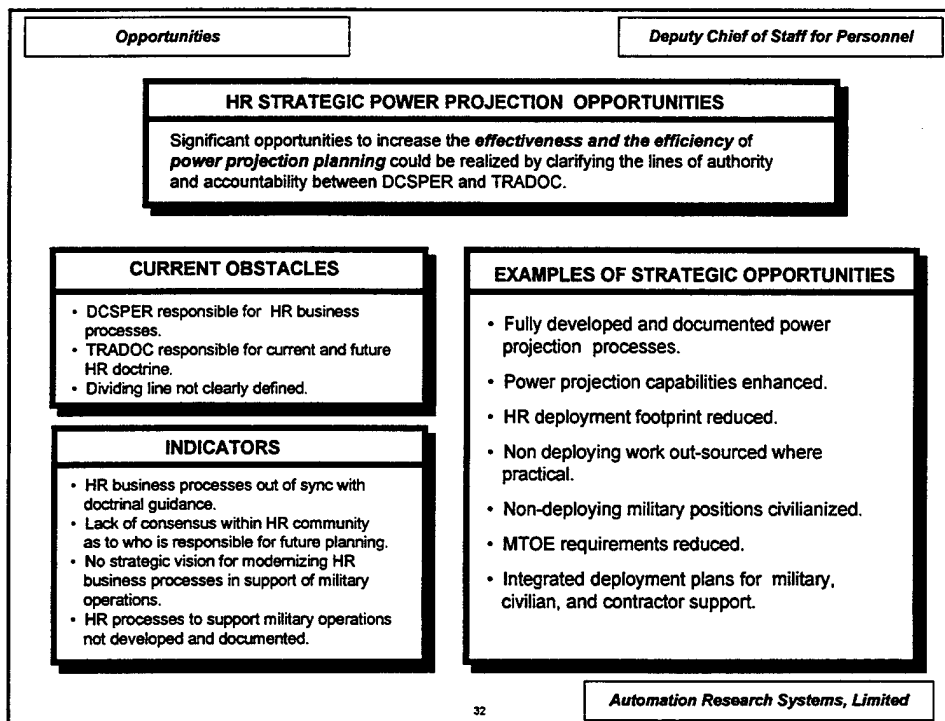
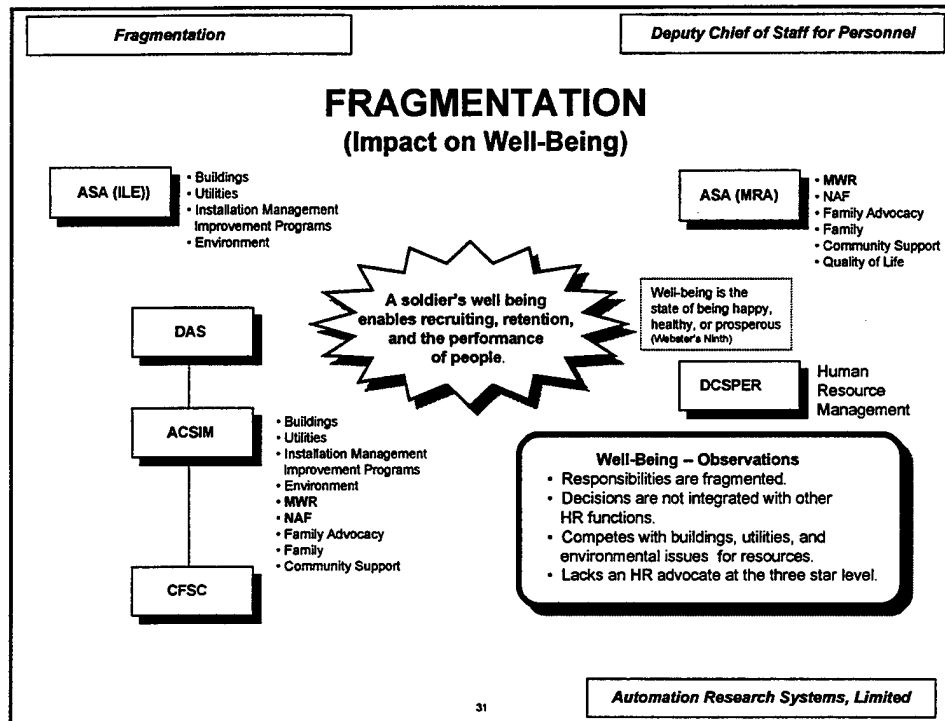
INDICATORS

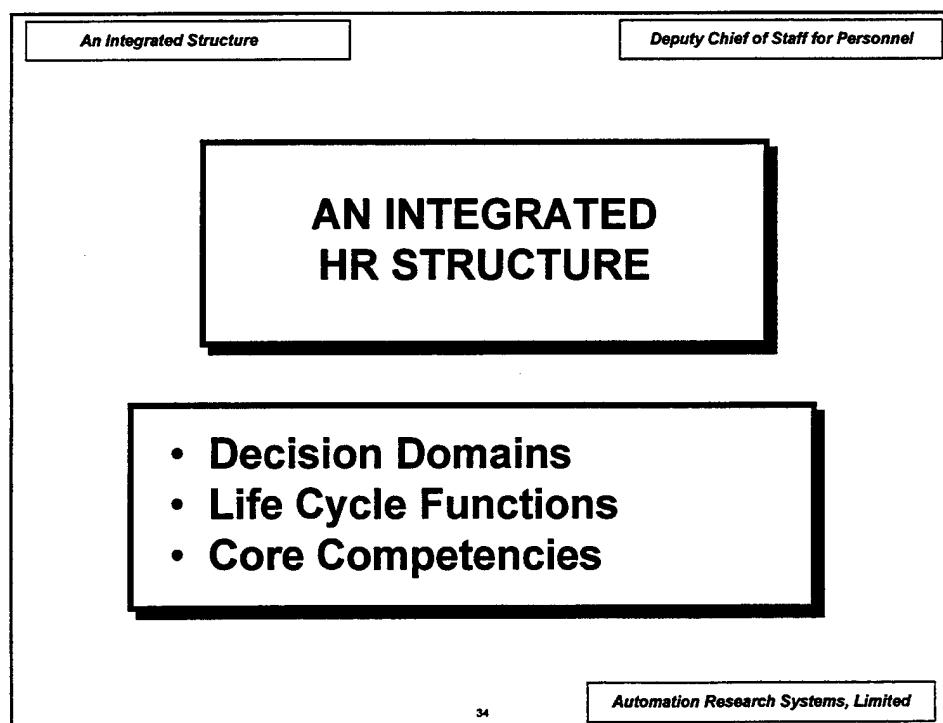
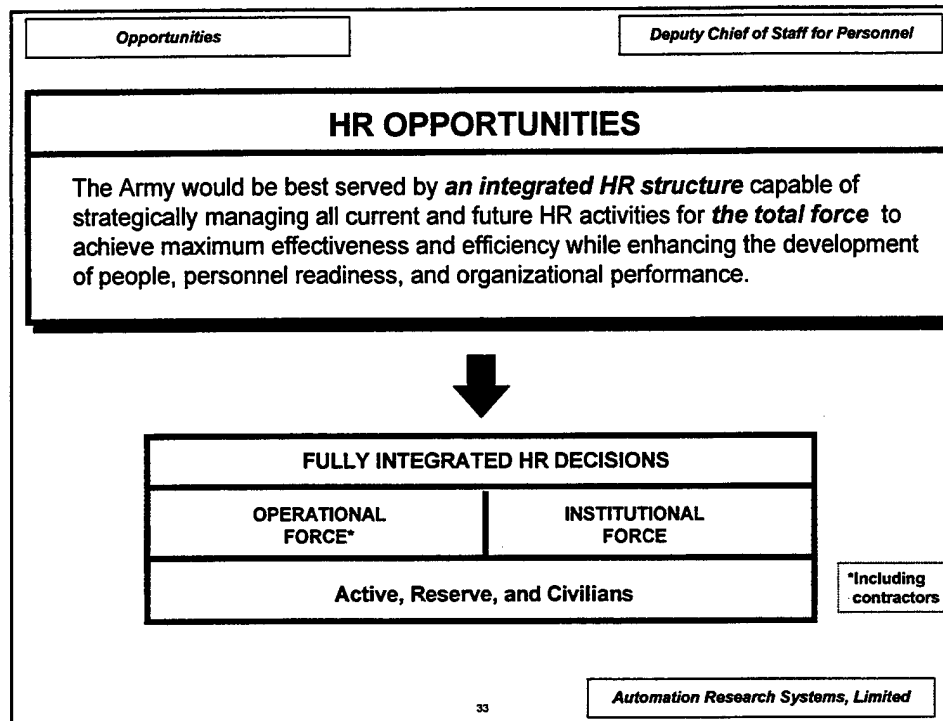
- Reactive rather than anticipatory decisions.
- Fragmented human development programs.
- Little synergy among similar HR functions.
- Automation support poorly integrated.

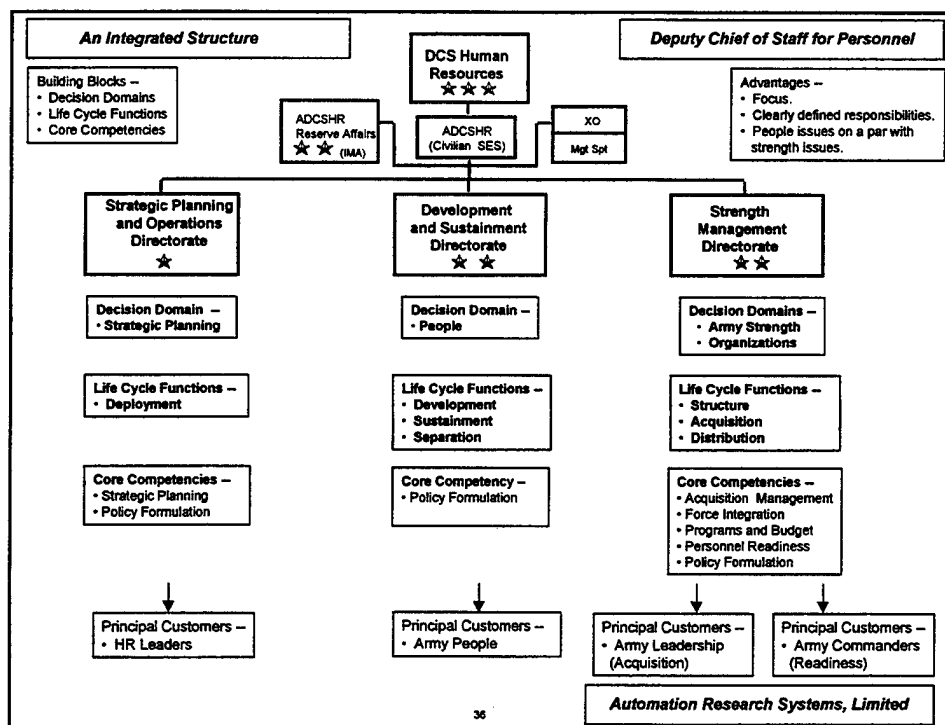
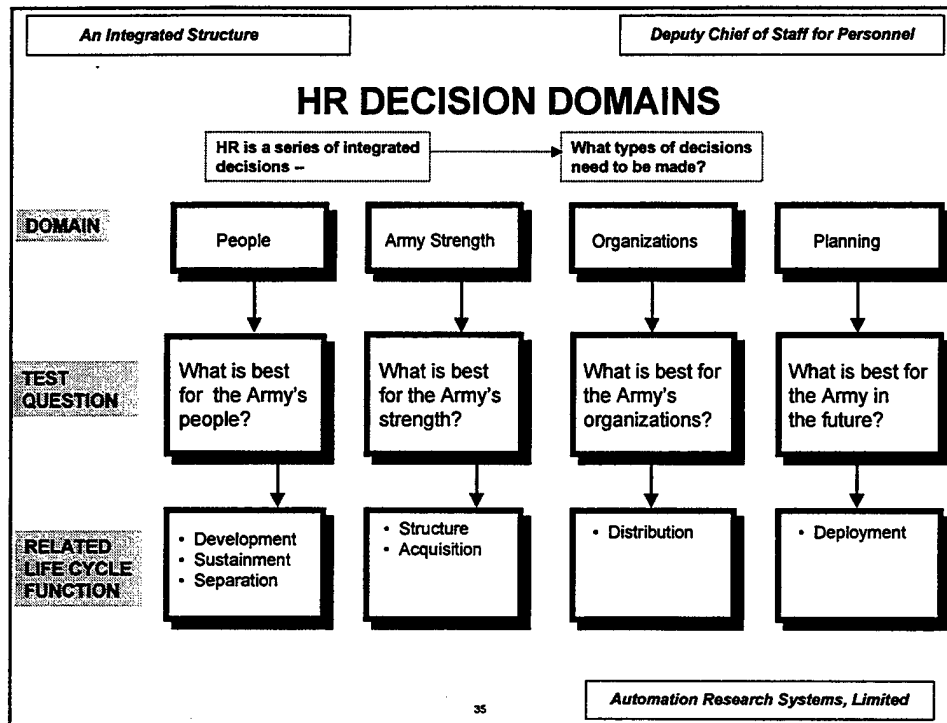
EXAMPLES OF STRATEGIC OPPORTUNITIES

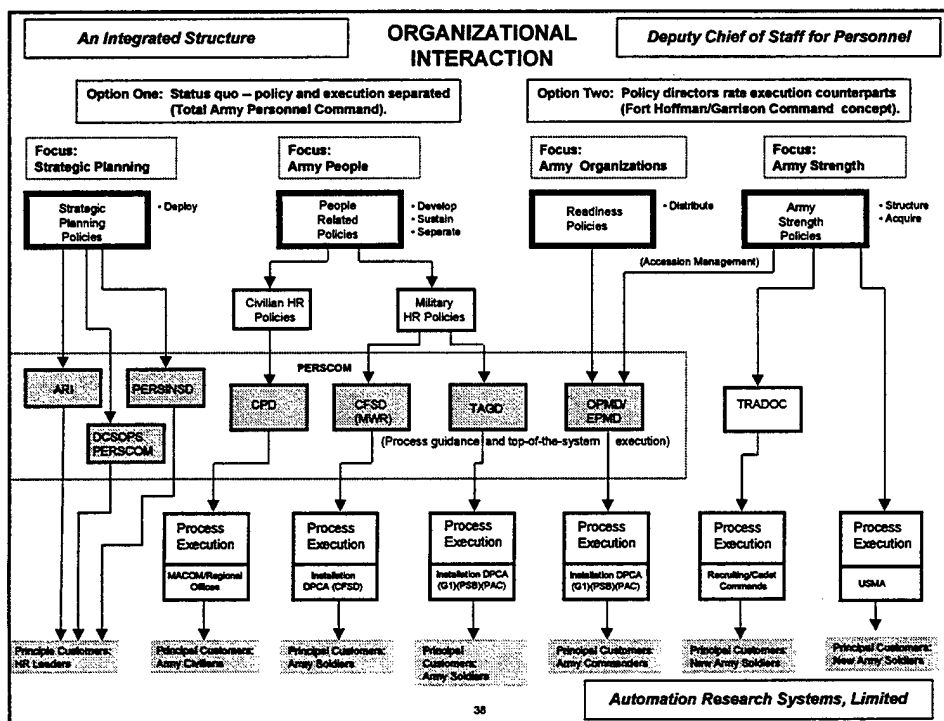
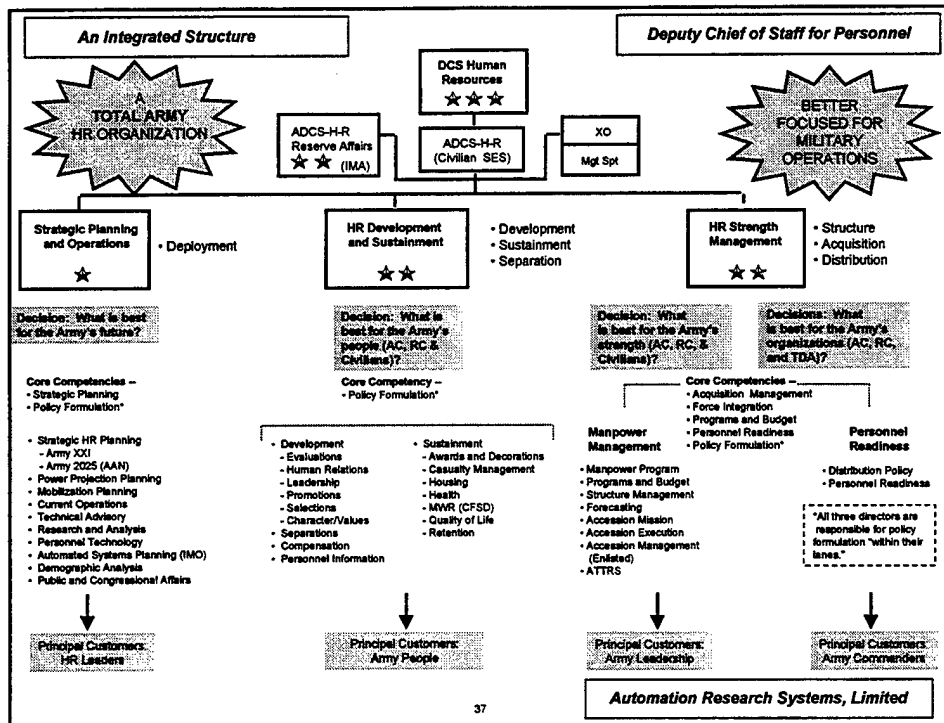
- Military and civilian HR functions integrated at the departmental level.
- Departmental functions executed with greater efficiency.
- All human development programs working from a common set of strategies and objectives.
- A single advocate for both military and civilian well-being issues and programs.
- Integrated compensation strategies and objectives.
- Common automated systems for military and civilian HR.
- Military and civilian HR functions share best practices at the tactical level.
- Recruiting, retention, and well-being decisions integrated.











SUMMARY

- Conclusions
- Transition Plan

CONCLUSIONS

- Army XXI and the Army After Next will demand greater effectiveness and efficiency in the management of the Army's human resources.
- A strategic HR management system and an integrated structure provides the potential for meeting that demand and capitalizing on the competitive edge offered by people.

TRANSITION PLAN -- STEP ONE

- Approve ARS requirements analysis --
 - Mission.
 - Vision.
 - Competencies.
 - Decisions domains.
 - Organizational structure.
 - Strategic management process.

TRANSITION PLAN -- STEP TWO

- Initiate action to bring about change --
 - Redesignate ODCSPER as ODCS H R.
 - Reorganize HR structure.
 - Establish a strategic management process.
 - Reassign civilian HR to ODCSHR.
 - Reassign CFSC to ODCSHR.
 - Initiate action with TRADOC to clarify roles and responsibilities for power projection.
- Announce change --
 - CSA Message
 - HQDA General Order
- Market and educate.

ARS TRANSITION SUPPORT

- Organization and Functions Regulation, ODCSHR –
 - HR Framework.
 - Organization.
 - Responsibilities.
 - Strategic management process.
- AR 600-1, Army Human Resources Management.
- 42/43 interaction and development guidance.
- Letter to TRADOC w/proposed MOU to clarify roles and responsibilities.
- Proposed HR dimension to "How the Army Runs."

ANNOTATED BRIEFING

RAND

Future Personnel Resource Management: Initial Report

*Bruce R. Orvis, Brian Nichiporuk,
Laurie L. McDonald, Denise Quigley,
Narayan Sastry*

AB-210-A

June 1998

Prepared for the United States Army

Arroyo Center

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PREFACE

As the future Army evolves toward new missions and structures, it needs to look ahead to demands that may arise from long-term changes such as a different range of missions, new technology, or civilian education and demographic changes. For example, new missions and technology may require soldiers with different skills, higher aptitude, and greater flexibility. In response, the Army may need to recruit and train a different mix of soldiers, retain a more senior force, or increase civilianization of positions now held by Active Component soldiers. These changes, in turn, could imply different personnel processes, such as recruiting from broader markets, increased retention for high investment technical skills, promotion to support a more senior structure, or more distance- and time-phased learning. An integrated assessment to explore the possible nature and extent of such changes, potential Army adaptations, and their implications for personnel management is being carried out by the Arroyo Center's project entitled "Future Personnel Resource Management." The materials provided in this annotated briefing document the initial report to the sponsor on the work conducted under the project.

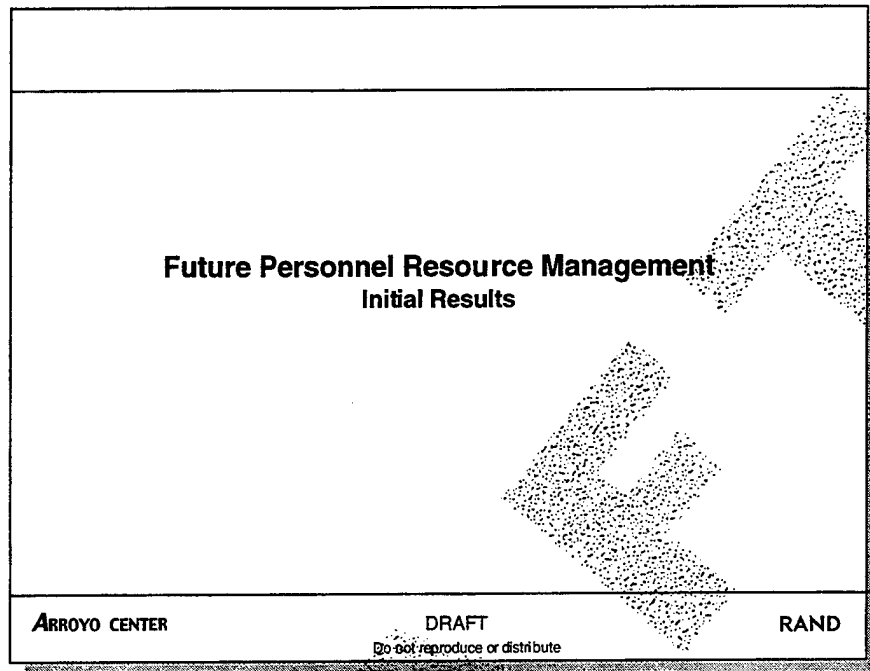
This research was sponsored by the Deputy Chief of Staff for Personnel and was conducted in the Arroyo Center's Manpower and Training Program. The Arroyo Center is a federally funded research and development center sponsored by the United States Army.

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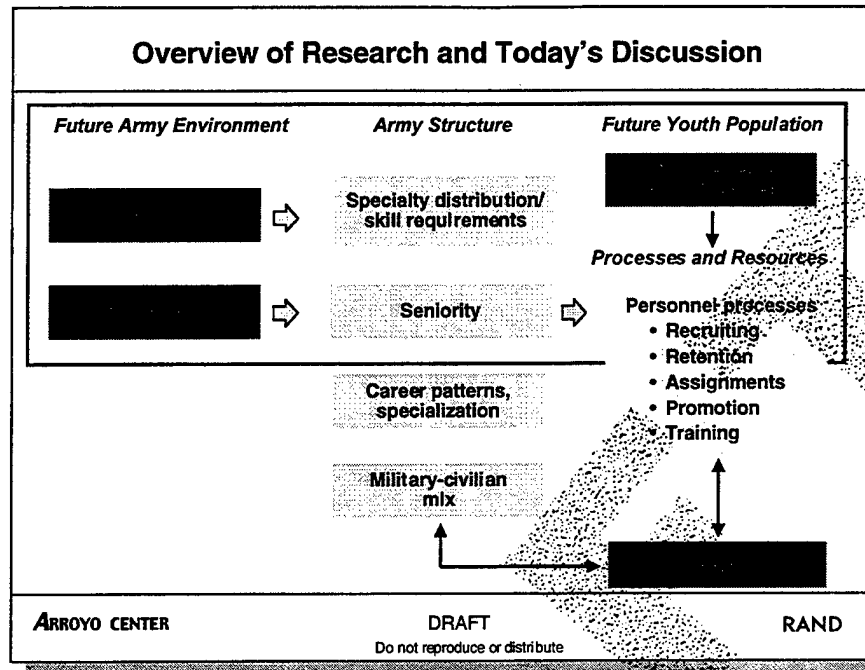
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1. BACKGROUND



This briefing constitutes the initial report of the Future Personnel Resource Management Project. It describes the preliminary results of analyses initiated last fall for the Army's Deputy Chief of Staff for Personnel.



The genesis of the project lies in concerns about the nature of the Army's future environment in the 2020-2025 timeframe. What types of worlds and missions will characterize the Army After Next (AAN) timeframe? What changes in technology will have occurred and with what impact on the employment of different equipment?

These potential changes in missions and technology could have important impacts on the Army structure. This impact can affect several dimensions, as seen in the center column of the chart, beginning with the types of military occupational specialties that are needed, the densities of personnel within those specialties, and the aptitude requirements to fill those jobs. Similarly, there can be changes in seniority requirements; for example, more autonomy in operations or more sophisticated technology may require a more senior force. There also may be changes in career patterns and specialization. For example, at one time in the past specialization continued through the grade of E7; today, it stops at E4, and we begin to move soldiers into a management track thereafter. That may or may not make sense in the future, depending on the complexity of the jobs in the future force. Last, there also are a number of issues involving matters of military-civilian mix. One concerns our ability to recruit the required number of youth with the aptitudes needed in 2020. If we cannot do so, we may need to civilianize certain positions now filled by active duty soldiers. A second involves the seniority requirements for the future forces. For example, given loss rates for the various pay grades, it is possible to have forces so senior that vacancies in the higher grades cannot be filled simply by promotion. Instead, it may be necessary to use lateral entry of civilians into the force at higher grades to help fill them.

At the same time as changes are occurring in the Army's environment and force structure requirements, there will be changes in the US youth population that we need to recruit into the future Army. These changes involve educational trends such as increased college attendance; they also involve changes in basic demographics, for example, in the number of youth and in their demographic composition. The mix of structure requirements and youth population changes directly impinges on the key personnel processes and related resource requirements needed to man and sustain the force, as indicated in the box on the right side of the chart. These include recruiting, retention, job assignments, promotion, and training. In recruiting, for example, they will affect the number of youth that have to be recruited into future forces, what markets the Army will ultimately have to recruit them from (e.g., high school senior, graduate, or college markets), and related resource requirements.

Similarly, there will be impacts on retention. If the implied recruiting requirements are not achievable, we may need to consider tradeoffs between retention levels and recruiting needs. More generally, we also will want to consider to what extent a greater investment in developing skills, for example, to deal with sophisticated technology, may suggest increasing retention profiles.

Job assignment patterns also could change as we attempt to build a greater level of expertise in each assignment, and, as we noted earlier, there are potential promotion issues in sustaining a senior force. Similarly, there are potential training issues. For example, what knowledge and abilities should youth possess at the time they are recruited into the Army, what needs to be provided in initial training, how often does that training need to be updated, and in what form should that updating occur—in the classroom, through distance learning, or through self-development?

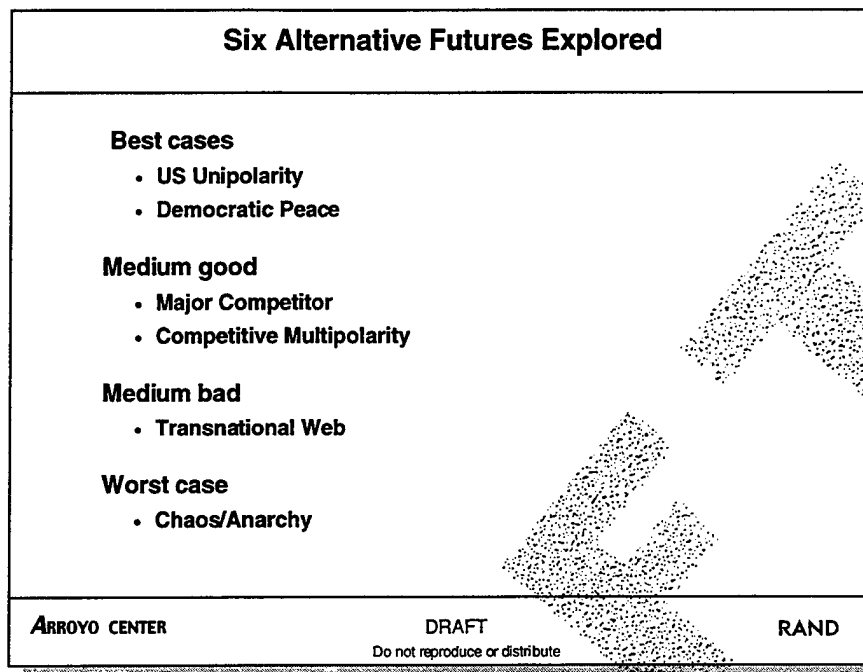
In reality, there will be more than one feasible structure that meets the Army's requirements and, similarly, more than one set of personnel policies that can support each structure. They will vary in their costs. The box at the lower right of the chart is included to indicate that those costs should be considered as the Army assesses which future structures and personnel policies may be most reasonable.

In this initial project briefing, we discuss some of the issues pertaining to the future Army environment, structure, and personnel processes, and to the US youth population, as highlighted in the lightly-shaded area at the top of the chart. We begin on the left side of this shaded area, with questions relating to the future Army environment.

2. FUTURE ENVIRONMENT

Future Army Environment		
Questions • What might the world look like in 2020-2025 and with what broad implications for Army missions and technology? • What would be some of the desired force characteristics for these future worlds?		
Approach • Explore a wide range of illustrative futures differing in their implications for Army missions, technology, and force requirements • Draw future worlds, implied Army missions, and general force characteristics from RAND research on AAN and Army XXI		
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In broad terms, the questions about the future Army environment addressed in this briefing concern what the world might look like in 2020-2025, and with what broad implications for Army missions and related technology. We also will look at the implications of those missions for desired force characteristics in these future worlds. The purpose is to explore a wide range of illustrative futures that differ in potential Army missions and related force requirements, so that we may explore the potential implications for personnel resource management. It is not to point to one particular answer as being "the future requirement." We will draw the future worlds with their related missions, equipment, and force characteristics from another Arroyo Center project: RAND's research for the Office of the Deputy Chief of Staff for Operations and Plans on AAN and Army XXI requirements.



This chart illustrates the methodology employed in exploring future worlds. It unfolds in four major steps. (See "Future Army Forces: A Capstone Project's Second Report," RAND, AB-216-A, 1998.)

Initially, the five development variables found in The Army Plan (TAP)—Demographics, Geopolitics, Economics, Technology, Environment—were used to build six alternative future worlds that the Army may face in the 2020-2025 timeframe. This was done by creating a matrix that included good, medium, and bad outcomes for each development variable from the standpoint of US national interests. These outcomes were then mixed in good/good, medium/good, medium/bad, and bad/bad combinations to produce our four categories and six alternative futures.

Second, a preferred illustration or "scenario" was generated for each alternative future. Scenarios were generated based on the "most demanding" standard; i.e., a particularly stressful scenario that could be built for the Army in each world was the one selected for this analysis.

Next, the strategies to tasks methodology was applied to each scenario, resulting in a list of critical operational tasks that the Army would need to perform. These operational tasks were easily converted into desired capabilities.

Finally, a set of desired force characteristics was created for each world—characteristics that would allow the Army to carry out the operational tasks mentioned above. These "bundles" of characteristics are the six future armies that represent a principal output of the present study.

Here we see the six alternative futures for 2020-2025 arrayed along a spectrum from top to bottom, in decreasing order of preference. At the top are US Unipolarity and Democratic Peace, which are best case worlds. At the bottom is Chaos/Anarchy, which is our worst case world. The different alternative futures are ranked according to the standard of US national interest. This spectrum of alternative futures is not intended to be exhaustive, but instead only provides an illustrative sample of what the future might hold.

US Unipolarity/Light Lethal Army

Features of this future

- US dominant militarily, economically, politically, culturally
- China/Russia/India/EU do not challenge US leadership
- Regional powers hostile, intimidate neighbors with WMD and asymmetric strategies
- Sporadic minor peace ops in areas of communal violence/famine

Desired force characteristics

- Light force that can self-deploy across large distances
- Operational mobility with significant firepower, including deep fires, all terrain combat vehicles
- Significant deployable TMD and ISR capability

Force size and composition

- Total AC force size like today's; half of AC is second tier of Army XXI forces
- AAN forces primarily infantry, armor, artillery, engineering, medical, air, and other support

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One of our best case worlds is "US Unipolarity." In US Unipolarity America remains the globe's only true superpower, and is dominant militarily, economically, politically, and culturally. None of the other large powers can challenge America across the board and thus they acquiesce to the continuation of the Pax Americana.

This environment would present the Army with two main contingency types. First, it would need to prepare for conflicts against rogue regional powers using either WMD or asymmetric strategies exploiting niche conventional capabilities. This contingency type is similar in form to the MRC planning scenarios used as benchmarks by the DOD today. Second, the Army would need to concern itself with minor peace operations in those areas of the developing world that are wracked by communal violence, famine, or general disorder. America's position as the only long-term guarantor of global stability would mandate it to periodically use military force to stabilize parts of the developing world. A conflict involving an Indonesian attempt to seize portions of Malaysian territory on Borneo was chosen to be our illustrative scenario for this future because of the long distance from CONUS to the theater as well as the harsh nature of the local jungle terrain.

The "Light Lethal Army" of this future world is designed to fight and win wars against such rogue regional powers that employ niche capabilities effectively. It is able to self-deploy much of its force structure over intercontinental distances, probably with the use of advanced tilt rotor technology. Once in theater, the Light Lethal Army would operate with a healthy mix of firepower and mobility—moving rapidly over all types of terrain with a new family of armored vehicles, while at the same time using organic deep fires systems (some autonomous) against packets of enemy infantry and reachback systems against the adversary's supply infrastructure and armored reserves. Coupled with these ground combat capabilities, the Light Lethal Army will require a solid TMD umbrella as well as an ISR suite that can detect infantry movements in harsh terrain.

The Light Lethal AAN force would be backed up by an equally-sized force of Army XXI divisions which would arrive in the theater 30-60 days after the outbreak of hostilities. This Army XXI force would be manned at 80% fill in peacetime. The total Active Component in this world would be roughly equal in size to today's active Army. The AAN force would consist primarily of infantry soldiers (about 30%); accompanied by roughly equal numbers of artillery, armor, engineering, and medical personnel (about 10% each); smaller numbers of aviation and air defense specialists, and other logistics, supply, and maintenance personnel (15-20%).

Democratic Peace/Policing Army

Features of this future

- Spread of democracy eliminates risk of inter-state wars
- EU, China, Japan are major economic, but not political, rivals of US
- Residual social disorder and ethnic violence in parts of the Southern Hemisphere
- Army participation in multinational stabilization ops

Desired force characteristics

- Protected light infantry, SF, airmobile units, MOUT, coalition interoperability
- Robust urban intelligence gathering capability
- Advanced nonlethal weaponry, personnel protection, and SIGINT

Force size and composition

- Total AC force size about two-thirds of today's; no second tier of Army XXI forces
- AAN forces primarily infantry, MP, medical, SF, linguists, intel, air, and other support

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Our second possible world is "Democratic Peace." In Democratic Peace, we assume that liberal democracy has taken firm hold in most parts of the world. As a result, all of the world's large and medium powers have come to regard inter-state war as no longer being a legitimate instrument of national policy.

In this future, the principal security problems that concern the United States Army are related to residual disorder existing in those pockets of territory that have not yet adopted or been able to sustain democratic governance (e.g., Central Africa, northern Latin America). This disorder would be caused by ethnic violence, the influence of transnational criminal organizations, or famine. Our illustrative scenario here is a multinational, US Army-led order restoration mission to Bogota, Colombia following urban warfare between rival drug cartels.

We have set up a force called The "Policing Army" to meet the demands of the Democratic Peace world of 2020-2025. This force would be predominantly light, with packets of 1990s vintage armor scattered throughout. Some new technology would be needed, mainly better sensors for intelligence gathering in urban areas (e.g., nanotechnology), advanced nonlethal weaponry (e.g., sticky foam, sleep agents), and more effective personnel protection for infantrymen, such as lightweight body armor.

The Policing Army is about one-third smaller than today's active Army, and there are no Army XXI divisions in the active force structure. This absence of Army XXI divisions is due to the fact that, in the Democratic Peace world, there is virtually no threat of large scale armored aggression in regions of vital interest to the US. The AAN force consists primarily of infantry soldiers, accompanied by small contingents of armor and artillery (about 40%); Military Police and medical specialists (about 10% each); Special Forces, linguists, military intelligence, and aviation specialists (about 5% each); and other logistics, supply, and maintenance soldiers (about 20%).

Major Competitor Rising/Big War Army

Features of this future

- Single power or bloc rises to challenge US across the board
- Develops significant conventional and strategic nuclear capabilities including power projection and space; leverages RMA
- Prepare to fight multi-corps sized ground wars in two theaters simultaneously

Desired force characteristics

- Precision deep fires to defeat attacking echelons in concert with air power
- Highly mobile force with armored vehicles to counterattack and overrun remaining enemy positions
- Advanced air/ground/space C4ISR architectures and attack helicopters
- Ground based theater ASAT and TMD capability

Force size and composition

- Total AC force size 10% larger than today's; no second tier of Army XXI forces
- AAN forces primarily armor, artillery, infantry, air, medical, and other support

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Now we move to the medium good worlds. The first of these is labeled "Major Competitor Rising." In this environment, the US is faced with the prospect of a single power or bloc challenging it across the board. This competitor would be able to project conventional power, maintain a robust strategic nuclear capability, leverage the RMA, and sustain an economy comparable in size to that of the US.

There are thus some clear implications for the 2020-2025 Army. It must be prepared to fight multi-corps sized ground wars against an enemy with large amounts of traditional armor backed by a somewhat sophisticated theater ISR architecture. It may even need to fight in two theaters simultaneously. A Sino-Russian Entente was the major competitor we chose for our illustrative scenario. This Entente would be a marriage of Russian combat power and Chinese technology, financing, and political support. The Sino-Russian Entente would attack the oil-rich portions of the Caspian Region in this 2020 scenario while at the same time making a secondary thrust against US allies in the Balkans.

To defeat the Sino-Russian invasion into the Caspian Region, the US would have to generate a "Big War Army." Our premise is that a portion of this force will be forward deployed in the Caspian Region when hostilities begin. The Big War Army would emphasize firepower over maneuver in its force structure, although it will retain some degree of battlefield mobility. The deep fires employed by the Big War Army will have to be long-range and accurate so as to be capable of heavily attriting the second and third echelons of enemy armor in concert with US air power and its arsenal of smart and brilliant munitions. The Big War Army will need to cooperate very closely and effectively with the USAF in order to overcome the threat posited here. Additionally, this force would need significant quantities of survivable attack helicopters and a state-of-the-art space, air, and ground based ISR architecture that could be shared both with the other services and those allies operating with us in the theater. It also would require ground based ASAT and TMD capabilities.

This active force is roughly 10% larger in size than today's Army. To maximize capability and deployability, the active force is entirely AAN; there are no Army XXI divisions in the Active Component of the Big War Army.¹ The AAN force consists primarily of infantry, artillery, and armor specialties (about 15-20% each); accompanied by significant numbers of aviation and medical personnel (about 10% each); a lesser number of air defense personnel (about 5%); and logistics, supply, and maintenance specialists (about 25%).

¹ In sizing this force, we have assumed a substantial tradeoff between improved technology and smaller force size. Arguably, the Big War Army might need to be even larger than we have stated.

Competitive Multipolarity/Global Maneuver Army		
Features of this future • 2-3 other Great Powers arise with military/economic capability comparable to US • Defensive alliances, multi-sided competitions for influence in less developed regions • Demand for power projection and presence deployments (Global Maneuver)		
Desired force characteristics • Diverse mix of combat capabilities for all terrain types • Ability to rapidly deploy force packages between and within theaters • Lean logistics and C2 networks that can support operations in all environments		
Force size and composition • Total AC force size about 50% larger than today's; half of AC is second tier of Army XXI forces • AAN forces primarily infantry, armor, artillery, engineering, air, medical, and other support		
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Our second medium good world is Competitive Multipolarity. This assumes that 2-3 large powers are capable of challenging the US on more or less equal terms and each of these near-peer rivals builds its own coalition of allies and friends. In this vision of the future there would be an ongoing competition between fluid defensive alliance systems, with incentives sometimes being offered to key smaller powers in order to attempt to persuade them to shift their allegiance from one major power to another. In this system, the chances of miscalculation and inadvertent conflict are great as the different alliances will also each be vying to project their influence into nonaligned countries. Here, our planning scenario assumes a three alliance world with a US/British/Japanese alliance competing with both a Russian/French/Indian alliance and a Chinese/Iranian/Saudi grouping. Specifically, we posit that these three alliances are jockeying for geopolitical position in an Iraq that is disintegrating along religious and ethnic lines.

A world of Competitive Multipolarity would require the US to have a "Global Maneuver Army." The Global Maneuver Army would have the difficult mission of rapidly projecting force into regions where the encroachments of rival alliances endangered American interests. Deterrence/presence would be the main purpose of most of these deployments in the Competitive Multipolarity world (such as in our Disintegrating Iraq scenario), but periodically these operations could result in combat, therefore the Global Maneuver Army would have to be capable of transitioning from deterrence to warfighting relatively quickly.

To accomplish its tasks, the Global Maneuver Army would be structured similarly to the Light Lethal Army. It would be largely self-deployable and light, but would have enough organic and reachback firepower to decimate a numerically superior armored force using previous generation technology. The major differences from the Light Lethal Army would be in the areas of C2 and logistics. This force would have more robust C2 down to the small unit level because of the need to carefully coordinate all tactical actions during politically sensitive deterrence/presence missions. The Global Maneuver Army would also need more flexible logistics systems because it would often have to spread its units out widely in order to maximize reach.

The Global Maneuver Army is the largest of our six armies because it could be pulled into multiple regions simultaneously in the Competitive Multipolar world. It has an Active Component about 50% larger than that of today's Army. Half of the AC consists of Army XXI divisions that would be used as follow on support to the leading edge global maneuver units in the event of full-scale war. They are manned at 80% fill in peacetime. The AAN force consists primarily of infantry soldiers (about 30%); accompanied by roughly equal numbers of artillery, armor, engineering, aviation, and medical specialists (5-10% each); and a large contingent of logistics, supply, and maintenance personnel (about 30%).

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Transnational Web/Netwar Army

Features of this future

- At expense of nation-states, rise in power of transnational distributed actors (e.g., corporations, criminal syndicates, terrorist or special interest groups, ethnic diasporas)

Desired force characteristics

- Robust cyberintelligence/IW capability
- Well funded "crisis public affairs" branch
- Networked teams of immediately deployable SOF personnel

Force size and composition

- Total AC force size nearly 40% smaller than today's: AC has 3-4 divisions of second tier, Army XXI forces
- AAN forces primarily Rangers, SF, computer/electronics experts, and intel

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"Transnational Web" is our one medium-bad world. In this future, the nation-state has lost a significant amount of its power in international politics as that power has been usurped upwards by transnational, globally distributed actors such as multinational corporations, transnational criminal organizations (TCOs), terrorist networks, special interest "peace and social justice" groups, and perhaps even ethnic diasporas. These transnational actors would coordinate their activities in near-real time via the Internet and some of them would pose a definite threat to the worldwide interests of the United States and other remaining "traditional" nation-states. In this world, it is likely that several major countries will in effect be controlled by transnational interests. One could imagine, for example, a future Poland whose government has been completely penetrated and coopted by a globally active Russian Mafia supported by its own army of mercenaries. To illustrate the challenges facing the Army in this world, we constructed a scenario in which a radical transnational environmentalist group uses the Internet to coordinate terrorist attacks against US embassies, businesses, and tourists on every continent after the US refuses to sign a draconian new international agreement on reducing fossil fuel emissions.

Unorthodox security challenges presented to the nation by the Transnational Web world could be met by a force we call the "Netwar Army." The term "netwar" was first coined by our RAND colleagues John Arquilla and David Ronfeldt. Three types of capabilities predominate in our vision of the Netwar Army: (1) a robust cyberintelligence/IW corps made up of seasoned, long-serving computer specialists; (2) a well trained public affairs branch that could rapidly defeat the Internet propaganda offensives that will be launched by hostile transnational actors to sway US public opinion in their favor; and (3) several elite anti- and counterterrorism units composed of SOF personnel that could deploy anywhere in the world on short notice to attack terrorist/mercenary cells controlled by hostile transnational actors. These special units would be networked, not hierarchical, and would often work closely with foreign law enforcement agencies.

The Netwar Army would be nearly 40% smaller than today's active Army. It would include 3-4 Army XXI divisions as a hedge against the outbreak of "traditional" aggression against US interests abroad, which would be manned at 80% fill in peacetime. The AAN force would consist primarily of Rangers, Special Forces, and computer/electronics soldiers (about 20-30% each); accompanied by military intelligence specialists (10-15%) and lesser numbers of aviation and medical personnel (about 5% each).

Chaos-Anarchy/Dirty Environment Army

Features of this future

- In several regions nation-states destroyed by overpopulation, environmental degradation, ethnic violence, emergence of regional warlords
- Increase in terrorism, WMD proliferation, mass migrations, disease

Desired force characteristics

- Force protection and counterterrorism capabilities against NBC use
- Emphasis on light infantry with light armored vehicles and heliborne support
- Strong infrastructure restoration and MOUT capability

Force size and composition

- Total AC force size about 10% smaller than today's; AC has 5-6 divisions of second tier, Army XXI forces
- AAN forces primarily infantry, Rangers, engineers, medical, MP-SF, and other support (including linguists, intel, and air)

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Our worst case world is "Chaos/Anarchy." In this future, the nation-state loses considerable power as well, however, this time we see power devolving down to subnational actors. The premise of Chaos/Anarchy is that factors such as overpopulation, environmental degradation, and ethnic strife cause the collapse of the nation-state in large swaths of the developing world. The resulting vacuum is filled by warlords who, lacking a tax base, turn to terrorism and the smuggling of contraband, narcotics, and weapons of mass destruction (WMD) in order to support their "regimes." This is a world of massive instability that frequently witnesses mass migrations and virulent epidemics as well as fierce communal violence involving ever more sophisticated weaponry. Terrorist attacks by various subnational groups against major Western cities ("have nots" attacking the "haves") become disturbingly common. Clearly, the national security threats posed to the US in this world, by virtue of their diversity, scope, and often shadowy quality, would be more difficult to grapple with than those we have seen in the previous five alternative futures. An Egyptian Civil War is the centerpiece of the scenario selected to illustrate the complexities of this worst case world. We constructed a situation in which this civil war between Islamists and secularists concludes with an Islamist nerve gas attack on Cairo. In response, the US Army leads a multinational effort to restore order in the devastated city; specifically, the Army has a twofold mission: (1) conduct humanitarian relief, and (2) carry out urban counterinsurgency operations against the remaining Islamist guerrillas.

The "Dirty Environment Army" is our answer to the problems existing in a Chaos/Anarchy world. This force is essentially a larger, more capable version of the Policing Army that we discussed earlier. The Dirty Environment Army has a very robust force protection capability, including comprehensive defensive systems to protect personnel and equipment against nuclear, chemical, and biological attack. In case these defenses should fail, the Dirty Environment Army has a larger than usual complement of medical personnel. Its emphasis is on light infantry with light armor and heliborne support. Just as in the Policing Army, there would be a need for advanced MOUT technologies, especially sensors that could gather accurate, real time intelligence on enemy positions, strength, and intentions. UAVs and microsensors would be among these technologies. Finally, since this Army will often be operating in heavily damaged areas, it will bring with it a large component of support engineers for infrastructure restoration.

Our Dirty Environment Army is about 10% smaller than today's active Army. It includes 5-6 Army XXI divisions as insurance against unexpected contingency types. These Army XXI forces would be manned at 80% fill in peacetime. The AAN force consists primarily of infantry soldiers (about 25%); they are accompanied by a roughly equal number of Rangers and engineers (about 25% together); lesser numbers of MP, medical, linguists, Special Forces, military intelligence,, and aviation specialists (5-10% each); and logistics, supply, and maintenance personnel (about 15%).

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Summary of Future Army Forces and Environments

Future Force/ Environment	IN	AR	FA	EN	MS	AV	MP	SF	MI	LNG	RGR	CMP
Light Lethal	+	+	+	+	+	+						
Policing Army	+				+	+	+	+	+	+		
Major Competitor	+	+	+		+	+						
Multi-Competitor	+	+	+	+	+	+						
Netwar					+	+		+	+		+	+
Chaos WMD	+			+	+	+	+			+	+	

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The preceding charts discuss a variety of aspects pertaining to six alternative future Army environments and forces. In this chart, we briefly summarize the types of personnel who make up the AAN portion of the six alternative forces. The environments/forces are listed down the left side of the chart; across the top we indicate the types of soldiers that make up at least 5% of the AAN portion of these forces. We primarily use branch designators for the soldiers; the last three—involving additional or newly defined skills—represent linguists, Rangers, and computer-electronics experts. With the exception of the Netwar force, each of the six also has a significant representation of AAN soldiers performing logistics, supply, and maintenance functions.

The point of this chart is that although the worlds vary in fundamental ways in their characteristics and missions, from a staffing standpoint they sort themselves into basically two groups: In the first group are forces whose purpose is similar to those of today or the recent past, i.e., conventional forces. This would include the Light Lethal force, the Major Competitor force, and the Multi-Competitor force. As the chart shows, these three armies have significant groups of armor and artillery in the AAN portion. In contrast, there are three armies oriented toward OOTW: the Policing force, the Netwar force, and the force designed to respond to a chaotic environment filled with weapons of mass destruction. As distinguished from the first group, the AAN portions of these armies do not have large components of armor or artillery, but instead consist of Special Forces, intelligence, and other support elements, such as MPs, linguists, Rangers, or computer-electronics specialists. Because the soldiers in these two groups of occupations differ in important ways and because we hypothesize the potential impact of AAN technology to be different for the two groups, remembering the distinction between them will be important in understanding differences in personnel characteristics that may be required for the six future armies.

3. ARMY STRUCTURE

Additional Army Structure Analyses		
Question: Given the desired characteristics of each future force, what are its implied aptitude, seniority, and other (e.g., linguistic) attributes?		
Step 1: Complete and assess each future force		
• Begin with major CMFs (and %s) identified for each AAN force; include tier of Army XXI forces when applicable • Add TDA structure • Apply recent EMF to resulting MOS distribution to explore force attributes		
Step 2: Explore potential impact of future technology on these attributes		
• Select CMFs that could be affected significantly by AAN technology, considering C4I requirements and operational concepts • Consider composition of each force with respect to affected CMFs • Consider both technology that does and does not increase AFQT needs		
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The preceding section of the briefing touched on the sizes and composition of the alternative armies. Given the desired skills and capabilities of these forces, we now examine several additional, important force structure questions. First, what are the implied aptitude distributions of these armies? In other words, what percentage of each enlisted force needs to be filled with high aptitude (AFQT Category I-III A) soldiers? We care about the answer to this question because it costs more to recruit and retain such soldiers. Another important question concerns the seniority requirements of the forces, expressed here as the percentage of NCOs in the enlisted force. Because pay is based on grade and years of service, it costs more to maintain such a force, and, if the force is sufficiently senior, there are potential issues concerning our ability to sustain the force through reasonable promotion policies, as noted earlier. We also will examine the linguistic capabilities required by the future forces. The ability to communicate in a second language is one of a number of additional characteristics we examined. In this case we are talking about the percentage of the force that is familiar with a second language, as coded today in the Enlisted Master File. This does not require being fluent in that language. We chose to present it in this briefing because there are training implications. Our analysis shows that these language skills are primarily acquired after entry to the Army (rather than being a skill new recruits bring into the Army).

Our approach to examining these questions started with building the six alternative future armies, beginning with the AAN portions of these armies. To do this, we used the major groups of MOSs (primarily, Career Management Fields (CMFs)) we described for each of the AAN forces in the preceding section of the briefing, in their relative proportions. Based on the same work, we next added an appropriately sized second tier of active Army XXI forces where indicated earlier. Because they represent backup forces to be deployed with substantial advance notification, we manned the Army XXI forces at 80% (in peacetime).

In addition, we needed to build a TDA structure. That can be done using various assumptions about its elasticity with respect to changes in the size of the TOE portion. We know that the TDA army does not change size perfectly in response to changes in the size of TOE forces. For this analysis, we assumed the TDA size changes half as much as the size of the TOE force. Similarly, we can examine force composition under alternative assumptions about the mix of Army After Next and Army XXI forces in the TDA portion of the force. For example, it can mirror the rest of the force, or it can draw disproportionately from Army

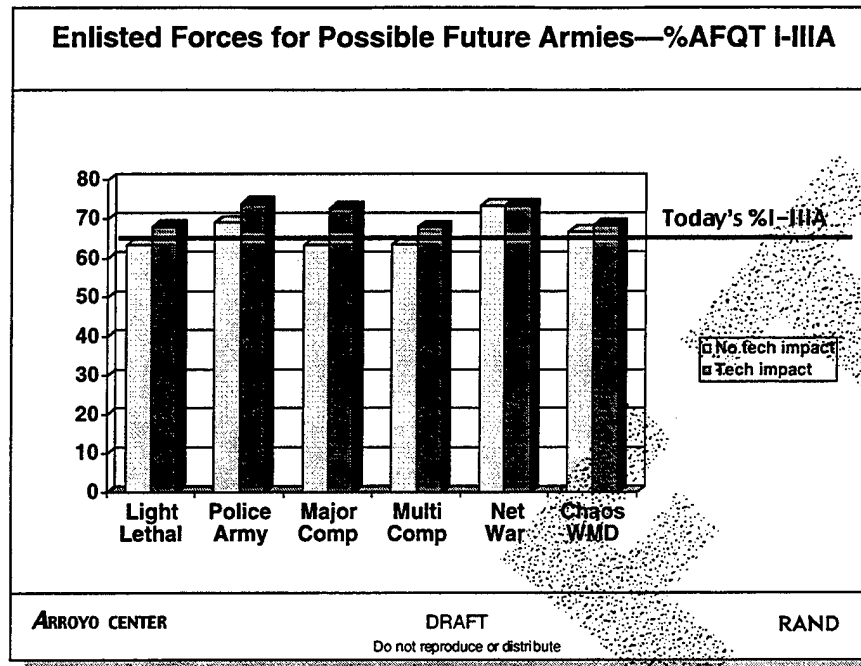
XXI soldiers to try to lower aptitude or seniority requirements that may be elevated in the AAN force. In this analysis we assumed the TDA composition mirrored the rest of the force.

In the absence of an impact of new technology, we assumed that the individual characteristics of soldiers within a given occupation—such as aptitude and grade—would look pretty much as they do today. We thus applied the 1996 Enlisted Master File to the distribution of occupations we had identified for each of the future armies to assess the resulting attributes of the enlisted force as a whole. In other words, changes in the composition of the forces—such as aptitude and grade—result from changes in the composition of those forces with respect to the percentage of the force found in each CMF/skill group.

Finally, we also considered the possibility that, as has often been true in the past, exploiting the additional capabilities provided by future technology could come at the cost of increased aptitude requirements for the soldiers operating and maintaining the new equipment.² To explore possible technological impact on force structure requirements, we began by selecting those CMFs that might be affected most notably by AAN technology based on (1) consideration of their likely information processing and C4I requirements and (2) how their operational concepts might change from today's, for example, in terms of how quickly they move, the independence of their movements and engagement decisions, and the complexity of their operations. This led us to select the areas of armor and artillery as being particularly good candidates for technology-based changes in personnel requirements and to select infantry and the logistics/supply/maintenance area as also being potentially affected by new technology and operations, but probably to a lesser degree.²

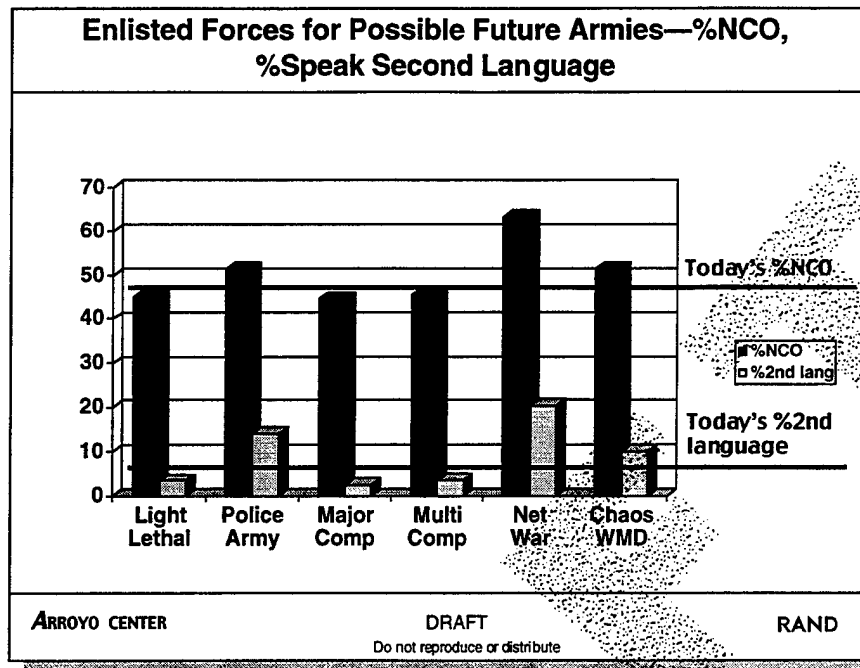
We then assessed the possible impact of new technology on the attributes of the alternative forces by taking into account the portion of each force that was made up of the affected CMFs. We applied "bookend" assumptions, in a desire to bracket the possible effect. In one case, we assumed that the increased capability provided by the technology would come at the expense of fully increasing aptitude requirements to the identified levels. In the alternative assumption, we assumed that the equipment could be designed in a sufficiently user-friendly fashion that there was no increase at all in aptitude requirements. Again, these assumptions are intended to bracket the probable impact of the new technology on aptitude requirements.

²Because the operators of future armor and artillery systems may have responsibilities that closely resemble those of current PATRIOT missile system operators in terms of information processing—monitoring radar screens, receiving information from higher echelons in digital bursts, and making rapid friend or foe identifications and engagement decisions—we believe that the aptitude requirements for future soldiers in these areas may closely resemble those of current PATRIOT operators, MOS 24T. Thus, for armor and artillery, we increased aptitude requirements from their current levels to those of MOS 24T. For the infantry and logistics areas, we increased aptitude requirements halfway between the current levels and those of MOS 24T.



We now begin to examine possible future force structure requirements, beginning with the percentage of high aptitude (AFQT Category I-III A) soldiers. At the bottom of the chart we see the six future armies. There are two bars for each army. The lighter, leftmost bar of each pair represents the case in which new technology can be designed in a very user-friendly fashion, and, therefore, does not increase aptitude requirements. The darker, rightmost bar of each pair represents the case in which there is a large impact of the technology on increasing aptitude requirements, as described on the previous page. The shaded horizontal line that runs across the chart shows today's percentage of Category I-III A soldiers in the force, which is just under 65%. The rear (uppermost) portion of each bar is to be compared with the height of this line.

The basic pattern of these results is that aptitude requirements increase for the force: most of the bars are above the shaded horizontal line. However, we note that if new technology can be designed in an user-friendly fashion that does not increase aptitude requirements, then those requirements fall to the current level for the Light Lethal, Major Competitor, and Multi-Competitor armies (the first, third, and fourth pairs of bars). As noted earlier, these are the three forces that resemble today's army or those of the recent past. In contrast, the analysis suggests that even with user-friendly technology, aptitude requirements for the policing type armies are likely to remain above today's levels, and particularly so for the Netwar army (fifth pair of bars). This is because the increase in aptitude requirements for these forces comes less from the introduction of new equipment than from their higher concentration of specialties that require high AFQT scores, notably, the Special Forces and military intelligence areas.



We also wanted to examine the possible seniority and linguistic requirements of the future forces. The taller, leftmost bar of each pair shows the seniority content of the indicated force, represented in terms of the percentage of NCOs (grades E5-E9). The upper shaded horizontal line running across the chart indicates today's level of NCOs in the force. Given the inclusion of TTHS soldiers, that current level stands at about 46% of the enlisted force. The analysis suggests that in the future the seniority level would remain close to 46% for the Light Lethal, Major Competitor, and Multi-Competitor armies. Again, the mixture of combat and support soldiers in these armies resembles that of soldiers in the recent past. In contrast, the policing type armies, and, especially, the Netwar army, would have greater seniority requirements. These greater requirements occur for the same reason as the greater aptitude requirements noted in discussion of the preceding chart, specifically, the prevalence of specialties or CMFs that require more capable, more senior soldiers, such as Special Forces and intelligence occupations. This also is a characteristic of the computer/electronics experts required in the Netwar army.

We also examined possible changes in a number of additional force characteristics. As we indicated earlier, we chose to present second-language requirements in this briefing, because of their potential training implications. The chart indicates that these requirements could vary considerably across the alternative forces. Today, the EMF carries a second-language indicator for about 5% of the force. We see that armies that resemble those of the recent past remain below those levels (the Light Lethal, Major Competitor, and Multi-Competitor forces). However, the analysis suggests that language requirements could increase substantially for the policing type armies, for the same reasons of CMF composition discussed in relation to seniority and aptitude requirements. This is important because these language skills are acquired primarily after entry to the force, and, thus, the largest increases imply up to a two- to three-fold increase in training requirements.

4. US YOUTH POPULATION

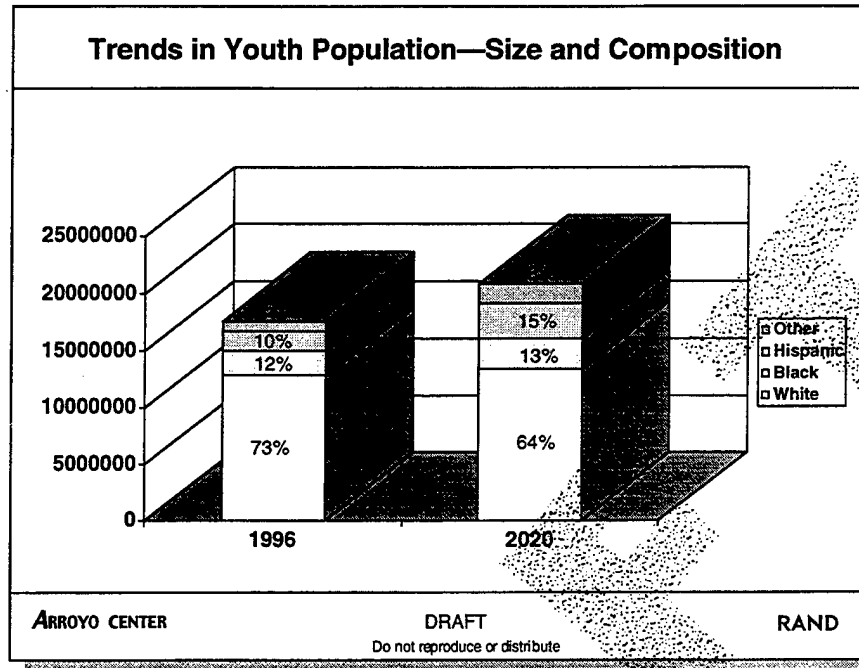
Future US Youth Population		
Questions: How will the youth population change by 2020? • Size • Race-ethnic mix • Aptitude (AFQT) distribution and college attendance patterns		
Approach • Use Census projections, Current Population Survey, National Educational Longitudinal Survey, and National Longitudinal Survey of Youth to estimate demographics of US youth population in 2020 • Using these estimates and recent RAND work on trends in AFQT scores, estimate number of I-III A and III B-V youth in 2020 according to gender, race-ethnicity, and college attendance		
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In this next section of the briefing, we discuss future trends in the size and composition of the US youth population, the population we recruit from. It is the combination of trends in this population together with changes in force structure requirements that will determine the appropriate personnel policies for the future force, and particularly so for recruiting. In this briefing, we seek to answer basic questions about the size of the population as we approach 2020, changes in its racial-ethnic makeup, and trends in aptitude scores and college attendance patterns. We care about these attributes because they are important from a recruiting standpoint. The size of the population and the aptitude mix provide the raw numbers of youth to recruit from; the race-ethnic mix of that population bears on social representation issues for the military; and college attendance patterns affect the sizes of the high school senior, graduate, and college enlisted force recruiting markets.

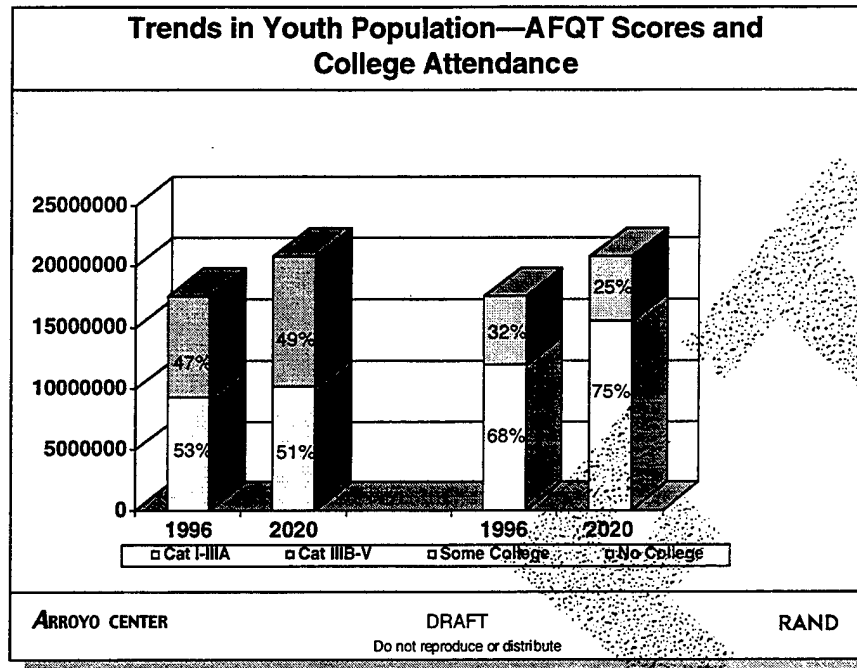
Estimating these trends in the youth population is a complex process involving the use of Census projections, several youth population databases, and also incorporating recent RAND work examining trends in AFQT scores and college attendance. The end result is to look at estimates of changes between 1996 and 2020 in 32 cells consisting of gender, crossed by high or low aptitude, crossed by one or more years of college attendance versus little or no college, crossed by race-ethnicity (white/black/Hispanic/other).³

³More specifically, to estimate US youth population changes between 1996 and 2020, we began with population estimates produced by the US Census Bureau, of the population by single year of age, sex, and race-ethnicity (white, black, Hispanic, other) for 1996. We combined the data for ages 18-24. Next, we used data on school enrollment from the Current Population Survey to categorize the youth population according to high school graduation status and college attendance. College attendance was based on those completing one or more years of college. We used achievement test scores from the National Educational Longitudinal Survey (NELS) together with results from recent RAND research by Kilburn et al. (1996) to estimate AFQT scores for NELS

respondents. (See Kilburn, M. Rebecca, Lawrence M. Hanser, and Jacob A. Klerman, 1996, "Test Score Trends and Military Recruiting: Estimates from the NELS," RAND, DRR-1487-OSD/A.) These data were used to generate estimates of the distribution of the population across AFQT categories for high school graduates who did not attend college and those who went on to college. Finally, since the NELS scores are for 18 year olds, we generalized the estimates to a population of 18-24 year olds by applying rates of test score growth with age based on the 1979 National Longitudinal Survey of Youth (NLSY). The NELS represents the best current source of data on youth achievement levels until data from the new NLSY-1997 are released. The final product was the distribution of the 18-24 year old youth population, by sex and race-ethnicity, across three education groups—non high school graduate, high school graduate no college, and high school graduate some college—where the latter two education groups were sub-classified by AFQT category (I-III, IIII-IV, V). The 2020 estimates began with Census Bureau projections of the youth population by single year of age, sex, and race-ethnicity. Data for youth aged 18-24 were again combined. To estimate the distribution of the 2020 population across AFQT categories, we began by assuming that any major growth in scores would lead to renorming the test, as is being planned presently, and thus that the 1996 distributions would be close to those in 2020 within each sex-race-ethnicity-schooling category. We projected sex and race-ethnic group specific rates of high school graduation and college attendance based on 30 years of historical data that were available from the CPS. When reassigning population from the "no college" to the "some college" categories, we moved people with their AFQT scores. Therefore, we were able to preserve the overall distribution of the population by AFQT category and to allow for continuation of the trend toward increased college attendance among youth of lower aptitude. The final product was a table describing the youth population in 2020 by sex, race-ethnicity, education, and AFQT category that corresponded exactly to the table for 1996. The 32-cell form of the table drops AFQT Category V youth and high school dropouts. The former are ineligible to enlist and, by 2020, we expect the latter to be as well.



This chart shows our estimate of changes in the size and race-ethnic composition of the US youth population. We estimate that by 2020 the population of youth ages 18-24—the primary recruiting market—will increase approximately 20%, from about 17.5 million to just over 21 million. The growth in the youth population will not be uniform across race-ethnic groups. The proportion of whites in the population is expected to decline by about 10 percentage points, from 73% to 64%. African-Americans will remain at about 12% to 13% of the youth population. There will be significant growth, however, in the proportion of the population made up non-black minorities, from about 15% today to approximately 23% in 2020.



Our work on future AFQT scores suggests two general trends, based on the changes in the youth population discussed in connection with the two preceding charts. First, we would expect scores to decrease slightly, from about 53% scoring in Category I-III A in recent times to about 51% in 2020. However, because the population is growing by about 20%, we would actually expect an increase in the *pool* of Category I-III A youth available, despite the lower average test scores. The population of AFQT Category I-III A youth ages 18-24 is estimated to increase from just under 9 million in 1996 to a little over 10 million in 2020.

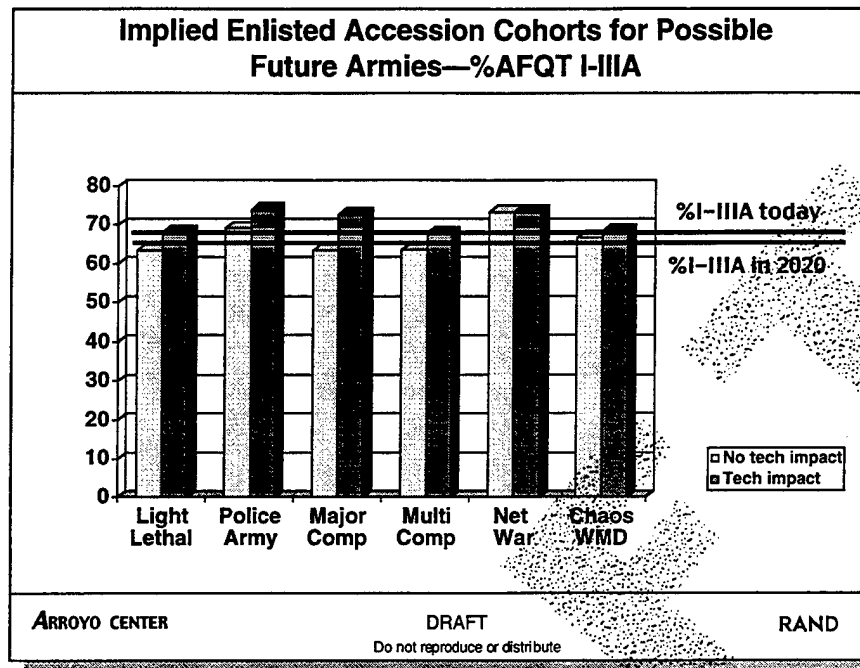
College attendance is expected to continue to increase substantially—as it has over the past 20 years—increasing from just over two-thirds of the population of high school graduates to roughly three-fourths of the graduates in 2020. These are youth attending one or more years of college. The college attendance trend bodes potential trouble, because increased college attendance moves more youth into a market that the Army is not particularly successful in recruiting from today. Moreover, the increase in attendance occurs disproportionately among AFQT Category I-III A youth—the primary market—and thus could offset much of the increase in the Category I-III A pool.

5. RECRUITING IMPLICATIONS

Future Recruiting		
Questions		
• Would recent Army enlisted recruiting penetration rates by gender, AFQT score, college attendance, and race-ethnicity produce the required aptitude (AFQT) mix for the alternative future forces in 2020? • Given the AFQT requirements of these forces, would there be a social representation issue? • Considering the <i>sizes</i> of these forces in addition to their AFQT requirements, which forces if any may pose serious recruiting problems?		
Approach		
• Assume penetration rates of Army recruiting remain at recent levels within gender, AFQT, college, and race-ethnicity subgroups of population • Apply these recruiting penetration rates to projected 2020 youth population to estimate number of recruits jointly by gender, AFQT score, college attendance, and race-ethnicity		
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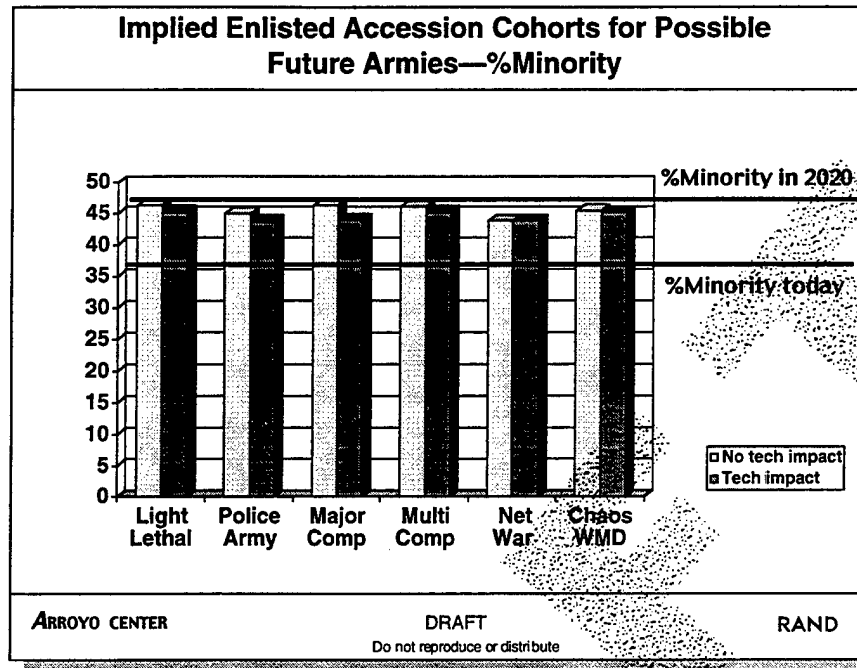
In this last section of the briefing we bring together results from the force structure analysis with the estimated changes in the future youth population and consider their implications for Army recruiting in the AAN timeframe. We want to address three fundamental questions. First, would recent Army recruiting practices and penetration rates by gender, aptitude, college attendance, and race-ethnicity produce accession cohorts with the aptitude mix required for the future forces in the 2020 timeframe? Second, if AFQT requirements could be met for these forces, would there be a social representation issue? This grows from concern that differences in test scores among different groups might lead to an undesirable reduction in minority representation in the force if aptitude requirements increase substantially. The third question follows from recognizing that recruiting requirements depend not just on the composition of a force—for example, the percentage of AFQT Category I-IIAs—but also on the size of the force that we need to support. Thus, if we consider the sizes of the annual accession cohorts required to support each of the six future forces together with their aptitude requirements, we wish to examine in a preliminary way which of the forces, if any, might pose notable recruiting problems.

Our approach to addressing the three questions is to assume that recent penetration rates of Army recruiting into the 32 subgroups defined by gender by high vs. low aptitude, by some vs. no college attendance, by race-ethnic group are maintained. By considering the changes in the population in each of these 32 cells over the next 20-25 years, we then allow the changes in population to change the number of Army recruits that could be anticipated in each of the cells in the 2020 timeframe. By aggregating across the 32 cells, we derive the potential accession cohort for the Army as a whole.



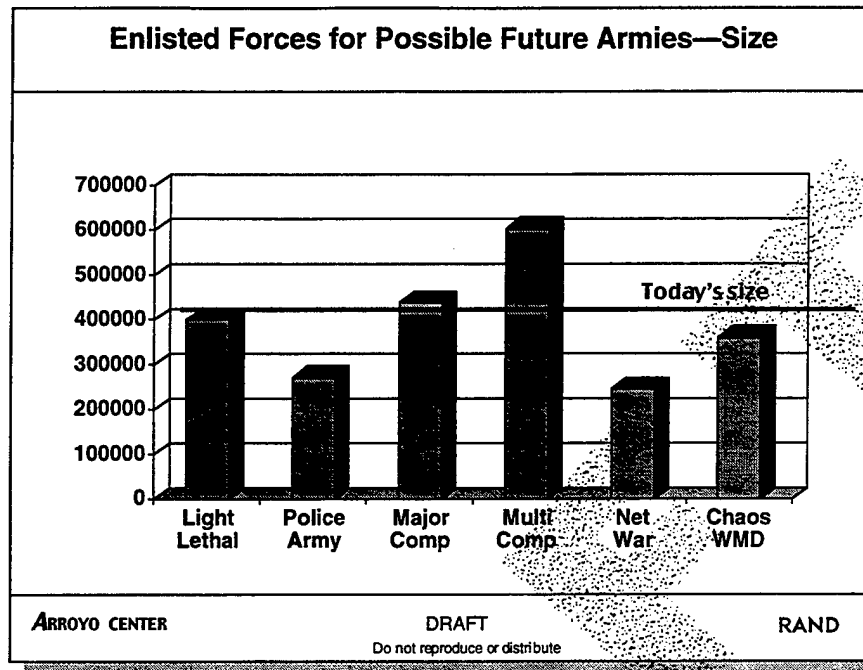
We begin by examining the percentage of the accession cohort that we could expect to consist of AFQT Category I-III A youth in relation to the requirements for the six alternative forces. The results resemble those seen earlier for the force as a whole. The two shaded horizontal lines running across the chart show the anticipated percentage of AFQT Category I-III A youth in the accession cohort. The upper line shows the percentage we could expect to access based on today's distribution of aptitude scores; the lower line shows the percentage we could expect to access in 2020. The percentage decreases slightly because, as discussed, we anticipate a slight decrease in the average AFQT score.

The question of whether the percentage of AFQT Category I-IIIs in the anticipated accession cohort meets the requirement for the future forces is addressed by comparing the heights of the bars (rear, uppermost portion) for each of the future armies relative to the 2020 line. We find that most of the 12 bars are above that line, some substantially so. This suggests that without changes in recruiting practices or penetration rates, there would be an additional challenge in recruiting the required percentage of high aptitude soldiers. However, if we look at the leftmost bar of each pair—the lighter bar, which presumes user-friendly technology that provides additional capability but designs out any increase in soldier aptitude requirements—we see that the aptitude requirements for the armies that resemble those of the recent past tend to be about those anticipated in the 2020 accession cohort. In other words, the percentage of soldiers who need to be AFQT Category I-III A in the accession cohorts for the Light Lethal, Major Competitor, and Multi-Competitor forces is pretty much what we would expect to access in 2020. On the other hand, a gap remains for the policing type armies. As we discussed earlier, this is due to the higher representation in those armies of CMPs that require higher aptitude soldiers, such as Special Forces and intelligence.



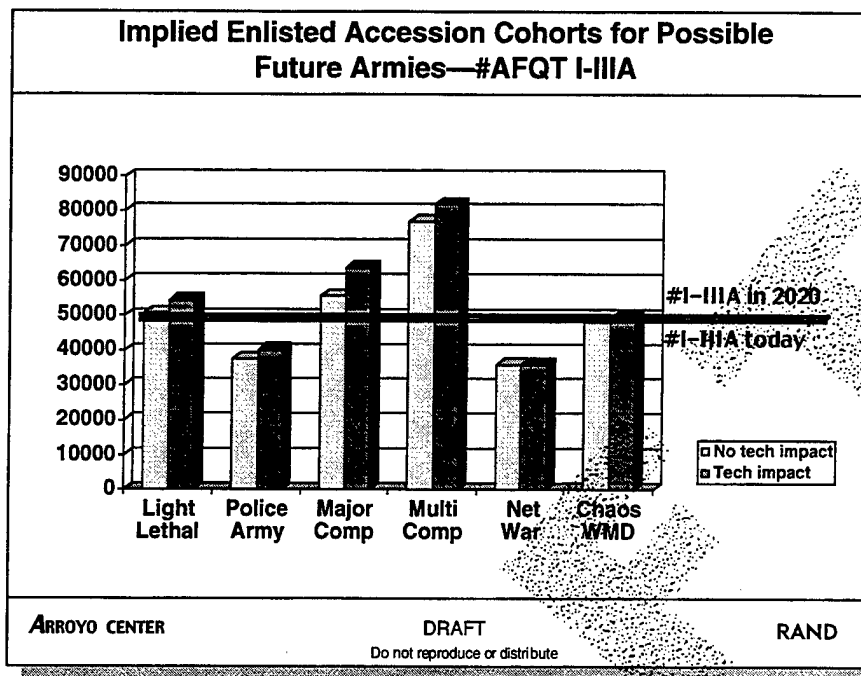
This chart presents results bearing on the issue of social representation. To maintain current representation levels for the racial-ethnic minorities, we must reach the shaded horizontal lines. The lower line represents the percentage of minorities in the accession cohort today; that stands at about 36%. The upper shaded line scales minority representation in the accession cohort up to a target of 46%, based on the growth in the minority population that we examined earlier. This maintains the same representation of minorities in the accession cohort that we have today (including their overrepresentation relative to their true proportion of the youth population).

The primary representation question concerns whether the vertical bars for the future forces reach the 2020 line. The bars represent the estimated minority percentage in the accession cohort for each alternative future force; they account for the percentage of AFQT Category I-III A accessions the force requires. The answer appears to be that minority representation is maintained. In some instances, the estimated percentage of minorities in the accession cohort is slightly larger than the 46% value, whereas in others it is a little smaller. However, in all instances minority representation is essentially at the 2020 line, which represents continuity of the representation levels that we have today, adjusted for the growth of minorities in the population. Thus, this analysis suggests that concerns about under-representation of minorities may not be founded. Moreover, representation at the 46% level would continue minority representation at a level that is well above the actual percentage of minorities in the population, as is true today. In the 2020 timeframe, that level is estimated to be about 36%, as we saw earlier, well below the levels implied by the analysis for each of the six alternative future forces.



Recruiting needs for the future forces depend not just on the composition of the desired accession cohorts, but also on their size. The sizes of the alternative armies were noted early in the briefing in terms of percentage changes relative to the current Army. Here, we directly consider the sizes of the alternative enlisted forces. We begin by sizing the Light Lethal army at 400,000 enlisted personnel, because it resembles today's Army in composition and missions. Clearly, size can either help or hurt recruiting.

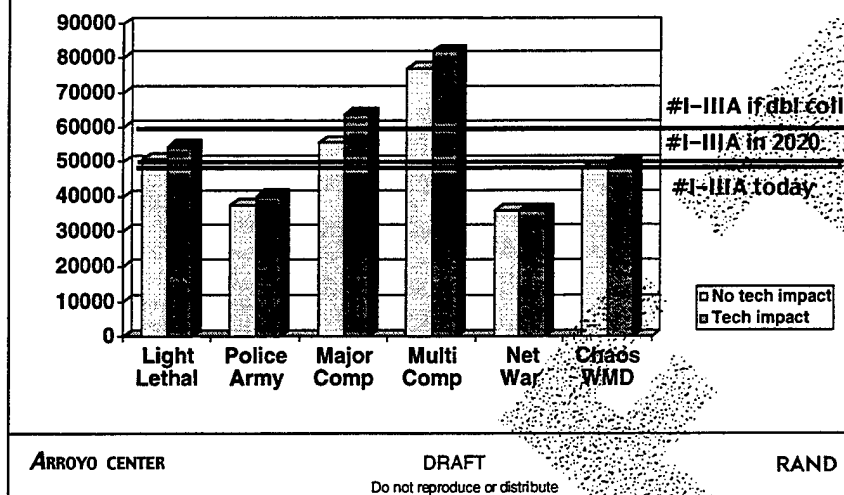
Smaller forces facilitate meeting recruiting numbers, whereas larger ones increase the requirement. Interestingly, our analysis suggests that the policing type forces whose aptitude requirements appeared potentially troublesome tend to be smaller than today's forces, and that this size difference will help recruiting, particularly for the Policing and Netwar armies. In contrast, the Major Competitor and, especially, Multi-Competitor armies are larger. This will make recruiting more difficult.



In this chart we examine the joint implications of composition and size for recruiting in terms of the number of AFQT Category I-III A youth that have to be recruited annually to sustain each of the future armies, assuming 20% replacement of the force. The upper shaded horizontal line indicates the number of Category I-III A youth that we might expect to access in 2020 based on recent recruiting practices and penetration rates, accounting for changes in the size and composition of the youth population.⁴ Note that two of the three armies that have raised some concerns in the earlier portions of this briefing because of their higher aptitude composition—the forces designed to Police and deal with Netwar—require fewer I-III A accessions than we are currently bringing into the Army each year. The third—designed to respond to an environment characterized by Chaos and WMD—would require about the same number of I-III A accessions. In contrast, the Light Lethal, Major Competitor, and Multi-Competitor forces require additional AFQT Category I-III A soldiers to be recruited each year as compared to current levels. This is particularly true for the Major Competitor and Multi-Competitor forces. The analysis suggests that limiting the impact of technology on increasing aptitude requirements by making efforts to design it in a user-friendly fashion might make it possible to trade off 5,000 to 10,000 I-III A recruits for lower aptitude recruits (left vs. right bar of each pair). Such lower aptitude recruits are generally considered to be less supply constrained than higher aptitude recruits.

⁴In this analysis we adjusted the recent accession cohort data for changes in the youth population by 2020 and then scaled up the anticipated number of accessions among youth ages 18-24 in 2020 to represent all non-prior service accessions.

Implied Enlisted Accession Cohorts for Possible Future Armies—#AFQT I-III A If Double College Enlistees



Last, given the potential recruiting challenges identified above, the continuing trend toward increased college attendance, and the preponderance of AFQT Category I-III A youth in the college group, we also wanted to examine the potential benefit of increased recruiting penetration in the college market. As can be seen in this chart, doubling the college penetration rate so that the accession cohort increases from just under 13% youth with one or more years of college to between 20%-25% with one or more years of college (upper shaded horizontal line) could yield a significant payoff: up to approximately 10,000 additional Category I-III A recruits. This level of just below 60,000 high aptitude recruits, if coupled with even moderate success in limiting the impact of new technology on increasing aptitude requirements, could meet recruiting targets for all of the future forces examined, with the exception of the very large Multi-Competitor force.

6. SUMMARY AND DISCUSSION

Summary of Initial Research Implications		
Aptitude/skill requirements for the future forces are likely to increase		
• CMF-based increase for Policing, Netwar, and Chaos/WMD armies • OOTW armies also have greater seniority and linguistic requirements • Possible technology-based increase, especially for Light Lethal, Major Competitor, and Multi Competitor forces		
Given future force requirements and concurrent changes in the youth population		
• Minority representation is likely to be maintained • Force size rather than composition appears to increase future recruiting needs		
Potential personnel policy emphases to help man the future forces		
• Limiting technology impact on aptitude help might save 5-10K I-IIIAs • Doubling penetration rate for college students could add up to 10K I-IIIs • Increased retention may help avoid recruiting shortfalls and meet seniority needs • Additional leverage may be provided by some lateral entry/civilianization, especially for support personnel		
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To summarize, we examined six future worlds and their related force requirements. In terms of force composition, we find that all of the forces could experience increased aptitude requirements compared to those of today's force if sophisticated technology used in new equipment increases AFQT score requirements for accession into the Army. However, if the new technology can be made sufficiently user-friendly to provide the additional capabilities desired without increasing aptitude requirements, then increased percentages of AFQT Category I-IIIAs might be anticipated for only half the forces. Specifically, this would apply to the OOTW forces, whose structures contain a larger percentage of Special Forces, military intelligence, and other high aptitude soldiers. For similar reasons, we note that the same three forces would have greater seniority and second language requirements than today's forces.

Our initial examination of recruiting implications of the possible changes in future enlisted force composition and in the US youth population implies some increase in the required percentage of high aptitude accessions. However, it also suggests that the increase in aptitude needs will not result in problems of minority representation. It further indicates that although the policing type armies demand the greatest aptitude, given the number of annual accessions required for each of the forces it is not the policing forces but rather the more conventional ones—such as the Light Lethal, Major Competitor, and Multi-Competitor armies—that could increase Category I-IIIa accession requirements notably from today's levels.

The work suggests that limiting the impact of new technology on increasing aptitude requirements might reduce the number of AFQT Category I-IIIa accessions needed annually by up to 5,000 to 10,000 recruits (allowing substitution of lower aptitude, more readily obtainable recruits), depending on the particular force. Moreover, the analysis indicates that doubling the penetration rate in the college market could add up to 10,000 Category I-IIIa recruits. Overall, then, given some success in limiting the impact of new technology on increasing aptitude needs and given increased penetration in the college market, a problem already faced today by the DCSPER, the analysis suggests that only much larger forces such as the Multi-Competitor force may pose significant recruiting problems. Increased retention may be useful in avoiding recruiting shortfalls for the Light Lethal, Major Competitor, and Multi-Competitor forces. The tradeoffs between the resources required for increased retention versus increased accessions need to be analyzed. Additional leverage in meeting recruiting goals may be provided by some civilianization of or lateral entry into the force, particularly in areas where recent experience indicates there may be some success. For example, today civilians help to provide support in logistics areas. Efforts also are under way to replace active-duty soldiers with civilians in TDA functions, such as those being evaluated in the SROTC staffing experiment.

Next Steps		
Refine initial estimates of future force composition, using additional information on CMF/skill mix, technology impact, and youth population Begin modeling of personnel flows within the future forces • Model retention-recruiting tradeoffs • Consider tradeoffs of experience with AFQT Category I-III A needs • Can seniority requirements can be supported without lateral entry/civilianization?		
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Finally, the next steps in the analysis will be twofold. First, we will refine our initial estimates of the effects of future environments and technology on force composition and recruiting. We will do this by incorporating additional information on the MOS/CMF mix and related skill requirements, including coordination with other ongoing RAND and non-RAND research, and by refining our analysis of US youth population trends. Our second focus will be to begin using the personnel models we have been building. This will allow us to model personnel flows within the future forces and to play out some of the tradeoffs that could lower accession requirements. These tradeoffs could include the retention-recruiting tradeoff noted earlier or, by using information from other studies on soldier performance, tradeoffs between experience and aptitude requirements. Using the personnel models, we also will assess whether the high seniority requirements of the policing type forces can be supported internally, given current retention patterns. There may be a need for some civilianization or lateral entry into such future forces.

Army After Next

Quality Soldiers on a World Stage: The Leadership Challenge

BG J.P. O'Neal
FORSCOM

QUALITY SOLDIERS ON A WORLD STAGE: THE LEADERSHIP CHALLENGE

BG J. P. O'Neal

I deeply appreciate the invitation to speak to you tonight. It is rare that I am given the opportunity to make remarks to a group of leaders who will truly shape the future of our force and have such an impact on the development of future leaders. After looking at the credentials here tonight, perhaps a better title for my contribution is "The Army's Answer to It Takes a Village".

In preparation for this evening, I decided to go through the web and into the Center for Army Leadership's database on AAN. After digesting a considerable body of literature, I spoke with John Lewis and his group of officers on their view of the emerging thinking on AAN leadership. Finally, I had an opportunity to speak with some RAND researchers, Ron Sorter and Maren Leed, who represent a group of scholars looking at combat leadership and the impact of today's policies on future leader development. These researchers are involved in a study jointly chartered by DA DCSPER and FORSCOM DCSOPS to examine the impact, on our combat leaders, of the policy to reduce time in traditional developmental jobs like company commander, operations officer, and executive officer.

While this research is in the beginning stages, initial findings do suggest that current policies are creating some "leader experience deficit". In particular, the researchers have already discovered active duty armor and infantry company commanders who will never have had their units in the field during their command tour. At the same time, some battalion executive officers are crediting the lack of proper and efficient higher headquarters training resourcing to the inexperience of their mostly lieutenant battalion staff. We need to wait another few months for a more complete assessment of the impact of these policies, but the early returns are not encouraging.

There is however another corner of the army where we can justifiably say that we have a "leader experience deficit". Because of policies we have made over the past five years to train our National Guard units to platoon proficiency only, with few exceptions (most often connected to CTC rotations), nowhere in the National Guard are enhanced brigade company commanders gaining any field experience commanding their companies. As a result we will soon see a generation of National Guard battalion commanders with no field experience as company commanders. This same phenomenon applies to the army reserve.

After spending some time looking at both the initial RAND study findings and the leader experience deficit in the RC, I was struck by the potential effect of today's policies and organizational predisposition on the future of AAN. Are our "20 meter" policies and predisposition endangering our "force march live fire" toward the AAN product? You may initially believe, as I did, that we would be able to overcome any weak policies of

today before we arrive in the AAN arena. However we must be aware as I am sure you are, that over the next five years we will shape the battalion commanders of AAN. Concurrently, we must also acknowledge that our record of rapidly reversing weak policy and organizational predisposition to make a timely recovery is not good. Historically we have not been very organizationally agile.

Recall, for example, the combined effect of McNamara's 100 thousand and the "shake and bake" sergeant policies of the 1970s and early 1980s. Remember the horrible leadership climate that was foisted upon our army, the absolute lack of NCO leadership, and the resulting delay in the post Vietnam recovery of our NCO corps. As an institution, we certainly won't repeat this personnel community's answer to "task force smith". However, how long did it take to recover from this policy? 15 years? My point is that we have within our history some evidence for making policies that create very real leadership deficits. Right now, we may be in the midst of another such policy. Dave McCormick, in his controversial 1998 book, The Downsized Warrior: America's Army in Transition would support this conclusion.

As another example, recall the early stages of developing the national training center. In the mid 1980's our organizational predisposition was to resist, at all costs, creating an NTC. Ann Champman catalogues this predisposition in her book The NTC Matures. The personnel community along with many other communities of our army, initially thought the NTC to be such a waste of resources that the NTC became the army's answer to Siberia! As a second order effect, the first batch of soldiers sent there for retirement assignments became a large part of the first DA civilian work force at NTC. Imagine how cooperative and supportive they were; only now almost 15 years later, are we recovering from this mistake. There was natural organizational resistance to NTC. My point is that our record of harboring policies and organizational predisposition that inhibit rational development toward our own goals is too good. What sort of delay did the resistance to NTC induce into the training and leader development system of the mid 1980s? My guess is about 7 years, 1986 to 1993. What then are the policies and organizational predisposition of today that may likely trail us into AAN and influence the rational development of AAN? I will propose only two, but I believe that we have several more.

First, this organizational or cultural predisposition of resisting creation of ad hoc organizations deserves a moment of thought. Every word that I read on AAN implies that, as with the army of today, we will be unable to tolerate ad hoc organizations. A brilliant leader and soldier, Huba Wass de Czege has said that we must have high performing staffs, stability in personnel assignments, a team of teams, and leaders who are capable of withstanding high levels of stress. In his paper on battle command in 2020 he states in part,

"Such an approach [speaking of the need for staffs to be creative, strengthened by information, decision support systems, etc.] will depend heavily upon routinely achieving highly cohesive and experienced command

and planning teams and upon a common understanding of doctrine and standard operation procedures. The personnel system will have to establish and stabilize planning teams so they can train together for the long periods of time necessary to establish a common understanding of their commander, each other, doctrine, and methods. Reliance upon inexperienced throw together staffs will substantially increase risk." (paper, "Battle Command and Teamwork: Realizing the Potential of 2020 Technologies", 16 January, 1998.

However, I submit that we must squarely face the prospect, reality, and necessity of ad hoc organizations. While the range of missions given to our army is increasing, we are without the structural tools necessary to accommodate the broader range of more complex tasks. Our experience in Bosnia provides recent evidence for this phenomenon. Before October 1995, no one in the army had thought about a Joint Military Coordination Council (JMCC). But we now have had one in Bosnia for almost three years, and it will be there as long as we have commanders in multi national division north sector. We do not have one of these in the inventory, yet this agency, critical and mission essential, is becoming a fixture on the military landscape of tomorrow.

Other examples of ad hoc organizations are a movement control battalion and base camp coordinating agency. Again, we do not have these organizations in the inventory, but we have a continuing requirement to provide their capabilities. Today, of the 8,500 soldiers in Bosnia, more than 1,100 are individual augmentees. Most of these are active component soldiers operating in ad hoc organizations.

Do we recognize this phenomenon in AAN? Do we think that this approach to operating on a complex world stage will disappear? How do we accommodate the reality of the AAN environment in creating the leadership architecture for AAN? The environment is not neutral or flat. Is it fair to deny the reality of this condition or, worse yet, say that we will cross that bridge when we come to it? Or perhaps, we believe that even with a smaller and more specialized force, we can adapt. I submit that this approach is folly.

Why not recognize the requirement for leaders in AAN to have the skills necessary to create ad hoc organizations. This would involve the leader having a thorough understanding of group dynamics, training and operating in an environment without tasks, conditions, or standards, and providing the leader with tools and expectations to deal with the reality of operating on the world stage. Why create an expectation of stability when the military requirements are moving in the opposite direction toward complexity, instability, and unpredictability.

I submit that the AAN community must attack this reality of adaptability instead of creativity, especially in leaders. Certainly OPMS XXI is a step in the right direction, but it is my belief that we must institutionalize the concept of flexibility and acceptance of ad hoc structure. We need a cultural adjustment.

My second observation concerns the development of training to support AAN. As a footnote, consider my remarks with the understanding that I have been an observer of the training development for force XXI for the past 5 years. Certainly some among the AAN community, namely, Doc Brown, have given the topic of training tomorrow's force some serious thought. My concern centers on my belief in an imperative to jointly and simultaneously proliferate leader and training development. Again, our history with simultaneous development of these two critical domains is not good.

Culturally, we seem to approach development in a sequential manner. Take, for example, the Army of Excellence. AOE development saw equipment development centering on the M1 in 1978 (3 ACR OTII), with doctrine coming on line in FM 100-5 in 1982, personnel in the form of first operational unit in 2 AD in 1984, and training in the form of FM 25-100 in 1989. This effort, bridging across almost 12 years, is significant in that training was the last in the line of development. I realize that our spiral development approach is an effort to overcome this predisposition. Training should be coincidental not be incidental.

In doing some low-level research for this session, it appears that the hottest topics in the AAN community (outside this room) are the organizational structure of the 2 ACR and the kind of vehicle it will have. Not surprisingly, agencies interested in equipping the force are driven by the POM cycle and the need to wedge funding into the budget to insure equipment is present when we begin to form this force. My counter point is that if AAN is a revolution in our ability to project force and fight on an information age battlefield, then the training for that force and its leaders will probably be substantially different than today's training environment.

The net effect of this new environment on the army's programming system will be new demands for MCA construction to create these training environments. Evidence for our lack of appreciation for this dynamic comes from our efforts to create a proper training environment for our force XXI units at Fort Hood. We are only now beginning to identify the training requirements, yet we have known that we need facility requirements for over 3 years. We just pull the establishment of training infrastructure behind equipping, organizing, and manning.

Finally, a thought on training the AAN force. With the complexity and capability of the organization, perhaps we will have to develop "operating system" training facilities to create an intermediate layer of training between the future home station environment and the future CTC. Imagine the future scout vehicle, Commache, and Outrider UAV operating as a system for surveillance and reconnaissance. While we might continue to train each of these low density systems at each home station, we might also find it more effective to consolidate system (or function training if you prefer) training at one regional world class site. This would involve rotating teams into an emersion environment to train with specially trained OCS and with special instrumentation. This would serve as the preparation perhaps certification for placing the whole team on the field at a modern CTC. Just some thoughts?

Regardless, as we draw a bead on what we want AAN leaders to be able to do, we must simultaneously develop not only leaders but also individual and unit training environments. This is fertile ground for imagination and creative thinking by our partners in industry and learning theorist in academia. Like you, I am uncertain of what our future training environment must be, but if we are indeed a learning organization, it is time to apply some learning power to the training of AAN.

Thank you for the invitation to speak. I hope that my candid observations will provide some stimulation to your thinking and work. Frankly the commercial world is constantly looking at the military and particularly, the army to guide them into the next training revolution. I offer that we need to pick up the pace of development toward this training revolution. Thank you again.



**DIVISION ARMY
WARFIGHTING
EXPERIMENT(DAWE)
LEADERSHIP/LEADER
DEVELOPMENT FINDINGS:
IMPLICATIONS FOR THE
ARMY AFTER NEXT (AAN)**

The Principles of War *For the Information Age*

LTC Robert R. Leonhard
25 June 1998

PURPOSE

- **To stimulate debate concerning the most fundamental expression of our doctrine.**
- **To offer revised and updated laws and principles of war for the 21st century.**

WHAT'S WRONG WITH THE PRINCIPLES OF WAR?

- They have ossified and are not responding to technological change.
- They are expressed as truisms but are subject to qualification and exception.
- They trade off against one another.
- They *require* flexibility instead of *producing* it.

CATEGORIZING THE PRINCIPLES OF WAR

Principles of Convergence

Mass

(one point in space and time)

Objective

(one purpose)

Unity of Command

Simplicity

(one idea)

(Economy of Force)

(minimize divergence)

Principles of Interaction

Offensive

(one side attacks the other)

Maneuver

(one side dislocates the other)

Surprise

(one side preempts the other)

Security

(one side forestalls the other)

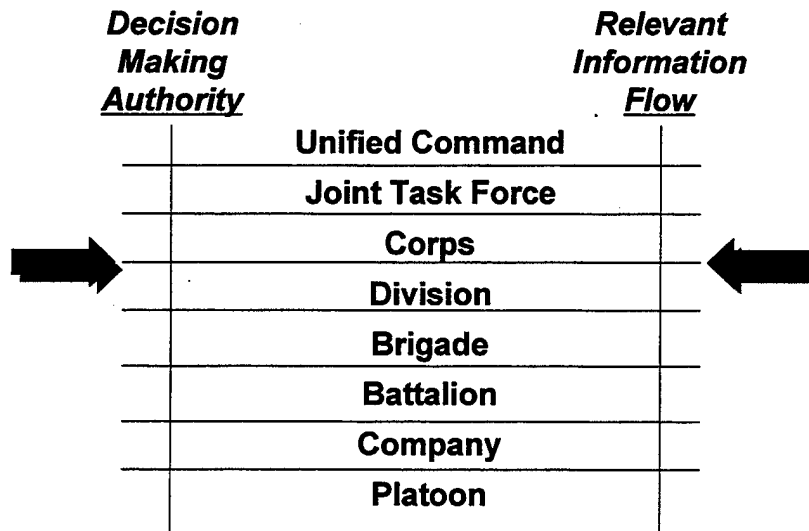
UNITY OF COMMAND

*"For every objective, seek unity of command
and unity of effort."*

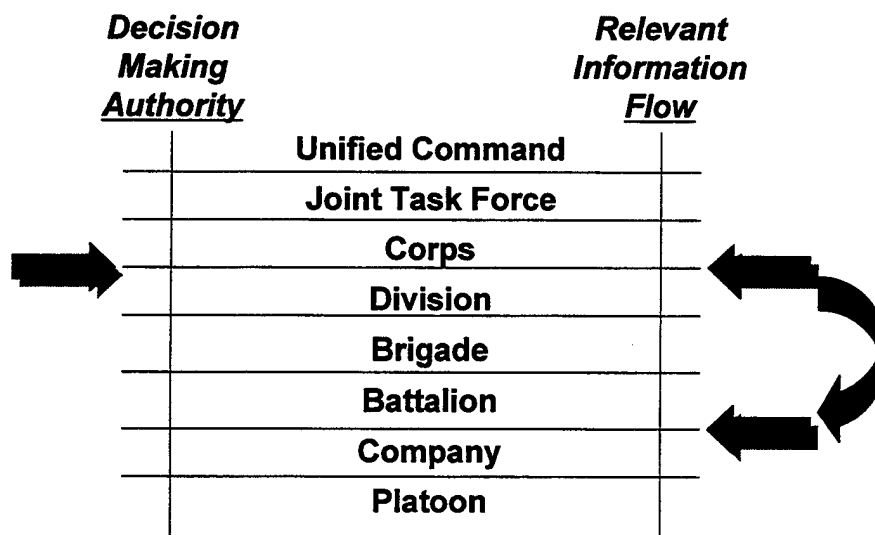
UNITY OF COMMAND

- The real goal is effective integration of battlefield activities. Unity of command was merely a technique.
- In practice, there are many factors that bring disunity of command. Example: a battalion task force!
- We need a flexible doctrine that balances the advantages of ***command*** with those of ***anarchy***.

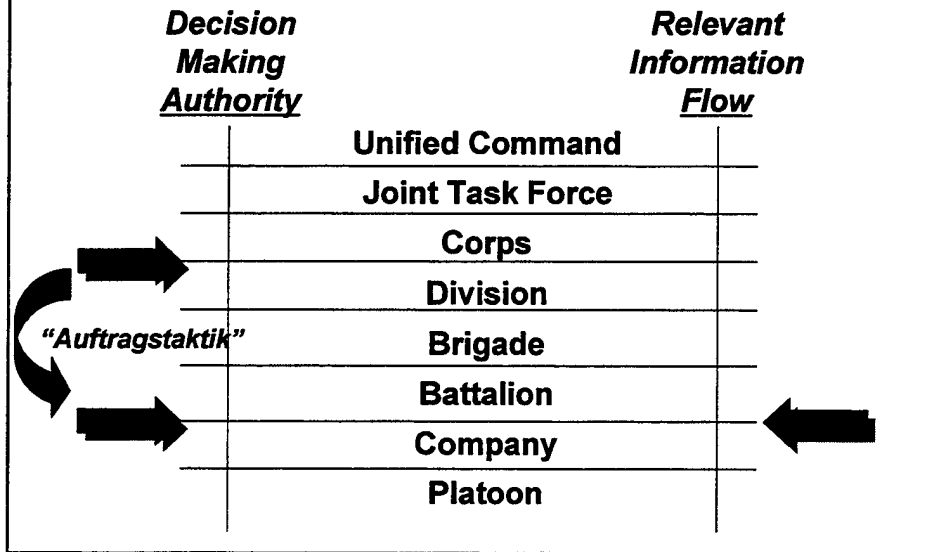
COMMAND AND INFORMATION



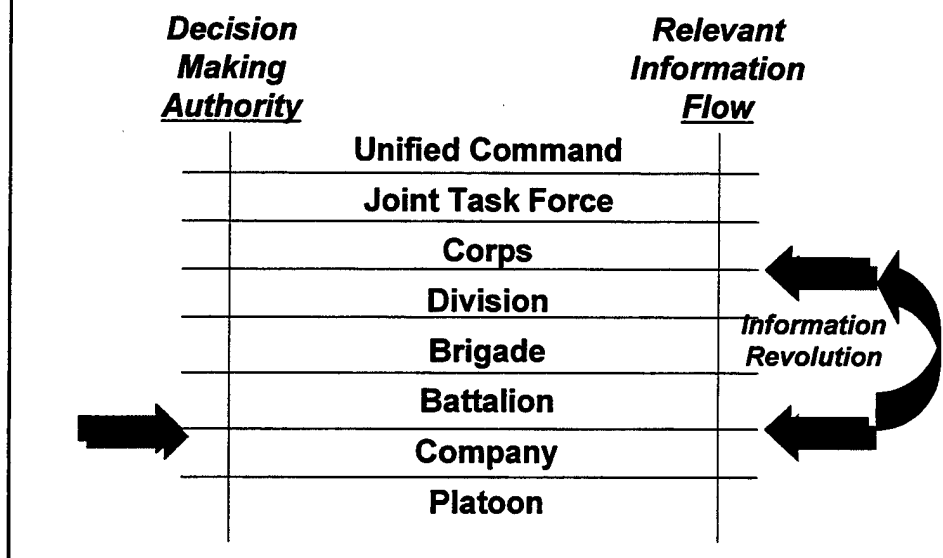
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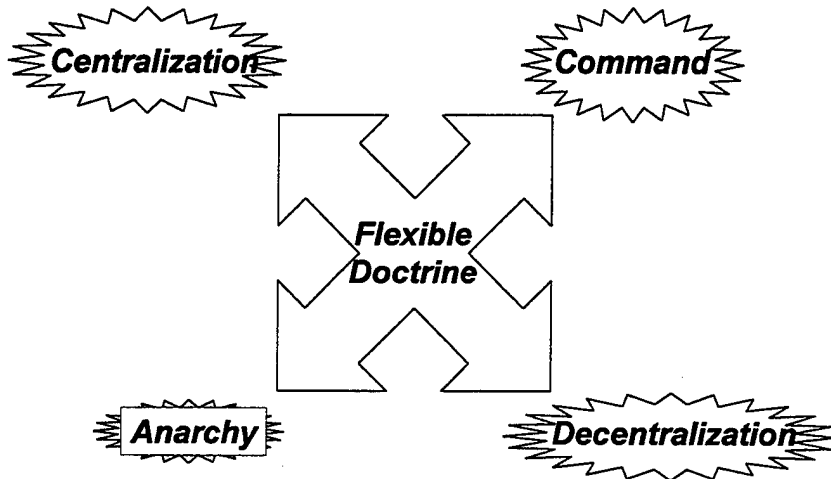
COMMAND AND INFORMATION



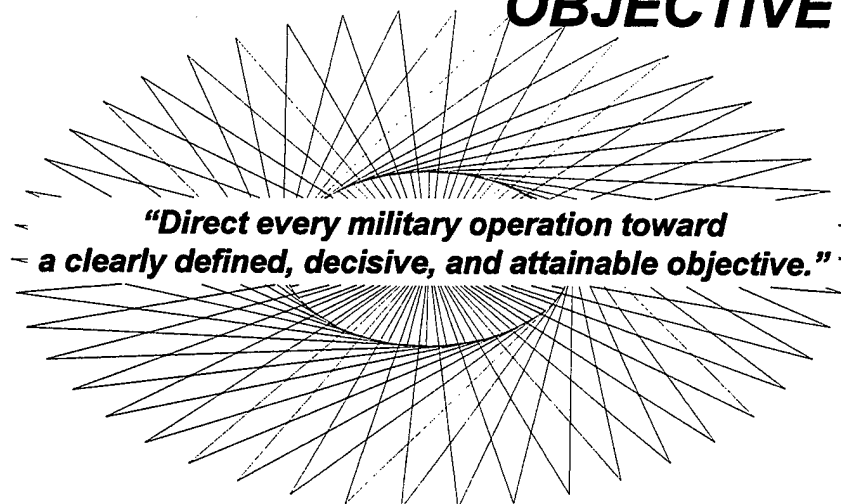
COMMAND AND INFORMATION



INFORMATION AGE COMMAND

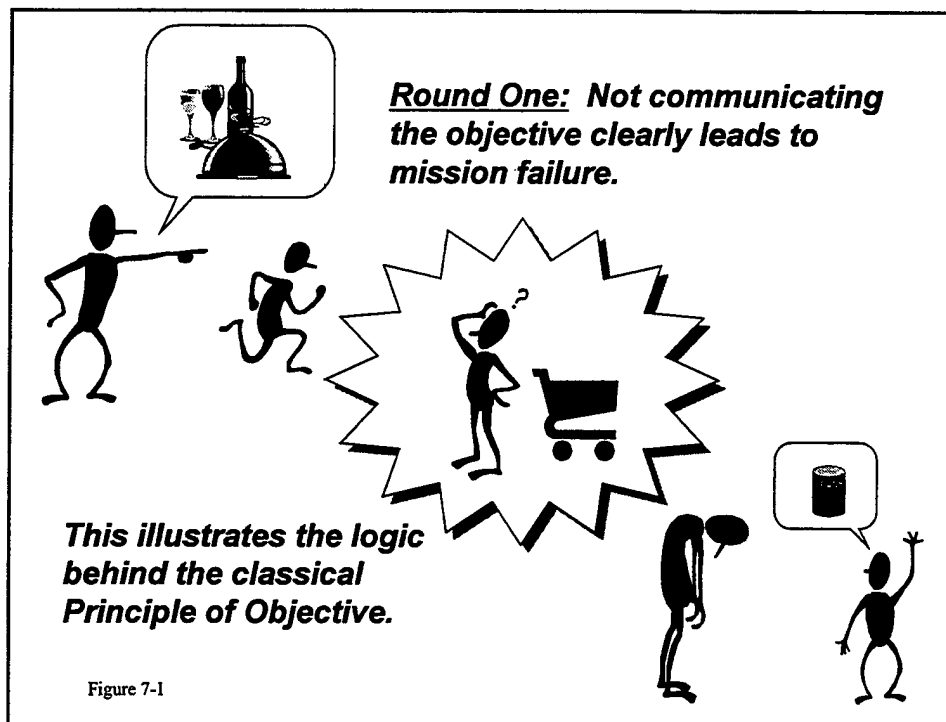


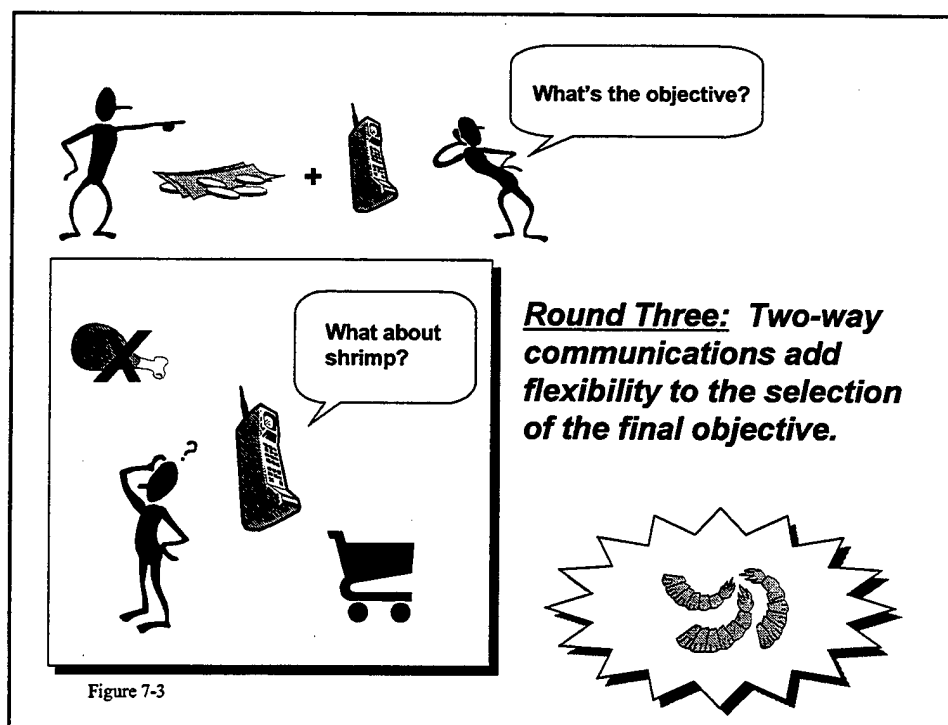
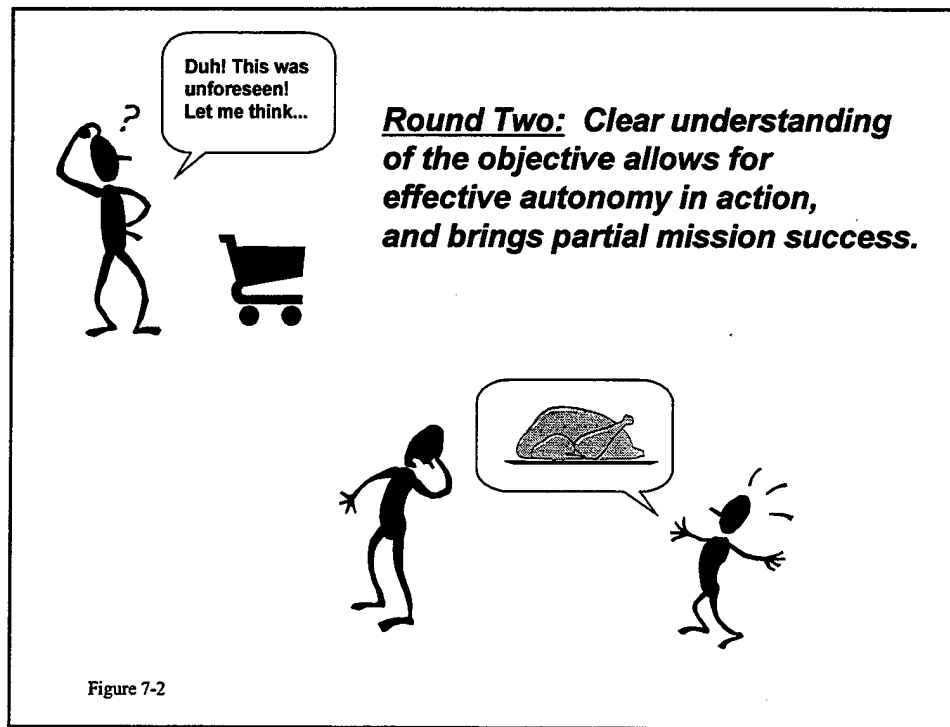
OBJECTIVE



OBJECTIVE

- Warfare must be purposeful, but...
- The ***selection*** and the ***communication*** of that purpose depends upon the technological context of the conflict.
- The Principle of Objective reflects reality in the Age of Sail.
- 21st century warfare will give rise to ***option acceleration***.







+



+



What about
the Principle
of Objective?

Fourth Round: With the introduction of "virtual presence" the Principle of Objective loses relevance. Technology has paved the way toward "Option Acceleration."

Figure 7-4

SUN TZU AND THE AUTONOMY ARGUMENT

King of Wu: *Can you conduct an experiment in the control of the movement of troops with women?*

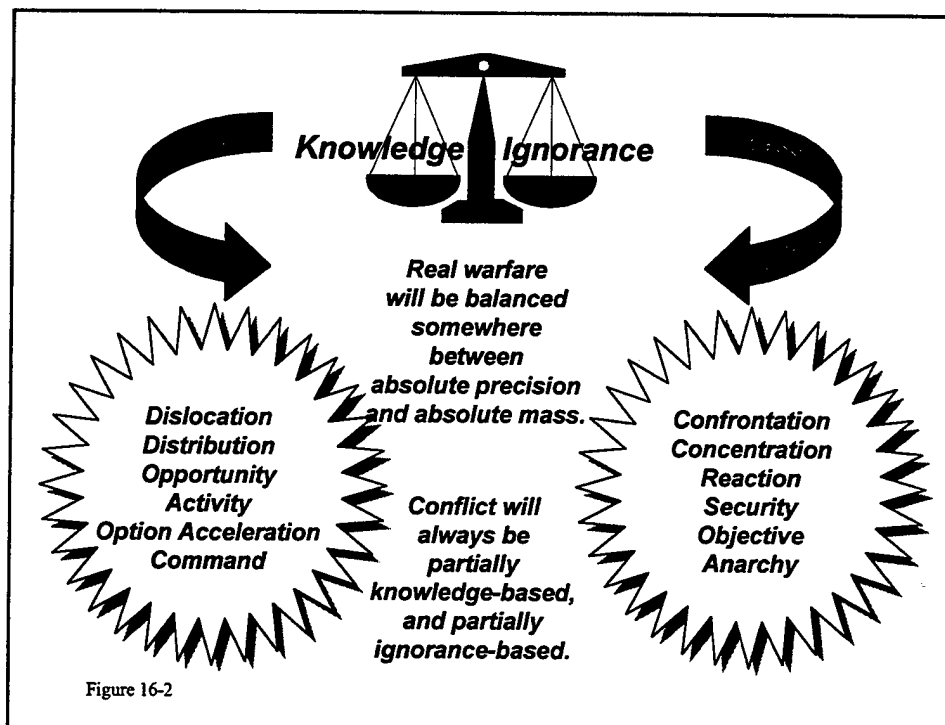
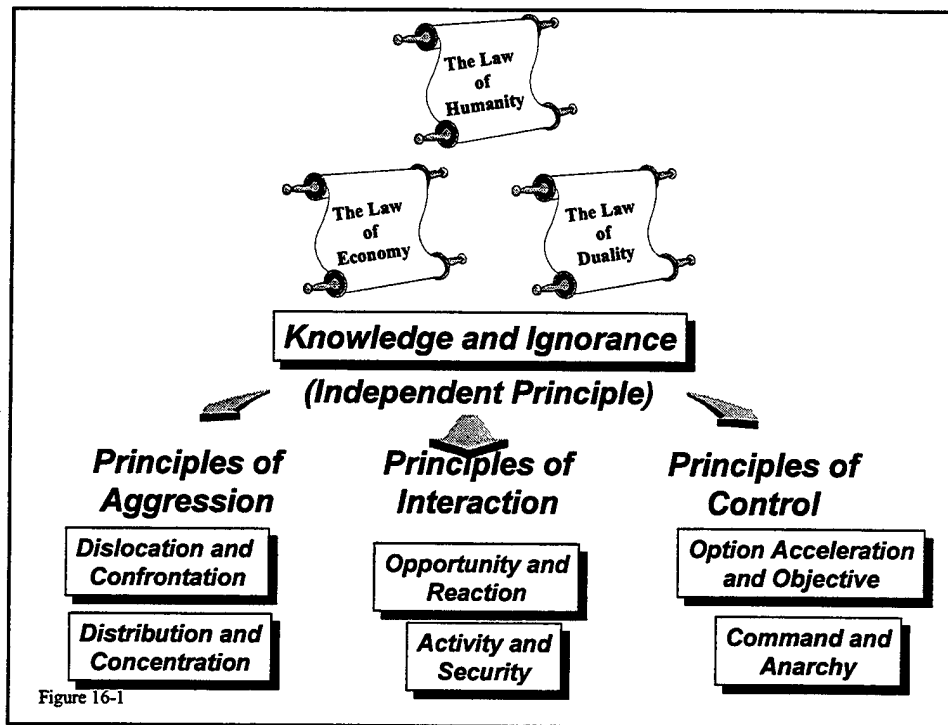
Sun Tzu: *I can.*

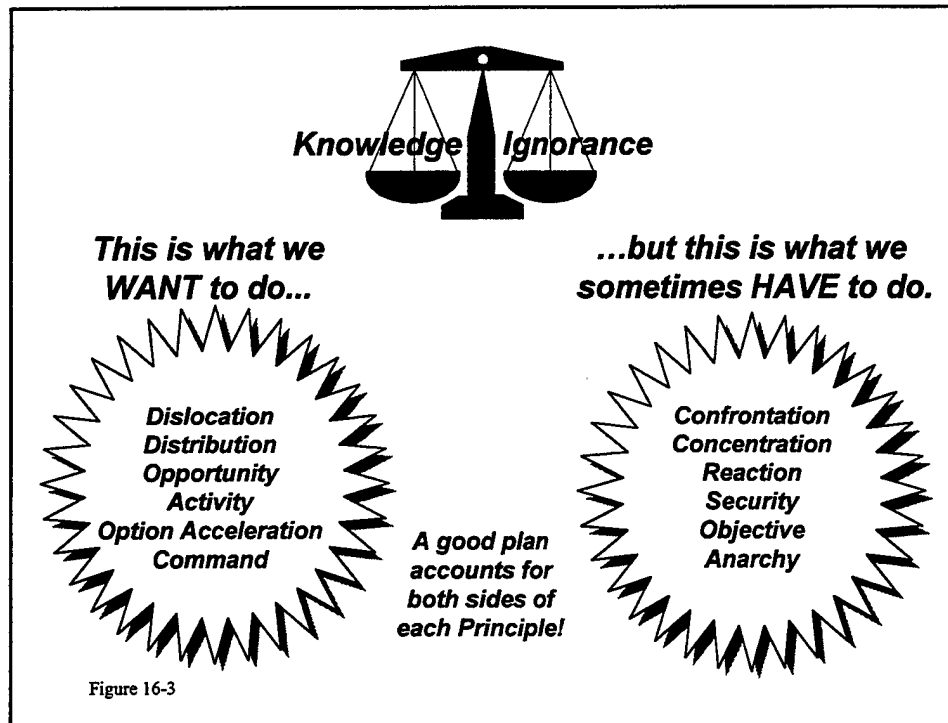
The King sent 180 women from the palace. Sun Tzu trained the women, but they repeatedly giggled when ordered to face right. Sun Tzu decided to behead the King's two favorites. When the King tried to intervene, Sun Tzu replied...



Sun Tzu: *Your servant has already received your appointment as Commander, and when the commander is at the head of the army, he need not accept all the sovereign's orders.*

Sun Tzu then beheaded the women and continued the experiment.





Training Battlefield Critical Thinking Skills

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Human and Organization Issues
for Army After Next - II
25 June 1998

Contract No. DASW01-97-C-0038 with the United States Army
Research Institute, Fort Leavenworth Field Unit. COTR: Dr. Sharon
Riedel

1

Overview

- Development of *Critical Thinking Training*
 - What does the Army training look like?
 - Results of testing in Navy and Army domains



How is training justified?

- Background Research
 - Naturalistic organization of situational knowledge
 - Naturalistic strategies for handling uncertainty

2

Why Critical Thinking?

Master chess players know much more than the rules of chess. They have developed broad and deep expertise in *how to win*.

Similarly, the Military Decision Making Process is a necessary set of strategies for thinking and planning about the battlefield. But by itself, it is not enough to create battlefield expertise or to ensure success.

Battlefield Expertise

Battlefield expertise has at least two major components:

- 1. *Knowledge* (e.g., METT-T, MDMP, tactics)**
- 2. *Skill* in using that knowledge = critical thinking**

Critical thinking skills are *part* of what makes an officer a battlefield expert. These skills are key patterns of thought that battlefield masters use.

Key Patterns of Thought

The following training is based on in-depth discussions with over 50 experienced Army commanders and staff officers -- to find out how they actually think about the battlefield under highly uncertain conditions, and how they develop and choose successful courses of action.

The training is designed to provide VALUE ADDED to the Military Decision Making Process, not to replace it or change it. It is designed to increase its speed, clarity, and effectiveness.

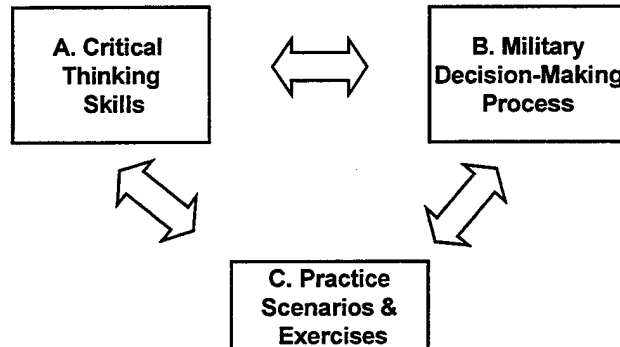
The Battlefield of Tomorrow

As the volume of information available to decision makers increases, *critical thinking skills* will become increasingly important. The key to victory will be the ability to:

- quickly sort out the relevant from the irrelevant***
- think critically and creatively about the significance of the information***
- make a timely decision***

Training Overview

During the training, you will be presented with material of three kinds: The first kind of material explains a critical thinking skill. The second shows how that skill is applied to the military decision making process, through historical examples or simple examples. And the third prompts you to apply the skill to a military planning exercise scenario.



7

Four Critical Thinking Skills

Choose Your Action Orientation
Know when & how to be proactive, predictive, and reactive

Keep Your Eyes on the Goal
Assess everything in terms of what really counts.

Each of these four skills reinforces the others.

Know the Battlefield
Recognize and handle key uncertainties.

Develop Confidence in Judgments
Be highly confident, based on thorough self-questioning.

Skill #1: Choose Your Action Orientation

In some situations a commander is able to anticipate or influence the enemy. In other situations, the enemy may act first, and the commander will be forced to react. We call this spectrum of possibilities action orientation.

In this training, you will learn how to *recognize* three action orientations - proactive, predictive, & reactive - and the issues that are relevant to each.

You will also learn how to assess which action orientation is appropriate or possible at a given time.

Historical Example: Being Proactive

"Oh, I am heartily tired of hearing about what Lee is going to do.... Go back to your command, and try to think what are we going to do ourselves..." -- U. S. Grant



The proactive commander *starts* by thinking about how to achieve his own goal.

Skill #2: Keep Eyes on the Goal

A characteristic of effective commanders is that they have a clear and deep understanding of their goal, and focus attention on achieving it. Less experienced commanders or staff may propose actions that sound good, but would not in fact achieve the goal, even if successful.

In this training, you will learn a simple tool for helping you stay focused on the goal. It involves thinking in terms of what we call "stories". A story is a succinct summary of events or ideas, that shows how each event or idea is linked to success or failure of your goal.

Historical Example: Know Your Goal

A subordinate suggested to General Grant that if certain other Confederate positions were occupied, the enemy would have to evacuate the river fortress at Columbus, KY.

Grant saw that the "victory" of capturing Columbus would be incomplete. His real goal was not to capture places, but to capture armies, in order to eliminate South's ability to fight. So, Grant objected: "Better attack," he said, "and capture the entire force where they are. Why allow them to withdraw and follow and fight them in the interior of Mississippi or Alabama under greater disadvantage." -- based on Bruce Catton



Grant used a simple story to explain why the enemy's evacuation would not serve his goal: We flank Columbus -- enemy withdraws south -- we follow enemy south & fight them deeper in their territory -- with a reduced chance of destroying enemy force (goal).

What are Action Orientations?

Action orientations always involve a *friendly action* and an *enemy action*.

Your action is designed to influence which action the *enemy* adopts.

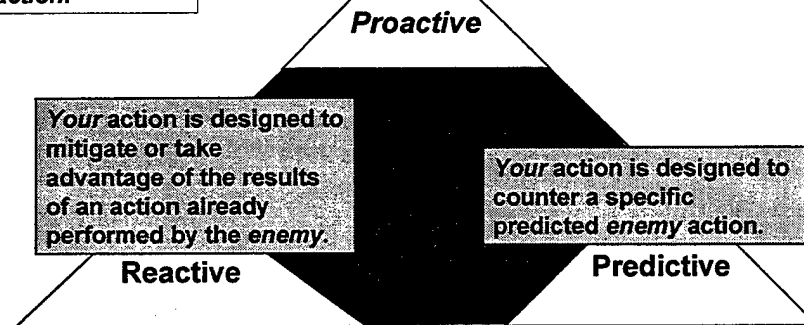
Proactive

Your action is designed to mitigate or take advantage of the results of an action already performed by the *enemy*.

Reactive

Your action is designed to counter a specific predicted *enemy* action.

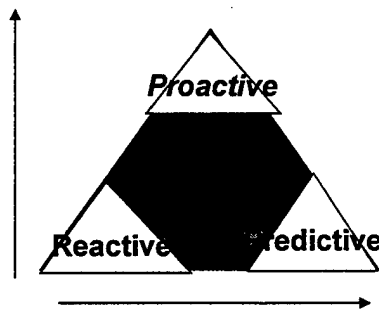
Predictive



What Action Orientation Am I Using?

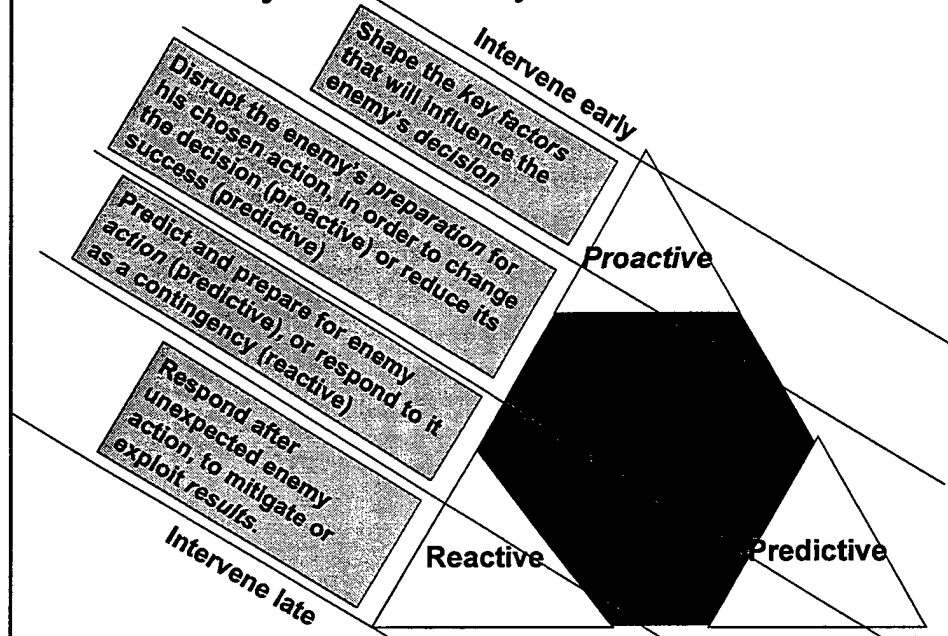
Action orientations differ from one another in two ways:

The degree to which *your action* attempts to influence the occurrence of the *enemy action*



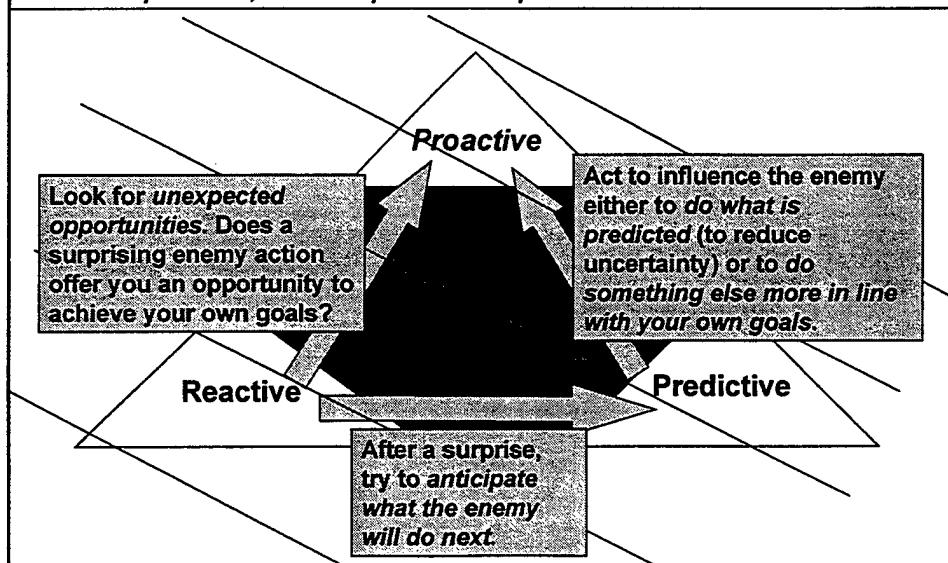
The degree to which *your action* depends on a specific prediction about future *enemy action*

Action Orientation Logically Determines When in the Enemy's Decision Cycle You Can Intervene



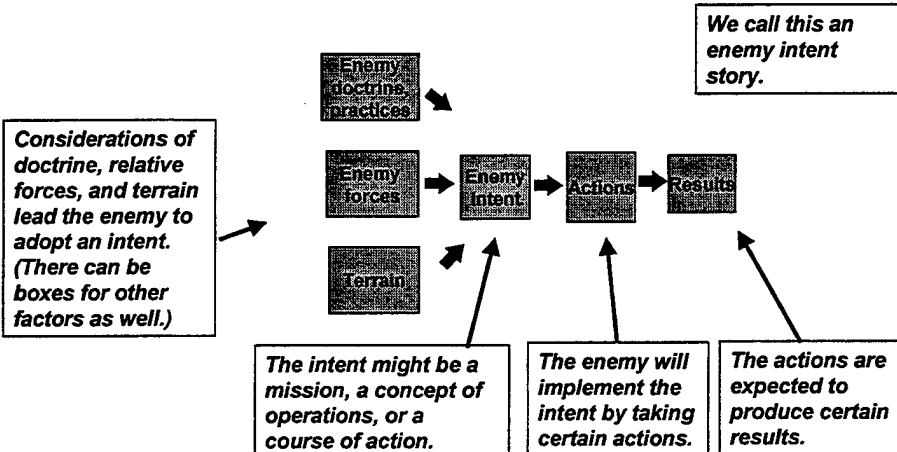
Finding Opportunities

Effective commanders look for ways to *intervene as early as possible in the enemy's decision cycle*. This is done by moving from reactive to predictive, from reactive to proactive, and from predictive to proactive.



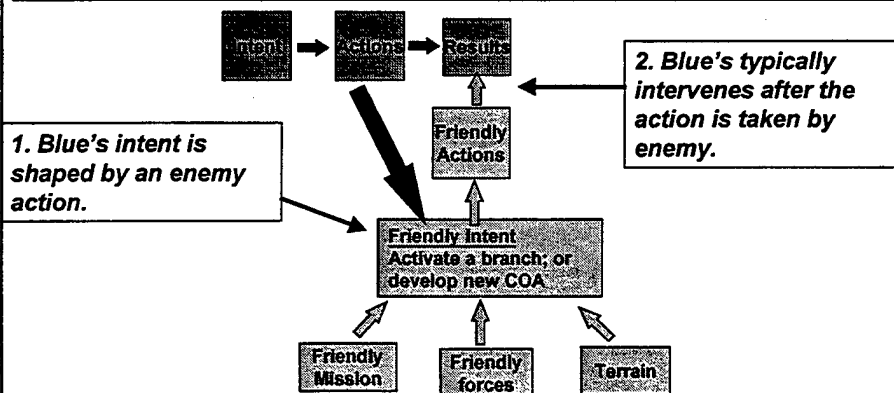
Enemy Intent Stories

To develop an appropriate action orientation, it is sometimes helpful to picture an explicit *story* about the *enemy decision cycle*. The red boxes & arrows below represent a simplified sequence of events in the enemy's mind:



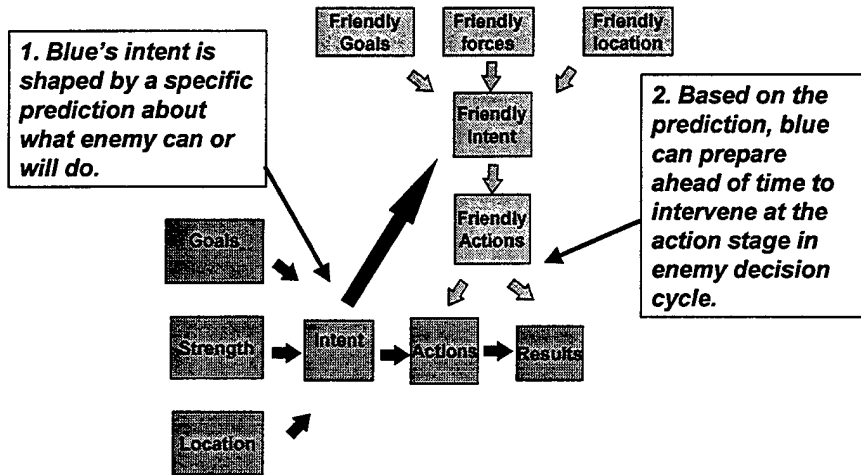
Reactive Action Orientation

When blue is reactive, blue may have chosen to wait & see how the enemy will act, or the enemy action may be a surprise. Blue then implements a branch of the blue plan (if one exists), or develops a new COA either to stop exploitation of the action by the enemy or to take advantage of it.



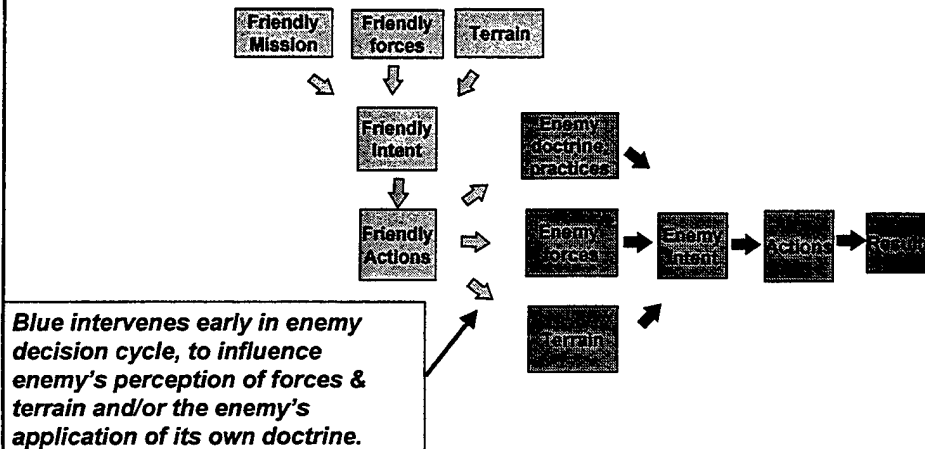
Predictive Action Orientation

When blue is predictive, blue anticipates the most likely (or most dangerous) enemy intent, and intervenes to counter or defeat it.



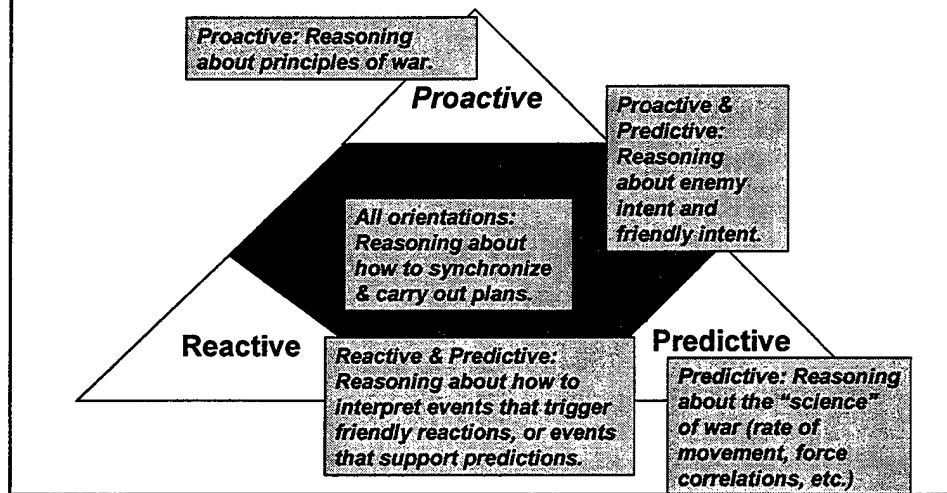
Proactive Action Orientation

When blue is proactive, blue actions are designed to shape the key features of the battlefield. These features will in turn influence Red decision making about intent.



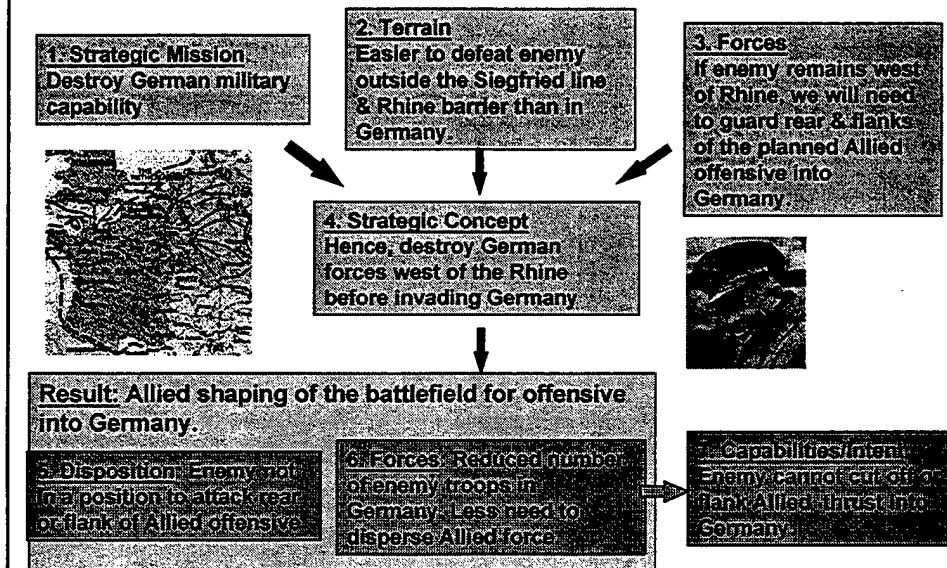
Action Orientation Influences What You Think About

Different action orientations cause you to focus on different aspects of the battlefield. Here are examples of the kinds of issues that arise, placed near the *action orientations* in which they tend to be considered.



Proactive Strategy: Campaign in France

The proactive strategy starts with your ultimate goals and uses strategy to shape what the enemy can or will do.



Predictive Operations: Ardennes

Predictive operations start with a prediction of enemy intent. Despite reasons 1,2, and 3 below, Eisenhower & Bradley thought the enemy would not strike a forceful blow through the Ardennes, because of 4.

1. Allied Forces
Enemy may detect thin Allied forces in Ardennes region and heavy concentrations north and south.



2. Enemy Objective
Enemy would want to attempt a counteroffensive.

3. Terrain
Ardennes is passable.

5. Predicted Enemy Intent
Enemy attack through the Ardennes in the near future is very *unlikely*. At most, a *small* spoiling action might occur there.

4. German Forces
Enemy forces are exhausted & depleted from recent battles. Not presently capable of mounting an offensive.

Conflict with 1,2,3

It has been argued that the Allied leaders did not pay enough attention to the conflict between 1, 2, & 3 and 4.

Reactive Tactics: Ardennes Offensive

Reactive tactics attempt to minimize the results of a surprise enemy action in battle.

2. Conflicts with prediction!

1. Action
Massive enemy offensive in Ardennes

3. Initial Result
Rapid enemy gains. Allied casualties.

Result: Mitigation of Enemy Advantage

6. Terrain
Enemy flanks exposed

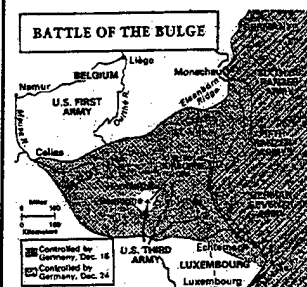
7. Enemy forces
Momentum peters out

8. Enemy forces
Cannot break out

4. Reaction to problem



5. Reactive Tactics
Resist enemy advances, but avoid piecemeal use of key troops. Minimize exploitation by guarding flanks of the enemy offensive.



Shift to Proactive Tactics: Ardennes

Despite the initial surprise in the Battle of the Bulge, Eisenhower saw the enemy offensive as an opportunity to achieve his larger goals in the campaign.

1. Strategic Concept

Destroy German forces west of the Rhine before invading Germany.

2. Forces

German forces in Ardennes offensive, are west of Rhine & outside of Siegfried line.

3. Tactical Plan

Allow enemy to exhaust itself, and overextend its offensive, then counterattack decisively with fresh troops on north (Montgomery) and south (Bradley).



4. Results

Large number of enemy troops in "bulge" will be destroyed.

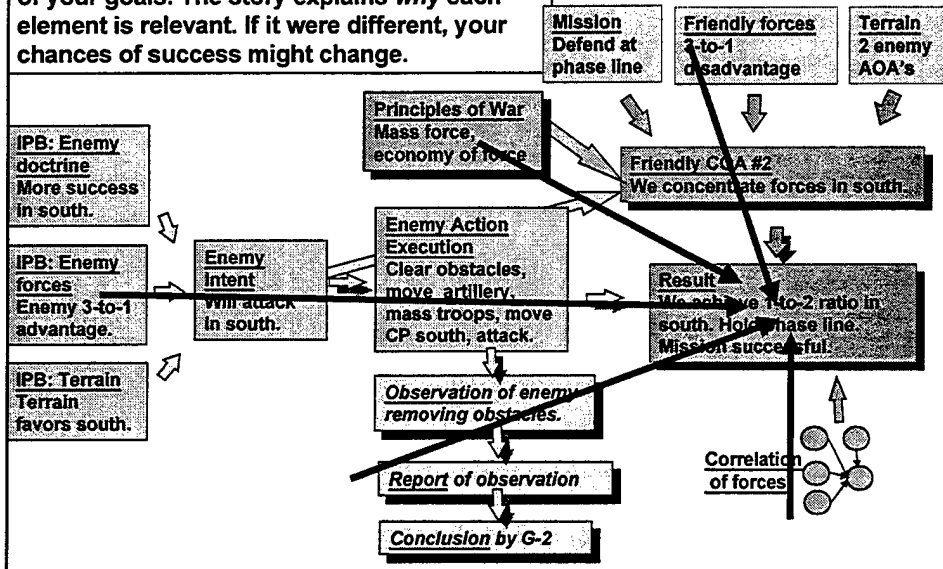
5. Forces: In subsequent invasion of Germany, a reduced number of enemy troops will be faced by a more concentrated Allied force.

Arisle Exercise B: Action Orientation

1. What aspects of your Arisle COA are proactive (i.e., attempt to influence enemy intent)? Explain how they are proactive. *Are there other proactive opportunities?*
2. What actions that you proposed to take in the Arisle scenario are predictive (i.e., depend on predictions of enemy actions)? Explain how they are predictive. *What else would it be useful to predict?*
3. What aspects of the Arisle operation are reactive? What kinds of events might occur in the future that will force you to react? What actions have you taken to be able to react effectively to such events? *What other actions could you take to increase your ability to react?*

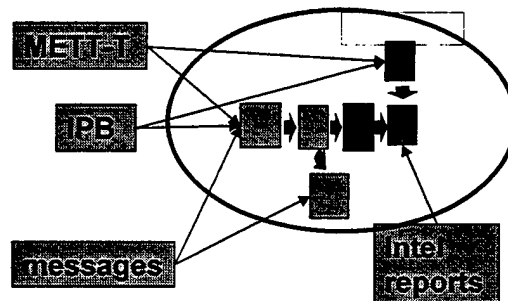
Stories Link Critical Issues to Your Goal

Finally, note that *every* part of this story is *connected*, by a chain of links, to achievement of your goals. The story explains *why* each element is relevant. If it were different, your chances of success might change.



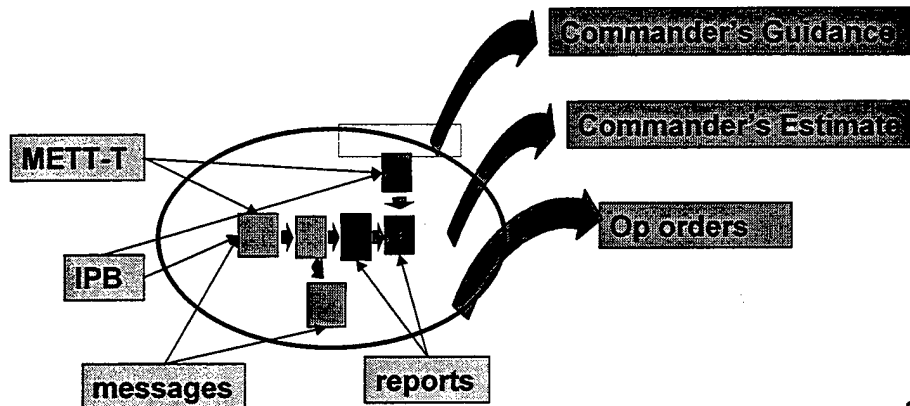
Stories Identify & Organize the Crucial Issues on the Battlefield

As we have seen, a story acts as a *filter* for the vast quantities of information available on today's battlefield, e.g., from IPB, intel reports, messages, and so on. *Telling a story* is a way for you to boil down large quantities of information, pick out the relevant facts, and show why they are important.



Stories Help You Communicate Clearly

Stories can be used to *build documents*, e.g., to *determine what must be included in operations orders or the commander's estimate*. Stories help you *clearly & quickly communicate your assessments and plans*, together with the *reasons for them*, i.e., *your picture of the battlefield*.



Skill #3: Know the Battlefield

A characteristic of effective commanders is that they are willing to act decisively in the presence of uncertainty and risk. They know what uncertainties can be resolved, and how to resolve them, and what uncertainties can or must be accepted.

In this training, we will learn an effective technique for thinking about and handling uncertainty in the battlefield. The "I.D.E.A.S." method will help you *find and correct problems* in your stories about the battlefield.

Historical Example: Know the Battlefield

[Grant] was always ready to move against his enemy: he was never petrified by numbers or situations, and never through fear or caution did he exaggerate the strength of his enemy...

– Adam Badeau

***In war anything is better than indecision.
We must decide. – U. S. Grant***



Skill #4: Develop Confidence in Judgments

A characteristic of effective commanders is confidence, even optimism, a faith in their troops and their own ability to lead. However, such confidence must be *well-grounded*. Sometimes, key assumptions or alternative possibilities are overlooked, causing a plan to fail. A commander's confidence is justified when he has taken such assumptions and possibilities into account.

In this training, you will learn a Devil's Advocate method for rigorously questioning the assumptions underlying your assessments and plans. Officers who use this method have been found to develop more confidence in their assessments and plans.

Historical Example: Develop Confidence

When you have completed your last preparations, you go into battle without hesitation... no doubts, no reserves; and I tell you it was this that made us act with confidence. – W.T. Sherman, in letter to Grant



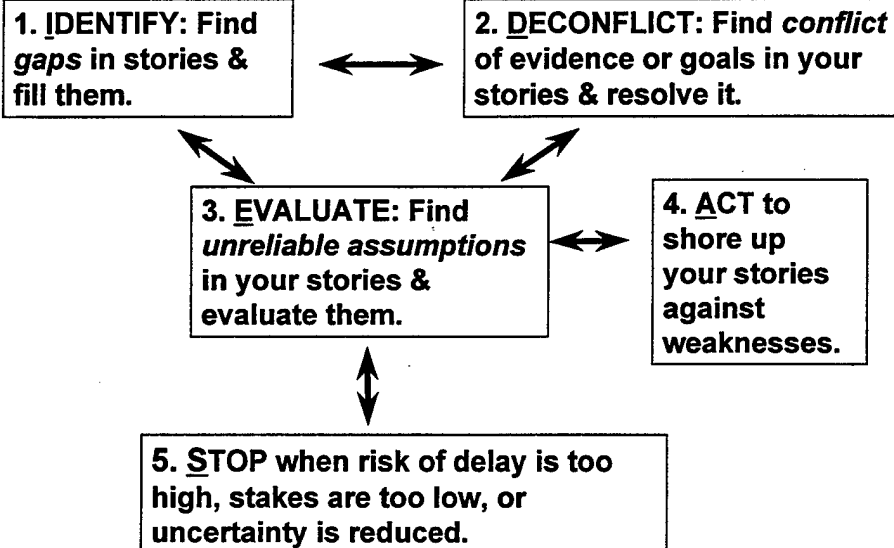
A Different Approach To Uncertainty

In this training, you will learn to approach uncertainty the way proficient decision makers do.

You will learn that:

- 1. Proficient decision makers search for and recognize *different types of uncertainty*.**
- 2. They adopt *different strategies for handling uncertainty* depending on what kind of uncertainty it is.**
- 3. They *stop trying to resolve uncertainty, and act on their current best picture* when the cost of delay is too high compared to the stakes of the decision.**

The Phases of the I.D.E.A.S. Process



Ways of Handling Conflict

You can:

- Ignore the conflict. Maintain your assessment or COA despite the evidence or goals that conflict with it.
 - Ignoring conflict can lead to unpleasant surprises!
- Change your mind. Revise the assessment or COA.
 - But what about the reasons that led you to the assessment or COA in the first place? This ignores conflict in a different way! Don't give up a good idea too soon.
- Try to find a number of ways to explain the conflict. If possible, test or evaluate the alternative explanations. If not, at least evaluate their plausibility.
 - This approach helps generate new critical information requirements, equips you to deal with different possibilities, and helps you find the best picture of the situation.

Historical Example: The Value of Time

There was a spur on the heel of every order [Grant] sent, and his subordinates were made to realize that in battle it is the minutes which control events. -- Horace Porter

Time strengthens [the enemy], in all probability, as much as it does you. -- U. S. Grant



The Crystal Ball

An effective method for putting confidence to the test is a *Devil's Advocate* technique. It forces you to imagine that you are wrong and to explain how.

A tool that makes you a Devil's Advocate for your own ideas or for others is The Crystal Ball Technique.



How to Use the Crystal Ball

Select a key assessment or prediction, no matter how confident you are that it is true -- and force yourself to imagine it is wrong. (Suppose an infallible crystal ball says it is false.)

Now explain how the assessment could be false.

Evaluate the plausibility of the explanation. If plausible, modify your plan to guard against the possibility, attempt to confirm or deny the explanation -- or else, decide to accept the risk.

Now the crystal ball says that the key assessment you started with is still wrong, but not for the reason you gave. You must come up with another explanation...

Don't stop until you have covered a variety of different kinds of risks.

Results: Critical Thinking Training

Variable	Study 1 (Individuals / SWOS)	Study 2 (Individuals / NPS)	Study 3 (Teams /SWOS)	Study 4 Teams with DSS / SWOS & NraD	Study 5 Individuals / Army
Issues considered in regard to assessment	+ 7%	+30% *	+30%	+56% *	+38%
Conflicting evidence identified	+52% *	+58% *	+29%*	+44% *	+53% *
Explanations of conflicting evidence	+26%	+27% *	+ 5%	+31%	n/a
Number of alternative assessments considered	+10%	+41% *	+15%	+19% *	n/a
Accuracy	+42% *	+18% *	+55% *	+28% *	+19% *
Agreement	+14%	+41%	n/a	n/a	n/a
Confidence	+13%	+20%	n/a	+ 2%	n/a
Frequency of contingency planning	+217% *	n/a	n/a	n/a	n/a
Subjective evaluations	73% positive	71% positive	88% positive	100% positive	77% positive

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What Emotional Intelligence (EQ) Can Tell Us about Selecting Leaders

John D. Mayer

Conference Paper (June 24th - June 26th, 1998). Workshop on Human and Organizational Issues for the Army After Next II. Workshop jointly sponsored by the Deputy Chief of Staff for Personnel and the Deputy Chief of Staff (Doctrine), TRADOC, and coordinated by the Army Research Institute (ARI). Xerox Document University, Leesburg, VA.

What Emotional Intelligence (EQ) Can Tell Us about Selecting Leaders

Introduction

Emotional intelligence is one of several hundred parts personality. It concerns the ability to reason abstractly about the information conveyed by emotions. Because there exist so many parts of personality, it is unlikely that only one, or even a few parts of personality can account for an individual's successful functioning. At the same time, some parts of personality are more important than others in predicting success, and these include the intelligences. Emotional intelligence can be defined as the ability to perceive, assimilate, understand, and regulate emotions. Research on emotional intelligence indicates that it exists, is interesting, and may be important in predicting life outcomes. Selecting leaders, however, will best be accomplished by using multiple parts of personality, examined together (including, perhaps, emotional intelligence). There are two good ways to use multiple parts of personality for selection purposes. The first way is to use an additive model -- to simply add up the desirable parts a person possesses (and subtract the negative parts) and choose people with the most desirable parts. A more sophisticated approach may be to search out particular personality types, and match them to particular jobs.

The Parts of Personality

Since the early 20th century, personality psychologists have been defining and studying parts of personality. For example, the great personality psychologists early in the 20th century included Sigmund Freud, Carl Jung, Alfred Adler, and the like. Each of these theorists proposed a set of personality components. Freud is closely identified with his formulation of an *id*, *ego*, and *superego*. The *id* was a collection of primitive, unsocialized, sexual and (in later theorizing) aggressive urges. The *ego* provided rational control so as to adhere to the standards of society. These standards, in turn, were represented within the person in the *superego*. In contrast to Freud, Jung suggested that there existed *archetypes*, *personas*, and other parts. The *persona*, for example, is a mask a person wears for social encounters. Being a drill sergeant involves a mask -- a certain way to behave with recruits -- that does not represent a person's entire personality.

Some parts of personality are well known to the public. Alfred Adler's *inferiority complex* has become a part of our language for describing feelings of inferiority. Similarly, most people can identify Hans Eysenck's *extraverted* part within those people who are outgoing, lively, and good-natured socializers. Other parts of personality are relatively obscure -- unknown even to many personality psychologists -- even though they capture intuitive experiences. For example, Jung's *enantiadromia* (meaning, roughly, "swing of the pendulum"), is defined as the mental mechanism that raises an idea opposite to what we have just thought. A supervisor who says to a subordinate, "You took too much time to plan this," may wonder inwardly whether he himself should spend more time planning. That opposite idea marks the *enantiadromia* at work.

Today, personality psychologists regularly employ about 400 personality components in discussing an individual's personality.¹ In employing so many different types, it often helps to classify them into different categories. A number of different classification systems of the parts of personality are employed in the field. Most of these are informal systems with poorly defined classifications, but a few are more formally worked out.² These more formal systems differ in the number of categories they use, but there is fairly good agreement on a few basic points: The parts of personality can be distinguished from one another according to whether:

- (A) they are mostly biological, learned, or some combination of the two.
- (B) they deal with motivation, emotion, or cognition.
- (C) they relate to the self-concept or not
- (D) they are large or small.

An example of one generic, somewhat simplified framework, can be seen in Figure 1 on the next page.³

¹ This number was taken from a count of personality components listed in the glossaries of several personality textbooks in the area. The textbooks were chosen for their authoritative quality, and different approaches to the field (Mayer, J. D., 1995. A framework for the classification of personality components. *Journal of Personality*, 63, 819-877).

² A discussion of the many frameworks employed for personality components can be found in the article referenced in Footnote 1, and also in the upcoming issue of *Psychological Inquiry*, in the target article (Mayer, J. D. (1998). A systems framework for the field of personality psychology. *Psychological Inquiry*, 9, 118-144), and in the commentaries on the article.

³ Figure 1 is modified from Mayer, J. D., Salovey, P., & Caruso, D. R. (in press). Competing models of emotional intelligence. In R. J. Sternberg (Ed.). *Handbook of Human Intelligence* (2nd ed). New York: Cambridge

<i>Level of Personality Function</i>	<i>Components of Internal Personality</i>		
<i>Higher-Level, Synthetic Abilities and Qualities</i>	<i>Intrapersonal Qualities</i> <i>Examples: Self-esteem, openness, spirituality, Machiavellianism</i>		<i>Interpersonal Qualities</i> <i>Examples: Extroversion,</i>
<i>Mid-Level Inter-actions</i>	<i>Motivational and Emotional Interactions</i> <i>Examples: Aggressiveness, Altruism</i>		<i>Emotional and Cognitive Interactions</i> <i>Examples: Optimism, emotional intelligence</i>
<i>Lower-Level, Specific Modes of Processing</i>	<i>Motivational Directions</i> <i>Examples: Hunger, thirst, sex, dominance</i>	<i>Emotional Qualities</i> <i>Examples: Happiness, sadness, anger, anxiety</i>	<i>Cognitive Abilities</i> <i>Examples: Learning, memory, judgment, abstract reasoning</i>
<i>Focus of Processing:</i>	<i>Internal Concerns</i> <-----> <i>External Concerns</i>		

In Figure 1, the lower-level parts of personality (smaller, more biological) include three categories of parts: the motivational, emotional, and cognitive. The motivational category includes such parts as hunger, thirst, sexuality, and dominance. The emotional category includes such parts as happiness and anxiety. The cognitive category includes such parts as basic learning and memory, judgment and abstract reasoning. These parts are typically viewed as close to the biological level in their basic operation. But relatively little in personality operates in a purely motivational, emotional, or cognitive fashion. Far more parts involve some combination of these categories.

The next portion up within Figure 1, therefore, shows that various areas of personality interact. Motivations, such as a need for power, may merge with emotions, such as anger, to create a synthesis of motivation and emotion, in a person's aggressiveness. Emotion and cognition may merge as well, as when a person is optimistic. Emotional intelligence also is probably located here, at the intersection of emotion and cognition.

Still further parts of personality seem to call upon all the basic parts of personality together. These higher-level parts can be categorized as intra-personal or extra-personal. Intra-personal aspects include such characteristics as the self-concept, which synthesizes motives, feelings, and thoughts. Other examples include internal spirituality, openness to new ideas, and self-consciousness. Extra-personal aspects include such characteristics as extroversion, or friendliness, as well as a variety of other interpersonal traits. These, too, synthesize motivation, emotion, and cognition.

What Is Emotional Intelligence?

Emotional intelligence, then, is one of the four-hundred parts of personality, and can be

classified as arising from an interaction of emotion and intelligence. More specifically, emotional intelligence can be defined as the ability to perceive, assimilate, understand, and regulate emotion within the individual.⁴ A first question this definition usually raises is: "What is there to understand about emotion, anyway?" If emotion is just irrationality or a bothersome leftover from our evolution beginnings, then emotional intelligence is like an intelligence dealing with irrationality! Emotions, however, are now believed by psychologists to convey information about relationships. Theorists across the ages have generally agreed that each emotion conveys information about a specific relationship. For example, happiness means a person has harmonious relations with others, fear means that someone is threatened. Anger can mean that a person has been treated unjustly. Sadness can signify a loss. The definition of emotional intelligence states that reasoning involved in each of its four sub-domains include the ability to perceive, assimilate, understand, and manage, this information about relationships.

Perceiving Emotion

The first part of emotional intelligence involves skills at perception of emotion. These skills concern how accurately individuals can identify emotions and emotional content. Young children learn to identify their own emotional states as they grow. Feelings are recognized in oneself, and then in other people, according to their characteristic features. For instance, the child notices the connection between personal anxiety and constricted posture: this enables her to recognize anxious expressions in other people and the anxious meanings in paintings, music, and art.

Assimilating Emotion.

The second, assimilation skills, concern how emotion might contribute to a person's intelligence. For instance, emotion serves as an alerting system essentially from birth. The infant cries when it needs milk, and laughs in response to smiles. As adults, emotions still prioritize our activities, as when a person in a hotel lobby nervously breaks off reading the paper to remind himself "I need to get to the airport on time."

A second contribution of emotion to a person's intelligence is to generate emotions "on demand" so that they can be better understood. When deciding how another person feels, people may put themselves in the other's place to generate the feelings within themselves. This permits an immediate, real time, inspection of the feeling and its characteristics. In the growing person, the ability to generate feelings assists with planning.

Understanding and Analyzing Emotions: Employing Emotional Knowledge

The third area of emotional intelligence concerns the ability to understand emotions and to utilize emotional knowledge. Understanding emotions includes understanding their meanings (e.g., that sadness means loss), but also understanding blends of emotions, and how emotions

⁴ For a further elaboration of this brief discussion, see Mayer, J. D. & Salovey, P. (1997). What is emotional intelligence? In P. Salovey & D. Sluyter (Eds). Emotional Development and Emotional Intelligence: Implications for Educators (pp. 3-31). New York: Basic Books.

unfold over time. For example, if Fred was angry at noon, and ashamed at 1PM, only a few things might have transpired in-between. Fred might have expressed his anger in a way that seemed "over the top" to him, or Fred might believe that anger is never appropriate, or Fred might have discovered that the injustice he was angry about was nothing of the sort, but rather arose from his own misunderstanding. Fred would have experienced an entirely different emotional progression if, in between, he had met a dignitary, been hugged by a friend, or been threatened by someone. Understanding these emotional states and progressions requires a considerable amount of analytic ability.

The Regulation of Emotions to Promote Emotional and Intellectual Growth

The last part of emotional intelligence concerns the conscious regulation of emotions to enhance emotional and intellectual growth. Emotional reactions must be tolerated -- even welcomed -- when they occur. For that reason, this highest-level branch begins with openness to feelings.

As children grow, their parents teach them to favor certain feelings, and even to dismiss others at times. For example, children may be taught to smile in public even if feeling sad, and to go to their rooms if angry. Gradually, these divisions between feeling and acting become internalized: the child begins to learn that emotions can be separated from behavior. Parents teach rudimentary emotion control strategies ("Count to 10 when you are angry"). As a consequence, the child learns to engage and disengage from emotion at appropriate times. In adults, emotional control strategies may be very sophisticated and tailored to the individual's unique disposition.

The Research Evidence for Emotional Intelligence

Does emotional intelligence actually exist? That is, can it be verified according to standard scientific procedures? To demonstrate it, it must be measured in some fashion. Over the past nine years or so, various measures of emotional intelligence have been developed. Most of these employ a self-report approach in which people are asked questions such as, "Are you optimistic?" Or, "Can you feel your emotions clearly?" Although this approach holds some promise, there are many reasons to doubt that people will answer such questions in a meaningful way. Such questions are highly influenced by mood, self-concept, and the desire to appear good (or not so good).

A better way to measure emotional intelligence is by actually asking an individual to solve emotional problems: to identify the emotion in a face, to compare an emotion to a color, or to answer questions such as the one discussed above about Fred (that is, "If Fred felt angry and then ashamed an hour later, what happened in-between?"). A performance scale of emotional intelligence has recently been developed called the Multifactorial Emotional Intelligence Scale, or MEIS.

Results from the MEIS indicate fairly conclusively that emotional intelligence does exist as a unitary part of personality. Moreover, it is related to self-reported empathy, and also to general intelligence (but is distinct enough from each of these to add some unique description of

an individual). This ability test of emotional intelligence is so new, however, that relatively little work has been done with it and little is known yet concerning what it predicts. My colleague Dr. Peter Salovey has told me that he has early (unchecked) results that emotional intelligence may predict school performance above and beyond the predictions made by SAT's. In our own laboratory, our early (also unchecked) findings indicate that emotional intelligence may predict the absence of bad behavior: identifying people who do not get into fights, making threats, etc., but that it does *not* predict good, warm, altruistic, or giving behavior. We are still following up leads on this.

Tests that use self-report measures of emotional intelligence (as opposed to the performance measure described above) are full of positive findings, but the researchers employing these tests typically fail to account for well-known influences of other, partly confounded variables. For example, all self-report measures of emotional intelligence correlate very strongly with positive mood, and positive mood is known to predict positive thinking. Self-report scales of emotional intelligence (as opposed to performance measures) are sometimes correlated with a person's self-judged satisfaction on the job. The correlations are high, but they may result from the fact that happy people believe they are more emotionally intelligent and more satisfied on the job than other people. These findings, in other words, say little about emotional intelligence as an ability. So, the self-report research is superficially impressive, but not well enough controlled to be convincing as of yet. The ability-testing research is just getting underway.⁵

Selection of Leaders and Emotional Intelligence

When TIME magazine "broke the story" of emotional intelligence, they said it might be "The Single Most Important Predictor of Success" – on their cover. Now, I plainly believe emotional intelligence is interesting and important – or I wouldn't have spent many years defining, developing, and researching the concept. At the same time, in the face of all the media coverage and best-selling books I feel compelled to say that (a) there is absolutely no evidence that it is the best predictor of success and (b) there will probably never be evidence that it is the best predictor of success, except perhaps for a few, very specific occupations.

So, what can emotional intelligence teach us about the selection of leaders? I hope this essay makes clear that there are variety of parts of personality that must be taken into account to select leaders. TIME magazine and other media outlets' exaggeration of the importance of emotional intelligence teaches us that we are prone to look for a single part of personality (a sort of "Part of the Month" club?) as a simple way of evaluating people. Whether we believe a cure-all to our personnel problems can be found in screening for self-esteem, intelligence, inferiority complexes, or emotional intelligence, we will likely miss the mark in each case. The answer lies in taking multiple variables into account.

⁵ Various research approaches to emotional intelligence are compared in Robert Sternberg's upcoming revised *Handbook of Human Intelligence* (see, Mayer, J. D., Salovey, P., & Caruso, D. (in press). Competing models of emotional intelligence. In R. J. Sternberg (Ed.) *Handbook of Human Intelligence* (2nd ed.) New York: Cambridge Press.

There are two basic approaches to selecting leaders through the use of multiple personality parts that can be pursued. Both begin by giving multiple tests, that measure multiple parts of personality, to the candidate for the position. This yields a series of measurements of a given individual that can be combined in predicting their success on the job. The first basic approach, which I will call the *additive* approach, adds up a person's positive characteristics (and subtracts the negative ones) so as to create a single score that predicts how likely the person is to succeed in a position. This is a tried-and-true method that I suspect the Army is already employing, and should continue to employ.

The second method, which I will call the *typological* approach, is one I would like to think will be used in the future Army (as well as in other organizations). This would involve combining variables together so as to indicate a *type* of leader that the person might develop into, and then matching that *type* of leader with the leadership position in which they will excel. For example, a technocratic leader might be good within some areas of the Army whereas an inspirational leader might be good in other areas of the Army. Negative, cautious, conservative leaders might contribute their important skills in still other areas. That is to say, there is more than one type of excellent leader, and different personalities may be more or less suited to fulfill a given, specific, leadership role. To create such a network of predictions, it will be necessary to create a typology of leaders within the Army, and a typology of leaders within personality psychology. Some personality psychologists are already working within the area of typologizing leaders. For example, in some thought-provoking, albeit not-yet-conclusive work, American Presidents have been classified into those who are motivated by the desire to achieve (type 1), to gain power (type 2), or to gain friendship (type 3). Classifying presidents into these three types (using the content of their inaugural addresses) leads to some interesting findings. For example, power-driven presidents are more likely to start wars, whereas affiliative-driven (i.e., friendship-driven) leaders are more likely to create scandals!⁶

What I am saying here is that we need to ask: "What type of leader do we want in what type of position?" I suspect it would be useful to begin speaking in terms of types of leaders – each of which could be of value in certain circumstances – rather than in terms of good leadership in general. In this regard, our management and our psychological science has to catch up with what historians have always told us: For example, that Churchill was a great wartime leader but that he was a less desirable peacetime leader. Or, that we needed the healing of President Ford after the divisiveness of President Nixon.

American psychology has been resistant to the notion of personality typologies, but there is no pressing logical or theoretical reason for this. In recent years, some of the most luminary personality psychologists have called our attention to the need to create typologies.⁷ Perhaps a typology of leadership is a good place to begin.

⁶ Simonton, D. K., (1994). *Greatness: Who makes history and why*. New York: Guilford.

⁷ For example, see Meehl, P. (1992) Factors and taxa, traits and types, differences of degree and differences of kind. *Journal of Personality*, 60, 117-174; or Weinberger, D. A., & Schwartz, G. E. (1990). Distress and restraint as superordinate dimensions of self-reported adjustment: A typological perspective. *Journal of Personality*, 58, 381-417.

Conclusions

In sum, personality psychologists commonly discuss about 400 parts of personality. Emotional intelligence has been demonstrated to be one of those parts. Its actual role in predicting success will be important, but probably no more important than a number of other parts of personality.

So, emotional intelligence has several things to teach concerning the selection of leaders. First, the media prefers to report a simple story, for instance, that a single part of personality is critical to success. Over the most recent decade, that single part of personality has been at various times: self-esteem, intelligence, and, most recently, emotional intelligence. These parts of personality are all important -- perhaps they really are all among the most important parts of personality. Even so, such simplistic, single-part approaches will not lead us toward truly effective advances in personality studies and selection in the future.

What must be sought out instead, are sets of variables (which may well include emotional intelligence) that each predict something about success. These groups of personality variables must be studied as a whole, and their prediction of outcomes assessed. One way to do this is by using a simple additive model; another way to do this is through the use of typologies. Both ways possess solid scientific footing and will lead to better personnel selection.

I believe that further progress in the area will depend upon understanding a typology or typologies of leadership. Leadership is a valuable concept, and it no-doubt exists. I believe, however, that there are also "leaderships" -- subtypes or substyles of leadership that are important for different occasions and different positions. It may be that the better these can be specified, the better will be our prediction of who will succeed as leaders.

Adaptive Architectures in Future C2 Organizations

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Summary

Tomorrow's military and business organizations must be flexible. Joint-service, multinational military operations cannot succeed using rigid procedures and static structures. For example, the Joint Task Forces (JTF) of the future must rapidly undertake a large range of missions, including both war and operations other than war, work with a variety of partners, and counter a wide spectrum of threats. They will confront unique uncertain situations under an accelerated tempo of operations.

Military command and control organizations, designed initially for nominal missions using a defined set of components and assets, are already stressed by demands for greater inter-operability with joint forces and/or multi-national forces, often for unique situations that were possibly unforeseen at the time the system was built. To achieve superior performance and maintain a common picture of the battlefield, command organizations must be able to adapt their command and control (C2) architecture—processes as well as structures—in response to changes in the mission and in the demands of the environment.

The technology needed to support flexible organizations is already available. Shared data bases, common displays, interactive video, and reconfigurable workstations allow organizations to restructure themselves. But, although flexibility and adaptation to mission demands are seen as required and even possible in future C3 systems, we know

little of how to actually design human organizations with such features, have scant theories as to how human decisionmakers will actually function in such dynamic organizations, and have limited knowledge as to the communications and shared information/displays that best support changing human coordination modes. Indeed, C3 organizations cannot be designed to be adaptive, or flexible, without a concomitant understanding of the coordination requirements such flexibility imposes on the commanders within the organization, and how these coordination needs are supported via adequate technology and training.

This summary presents a perspective of the research issues relevant to the study of adaptation and change in complex organizations. This project, is currently sponsored by the U.S. Office of Naval Research (ONR) through an interdisciplinary research program entitled Adaptive Architectures in Command and Control (A2C2). While the general context for the research in a Joint Task Force organization centered around amphibious operations, the research has wide applications to future C2 organizations that depends on an information-rich, fast paced, and fluid environment. As such, the A2C2 program is an industry-government-academia initiative designed to examine in depth the underlying processes of organizational changes and architectural adaptations that occur in complex organizations.

As an example of adaptation in C2 organizations, recent team decision-making research has shown that superior command teams adapt their coordination processes to changes in both the task environment and the organizational structure (via a mix of implicit and explicit components) in an attempt to achieve acceptable performance while not exceeding workload tolerances (Figure 1). The Adaptive Team Model is a process-oriented model (Serfaty, Entin, & Volpe, 1993) built on the proposition that team adaptation mechanisms can provide a key link between shared knowledge (team cognition), teamwork strategies (team behavior), and performance (team outcome). Several researchers (Serfaty, Entin, & Johnston, forthcoming; Serfaty, 1996; Serfaty, Entin, Deckert, & Volpe, 1993; Orasanu (1990); Kleinman & Serfaty, 1989) have used

this model as an explanatory mechanism to explain the observed behavior of superior teams, in particular their ability to quickly and adequately adapt to sudden changes in their task environment.

In the search for effective teamwork strategies, research has shown that superior teams have one key quality in common—the ability to adapt to task demands. The central premise of the Adaptive Team Model, illustrated in Figure 1, is that, under conditions of increasing task demands, high-performing teams are able to adapt their: 1) taskwork strategy, 2) teamwork strategy, and 3) team structure, in order to maintain team performance at acceptable levels while keeping the perceived task demands (e.g., stress, subjective workload) at tolerable levels. It is essential to quantify those design factors that will facilitate and support the adaptability of the team and the C2 organization as a whole. The model suggests an important mechanism utilized by highly effective teams in the adaptation process: the development of a shared situational mental model of the task environment and the task itself, and a mutual mental model of interacting team members' tasks and abilities.

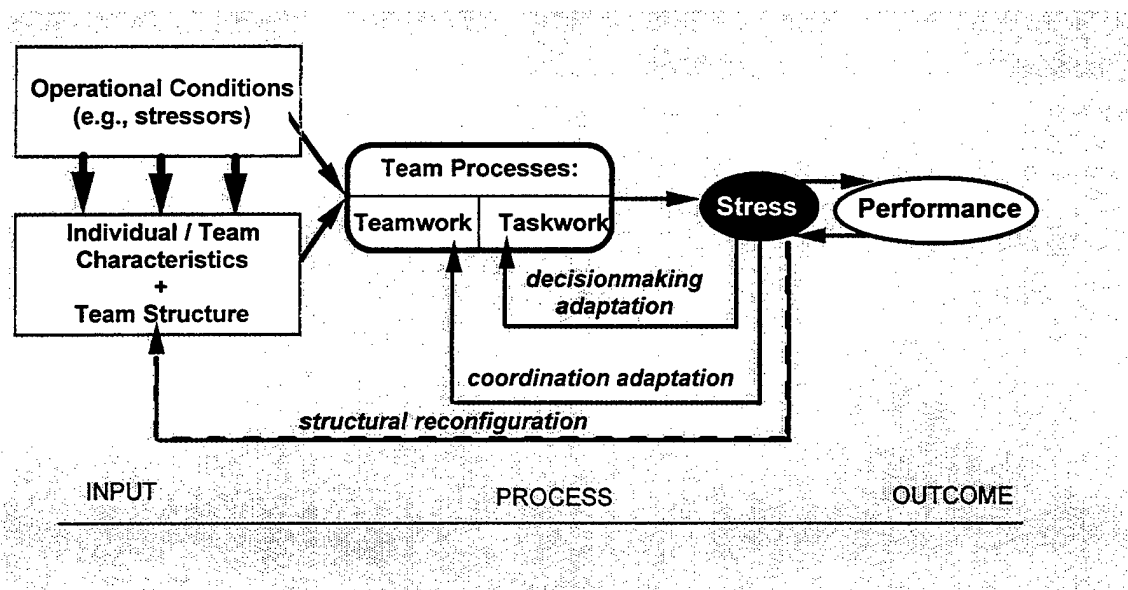


Figure 1: The Adaptive Team Model

A wide range of human performance measures has also been developed, using both subjective and model-based concepts, that can be generalized to quantify organizational performance and processes in a changing task environment. The thesis put forward in this work is that a precursor to the design of flexible organizations is a practical knowledge of the interaction among three key dimensions, all driven by the mission: Task structure, organizational structure, and coordination requirements. One of the goal of the theoretical and empirical efforts is the construction of a model of triggers of adaptation and the resulting forms of architectural adaptations.

The A2C2 interdisciplinary approach is directed along two principal axes:

1. Model-based vs. experimental research:

The A2C2 research teams are in the process of integrating optimization, modeling, and simulation-based research efforts with psychology-based and experimental activities. To address this need, we have followed a model-driven experimental approach. An explicit effort is made to conduct experimental research driven by models of organizations and adaptation in C2 architectures. In general the models produced by the modeling/simulation research teams support the formulation of hypotheses, the determination of key variables and parameter values, and the prediction of organizational performance and processes of adaptation. The experimental data, in turn is collected and produced in a way to be easily used by the modelers for post-experimental model-data comparison. To respond to these requirements for interdisciplinary research, we designed a process of model-driven experimentation described in the following diagram (Figure 2).

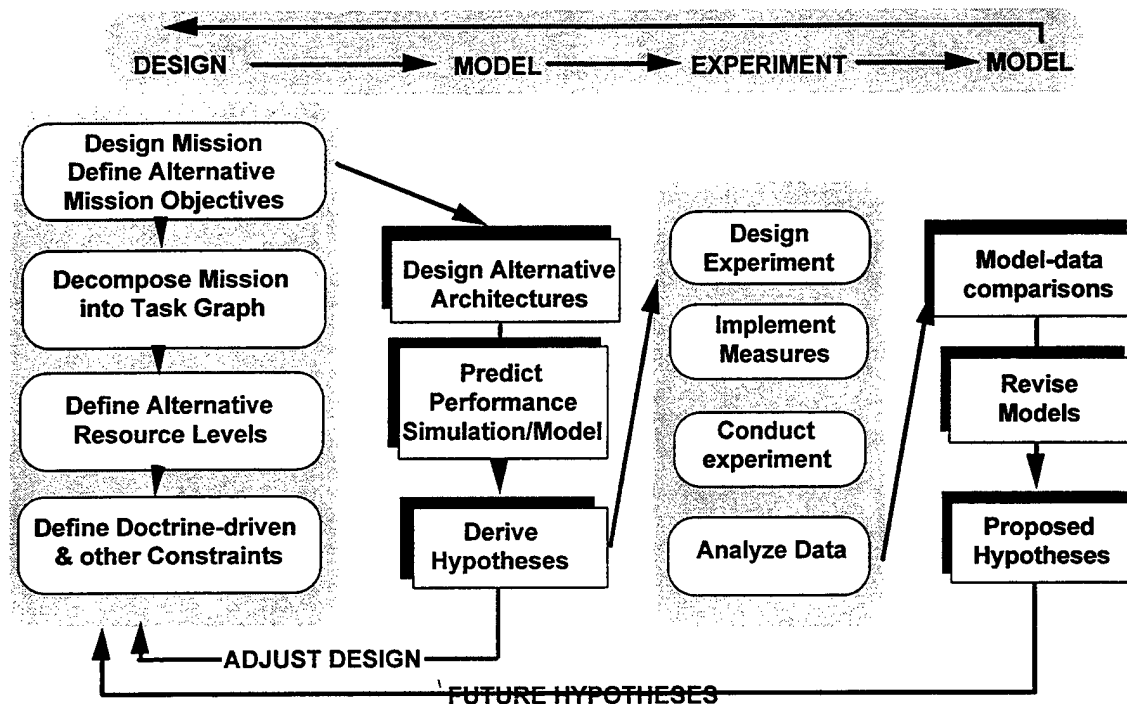


Figure 2. Process of model-based experimentation

This Design-Model-Experiment-Model process should be viewed as a guideline rather than a plan for all A2C2 experiments. The key elements are the interactions between the design, modeling, and experimental activities. The feedback loops are designed to use the pre-experimental model predictions to revise the design and the post-experimental model/data comparisons to refine the future research hypotheses.

2. Basic vs. applied research: The capability to abstract complex C2 missions, scenarios, and procedures in terms that are amenable to modeling and laboratory experimentation poses a second interdisciplinary requirement on the A2C2 research team. The context in which we study architectural adaptation is Joint command and control, or more precisely the Joint Task Force command staff. It is therefore essential to make sure that the architectural forms emerging from the basic research effort, and tested in experiments, have a certain degree of face validity. The conduct of experiments with officers-in-the-loop simulation at the Naval Postgraduate School and the progressive

evolution from low-fidelity to high-fidelity team simulators have been designed to achieve this transition, while ensuring a rigorous scientific approach.

Current research efforts focus on the concepts of organizational change and adaptation. The first phase of the A2C2 project focused on the development of Joint C2 scenarios and network-based team-in-the-loop simulations, the modeling of the mapping of tasks onto architectures and the study of structural and architectural variables and their effects on organizational performance. The current phase systematically investigate the variable of adaptation, both theoretically and experimentally, by focusing on causal relationships between drivers and forms of organizational adaptation (Figure 3).

CLASSES OR FORMS OF ADAPTATION	DRIVERS OF ADAPTATION (examples)							
	External: Task/Environment				Internal: Organization			
	Load (tempo of operations)	Uncertainty (tactical surprise)	Coordination Demands (task synchronization)	Topology (task structure)	Load (workload distribution)	Uncertainty (own forces capability)	Coordination Demands (comm. procedures)	Topology (reporting hierarchy)
Taskwork Process Adaptation (shifts in individual decision-making, problem-solving, and information handling strategies)								
Teamwork Process Adaptation (shifts in communication, coordination, dynamic redistribution of workload, and organizational procedure strategies)								
Off-line Structural Adaptation (pre-mission organizational changes due to knowledge of operations, mission, personnel available, pre-planning requirements, and commander's preferences)								
On-line Structural Adaptation (real-time reconfiguration in one or more components of organizational structure, e.g., communication structure, information structure, resource structure)								

Figure 3: Matrix of Drivers and Forms of Adaptation

A rich set of research issues are salient to the design of adaptive organizations. When an organization such as a JTF is given the freedom to be flexible, i.e., to adjust its own C2 processes and structure, there are a host of questions that must be answered. These include: What are the dimensions of organizational architecture? Is there an

optimal organizational structure that will best fit the demands of the task structure, without compromising the overall mission? How, when, and why will humans actually change the structure dynamically-i.e., in response to what cues? Will decision and coordination strategies adapt harmoniously to changes in structure? What display and information sharing technology will best support different mixes of implicit and explicit coordination modes? What skills and training are required for the concept of the adaptive organization to become a reality?

The goal of this research is to advance the state of knowledge regarding decision making in organizational settings to include an understanding of how, why, and when organizations adapt and what skills, training, and technology are required to support that adaptation. Although the problem domain for the initial effort is Joint military command and control, the principles and findings that will emerge from the program will have wide applications in organizational design for business and industry.

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Human and Organizational Issues for the Army After Next Conference

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Adaptive Joint C2 ...

*"Jointness is not created by doctrine, joint or otherwise.
It is brought about by people..."*

Colonel Lawrence Wilkerson, JFQ 97

"Joint warfare is team warfare"

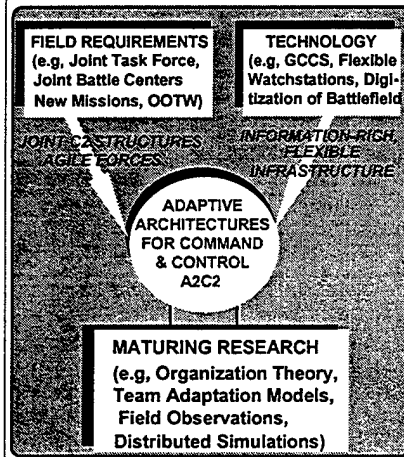
General Colin Powell, Joint Pub 1



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Adaptive Architectures for Command and Control: A2C2

Motivation



Research Objectives

- Develop & test theory of adaptive architectures:
 - Properties of architectures
 - Analysis tools for organizations
 - Measures of merit
 - Design "optimal" architectures
 - Drivers & classes of adaptation
- Focus on:
 - Key issues in Joint C2
 - C2 Operational team planning & decision-making at a command level higher than in previous C2 studies



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Some Definitions

- Adaptation
 - process of modification to fit evolving circumstances
- Architecture
 - structures (command, organization) + processes (C2, doctrine)
- Joint C2
 - Context: multi-service operational planning & decision-making problems at the commander, joint task force (CJTF) level





Premise: Commanders Adapt

■ Individual

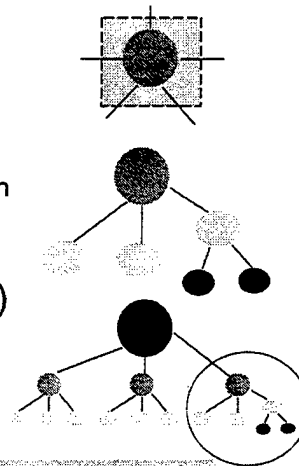
Analytical <---> Intuitive Decision-making
Deductive <---> Inductive reasoning
Recognition <---> Metacognition

■ Team

Centralized <---> Decentralized Information
Authoritative <---> Delegative Command
Explicit <---> Implicit Coordination

■ Organization (Team of Teams)

Synchronization <---> Autonomy
Function-Oriented <---> Mission-Oriented
Combat <---> OOTW



Adapting: Aligning With the Mission Demands



Challenges

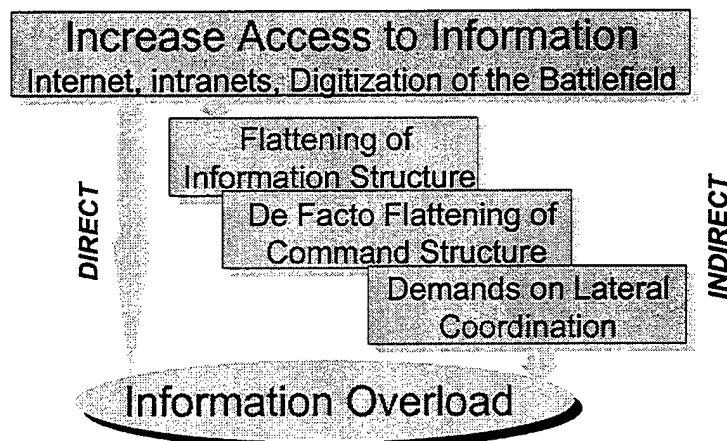
- How to study complex C2 organizations in naturalistic settings?
 - curse of dimensionality
 - curse of observability
- How to create military scenarios to bring about human processes of adaptation in a simulated environment?
- How to develop C2 organizational/team design principles based on tested theory and models?

Individual ---> Team ---> Organization



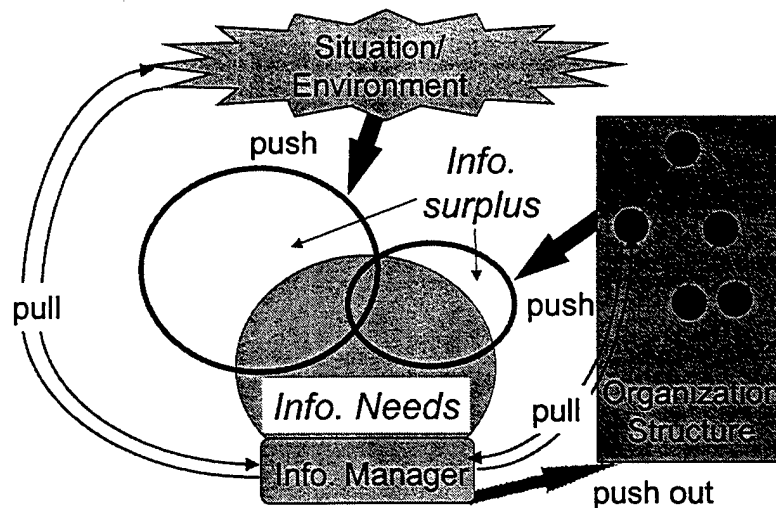
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Information Overload in Future C2 Organizations



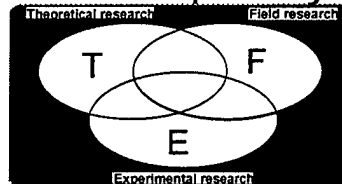
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Info. Management in C2 Organizations





A2C2 Interdisciplinary Approach



- MODELING of teams and organizations
- Exploring the variable of STRUCTURE
- Studying organization change, ADAPTATION processes, and adaptability properties
- Measuring performance in DISTRIBUTED teams
- Domain: complex JOINT C2 operations

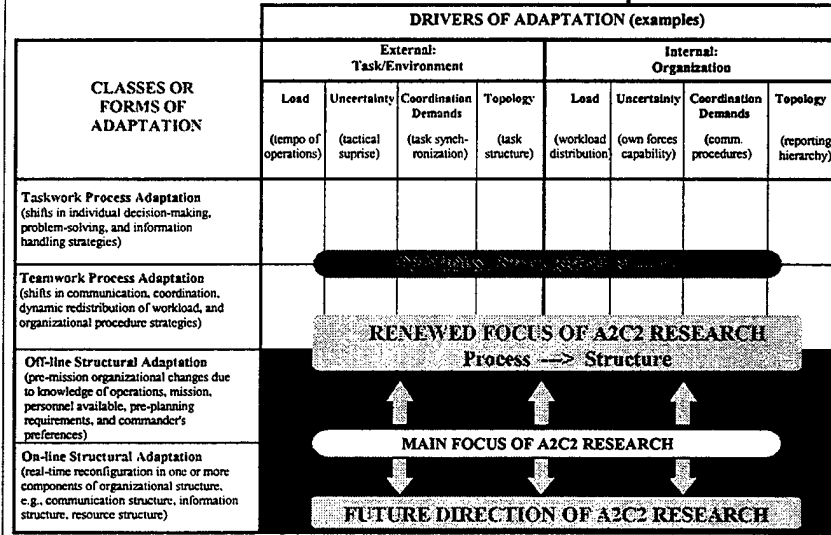


A2C2 Focus in the First Phase

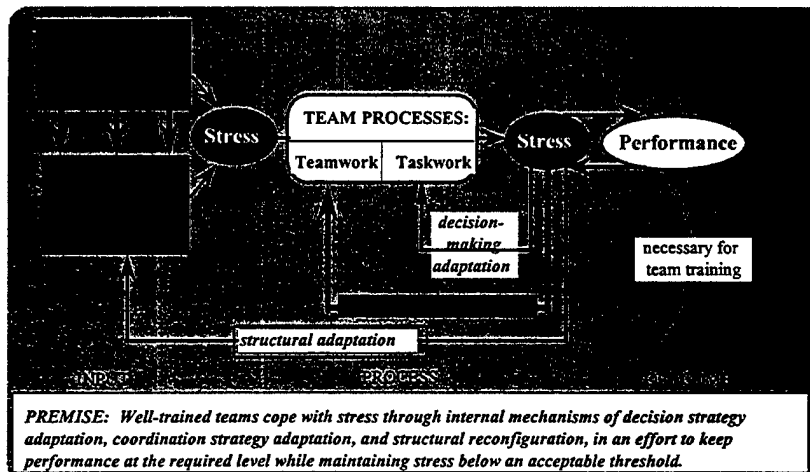
- Learning about Joint C2 environment
 - Interviews, observations
- Construction of DDD-III simulator with behavior-shaping joint scenario
- Focus on variables of structures and dimensions of architectures (tasks and organizations)
- Development of tools: design methods, modeling, and simulation
- Conduct and analysis experiments at NPS
- Build concept of triggers & forms of adaptation



Drivers and Forms of Adaptation



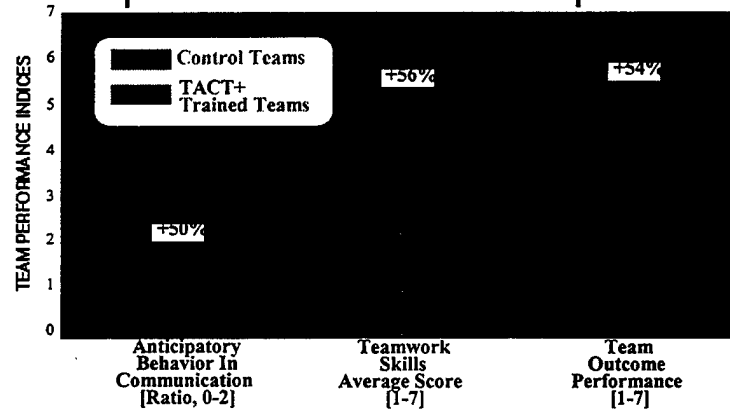
Example: Model of Adaptation to Stress





TADMUS :

Example of Benefits of Adaptation



- Adaptive strategies of team coordination are performance-enhancing and trainable (TACT/TADMUS)



Two New Evolutions

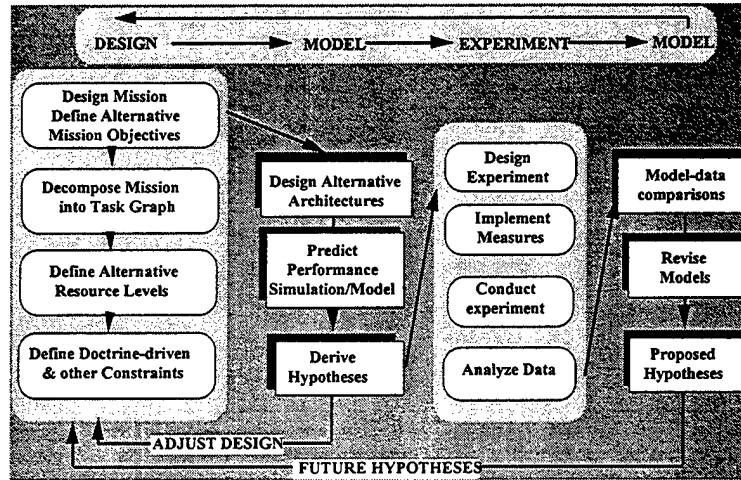
Process → Structure

- Re-focus on process adaptation as a powerful precursor of organizational change
- Concept of emerging structures

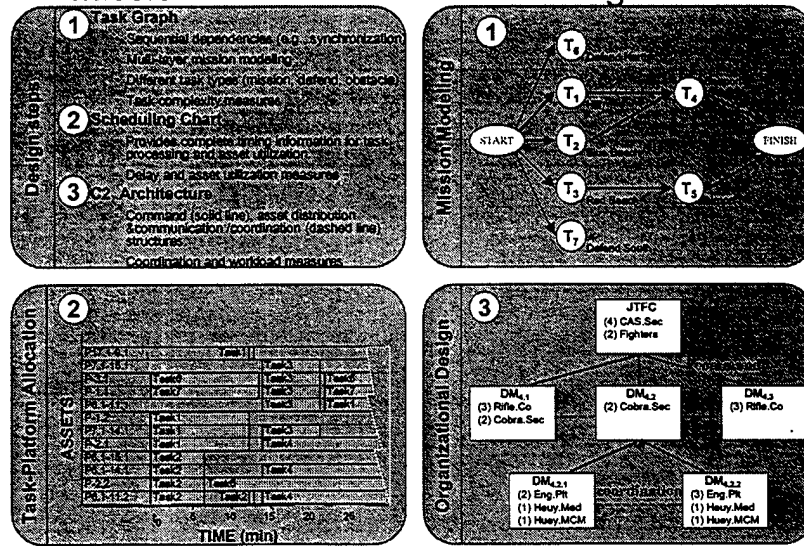
Initial Conditions

- Pre-existing conditions
- Criteria for change = threshold
- Trigger
- Adaptation/Change
- New organizational architecture

Design-Model-Test-Model



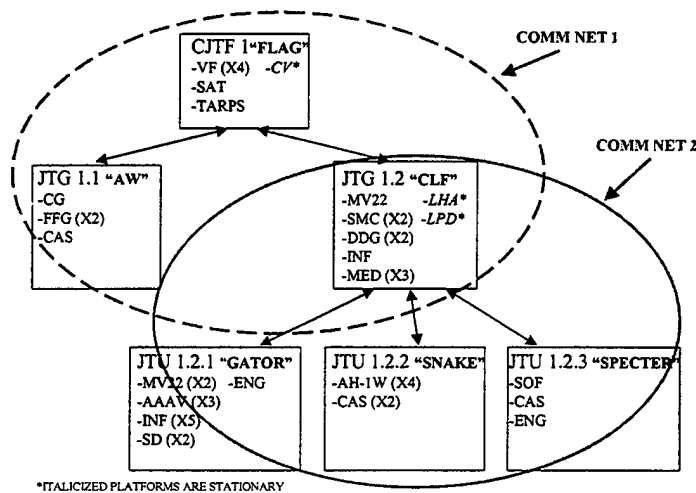
Mission-Driven Architecture Design Process





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A0: Model-Generated Architecture

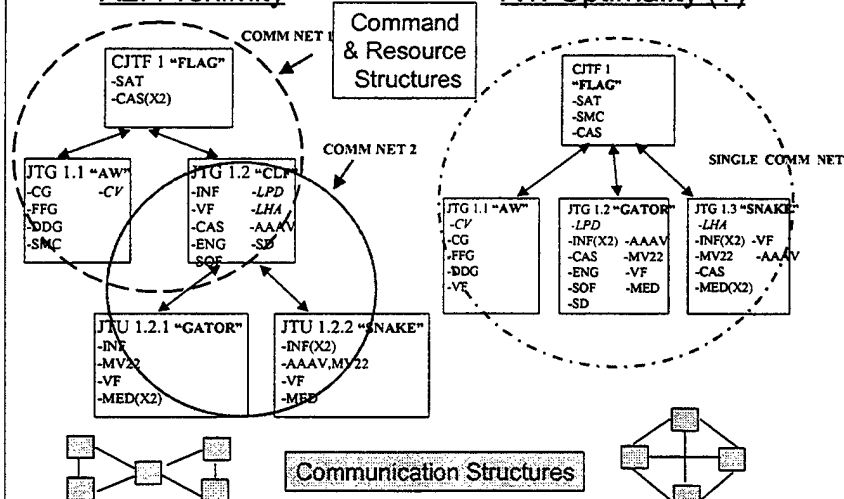


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Architectures Post-Trigger

A2: Proximity

A1: Optimality (?)





Experiment III Objectives

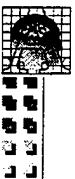
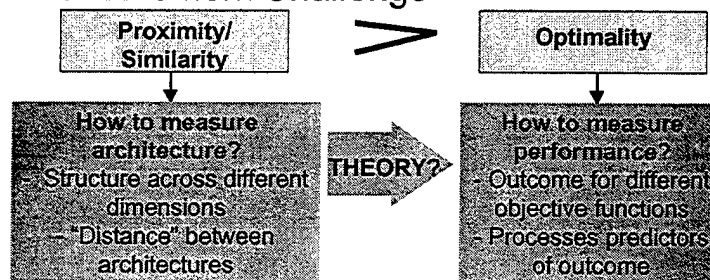
■ Research Hypotheses

- 1. Organizations will adapt to an architecture closer to their current one, rather than to an 'optimal' one

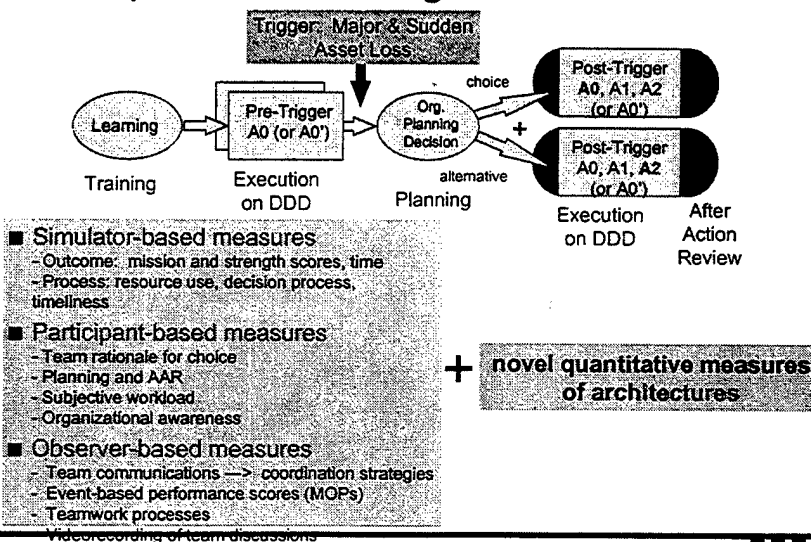
PROXIMITY vs. OPTIMALITY

- 2. The 'level' of adaptation is a function of the perceived strength of the trigger relative to the strength of the architecture

■ Measurement Challenge



Experiment Design and Measures





Measures of Architectures

■ Simulation-based and Graph-theoretic

- Span of control
- Levels
- Graph hierarchy
- Graph efficiency
- Need for Coordination
- Others (data-driven)

■ Principles of Warfare C2-based

- Unity of Command
- Unity of Effort
- Economy of Force
- Simplicity
- Span of Control



New concept of distance between architectures:

- When are two organizations significantly different?
- Implications for definition of "change"

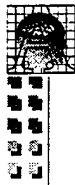


Choice of Architectures After Trigger

- 9 out of 9 teams selected A0—or A0'— (same as pre-trigger) as their first choice
- 8 out of 9 teams selected A2 (closer to A0) as their second choice
- 1 out of 9 teams selected A1 (farther from A0, but model-optimal) as their second choice

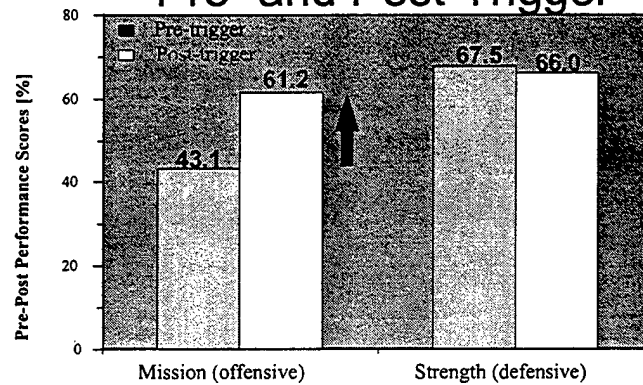
■ Adaptation & Change Issues:

- If we force a change, is proximity hypothesis accepted?
- Should the A0 choice attributed to organizational inertia, familiarity with the architecture, or informed choice?
- Will teams play A0 'differently' after the trigger: process vs. structural adaptation?
- Do the modelers take into account the full range of variables involved in that choice?

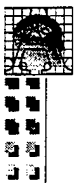


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Organizational Performance Pre- and Post-Trigger



- Higher Mission performance with fewer assets
- Hypothesis: successful team adaptation process



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Key Research Issues

1. Research Methods

- Organization size
- Face validity
- Terminology
- Small effects
- Dependent measures
- Unified Modeling
- Subject Population

2. Architectures

- Underlying principles of architectures
- Functions and tasks
- Collaborative tasks and coordination



Key Research Issues (cont.)

3. Adaptation Triggers

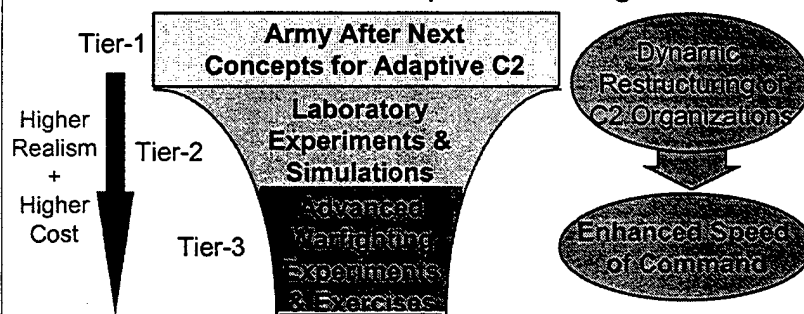
- Trigger design
 - guidelines
- Trigger implementation
 - abrupt vs. progressive
- Trigger Complexity

4. Adaptation Forms

- Organizational Inertia
 - anchoring effect
 - inhibitors of change
 - facilitators of change
- Incremental Adaptation
 - "morphing" structures
 - organizational learning
- Emergent Architectures



Proposed Approach for Incremental Testing and Validation of AAN Adaptive C2 Organizations



- Tier-1: Develop Models and Metrics (MOPs & MOEs) for Key Variables and Processes Representing AAN Organizational Concepts
- Tier-2: Conduct Model-Based Laboratory Experiments and Simulations on Adaptive Organizations with C2 Testbeds (DDD, MTWS, etc..)
- Tier-3: Validate Concepts and Models in Advanced Warfighting Experiments, Fleet Battle Experiments, and other exercises



Summary

- Emerging ideas and methods to design mission-driven adaptive teams & organizations
- Adaptability (property) vs. adaptation (process)
- Adequate representation of organizational size
 - Synthetic agents?
- C3 Organizations seem to use a wealth of strategies to adapt to mission/work demands
 - Organization self-monitoring skills
 - Organizational meta-cognitive properties?
- Investigating sources of organizational inertia...
- Complex research effort ==> AAN applications

Examining Adaptation and Flexibility in Command and Control Architectures

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EXAMINING ADAPTATION AND FLEXIBILITY IN COMMAND AND CONTROL ARCHITECTURES

How do you design an organization, such as the army after next? What should the distribution of resources look like? Are there alternative command and control structures that make sense? How can the army be designed to avoid information vulnerabilities? This paper describes an approach, based on computational organization theory, to address questions such as these in a formal and empirical fashion.

The army as a whole, each division, battalion, tank command etc. can be characterized as an organizational unit. Each unit has its own C³I architecture, rules of engagement, set of tasks or orders, and performance characteristics. From a design perspective the issue is deciding how to set the architecture, rules, and orders to maximize performance. Unit level computational models can assist this design process.

Computational analysis can be an invaluable tool for developing theory, examining issues of organizational dynamics, and planning through the exploration of alternatives. The natural complexity of organizations is such that they are poor candidates for analytical models and good candidates for computational analysis. Computational models of organizations are particularly valuable when the user is able to establish a set of precise, consistent and complete set of mechanisms, complex interactions among them, and empirically validated parameters. Such computational models have a large number of potential uses in the army. Unit-level models could be used to simulate the behavior of units under the commander's direction and so enable both training and planning. Realistic unit models enable the exploration of the impact of communication losses, personnel losses, manpower reduction, misinterpretation of orders, resource attrition, and so on. Realistic unit models could be used to do a series of "what if" analyses to determine the relative merits of different information and communications equipment, assess the vulnerability of own and opposing forces, and assess the potential impact of changes in the C³I architecture.

While the advantages of this approach are legion, there are still relatively few organizational level models (Pew and Mavor, forthcoming). Such models can be built using a multi-agent approach. However, units are more than simple collections of agents with inter-dependent actions. There are at least three aspects of unit level behavior that need to be considered in designing unit level models — scale and constraints, emergence, and synthesis.

Aspect 1: Units, at different scales (such as a battalion versus a tank) different factors may dictate overall performance by imposing constraints. In general, for units the performance is a function of the C³I architecture, the task, the stressors, and the resources (see Figure 1). These factors may determine the unit's performance by severely constraining the flow of information among personnel, the set of actions that personnel can take, and the decisions that personnel can make. If the constraints imposed by these factors are severe enough and the task is routine then cognition is largely irrelevant.

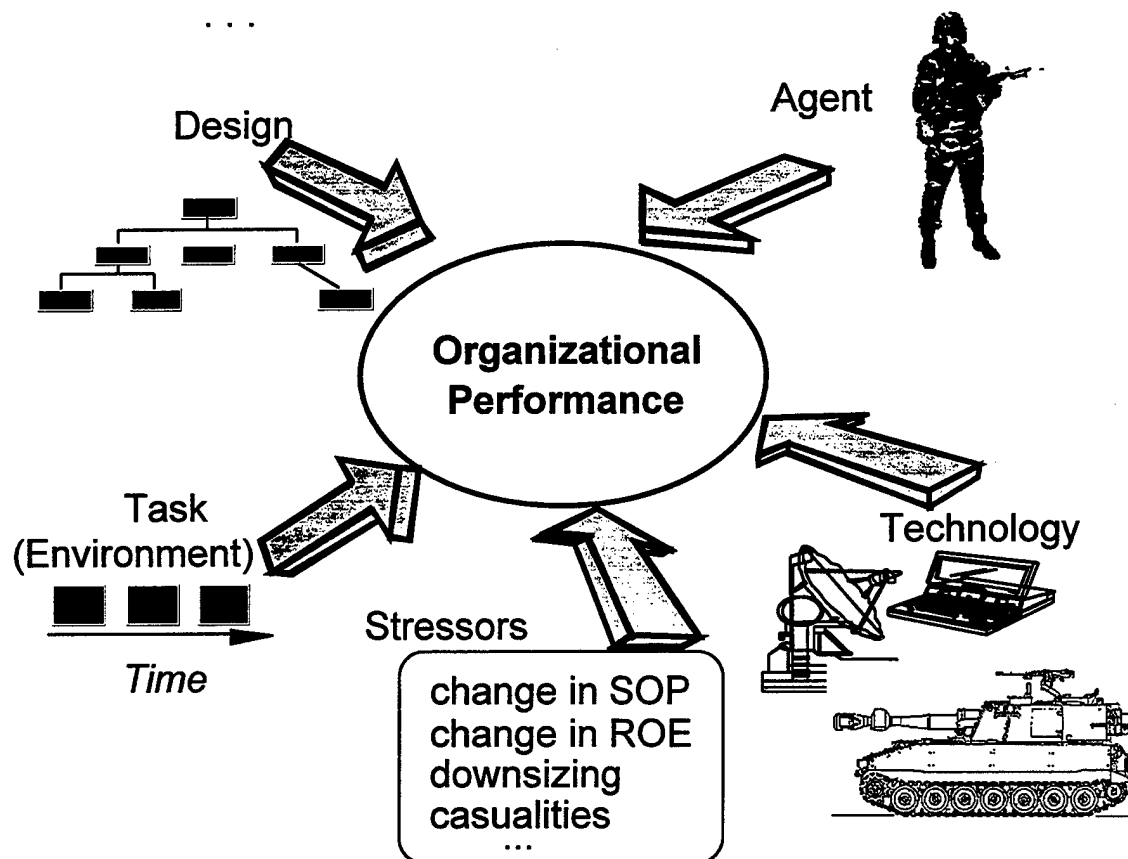


Figure 1: Factors Affecting Performance

Aspect 2: Even though much of the unit's behavior is determined by these constraints; other aspects are emergent. This is due, in large part, to the "learning processes" that take place at both the individual and the unit level. Individuals learn both task knowledge and who knows what through experience, through memorizing procedures, through working with and interacting with others. This learning results in individuals altering their mental models by adding and dropping concepts and the relations among them. This learning also results in changes in the distribution of knowledge throughout the organization. Knowledge assessment techniques are needed to determine the distribution and explore its impact on unit performance. Additionally, units learn structurally. Structural learning occurs as institutional memory becomes codified in procedures, ways of doing business, connections among personnel, and development of stable roles and positions. Structural learning results in the movement of personnel through the unit and changes in who reports to, works with, or interacts with whom, and who has access to what resources. This learning results in changes in the distribution of personnel and resources throughout the organization. Structure assessment techniques are needed to determine the distribution and explore its impact on unit performance. For the unit, the existence of multiple types of learning means that there may be unintended consequences to change and that adaptation at one level may not aid adaptivity at another level. A consequence is that as individuals learn units tend to improve in performance; however, depending on the C3I architecture reducing the number of personnel or transferring personnel may not degrade performance and adding resources may not improve performance. Another consequence is that, in non-routine tasks, the interaction between cognition and these constraining factors is key to performance.

Aspect 3: Units are themselves artificial agents synthesized out of humans, resources, and so forth. Consequently, units have memories and abilities that are distinct from the sum of the memories and abilities of the component agents (see Figure 2).

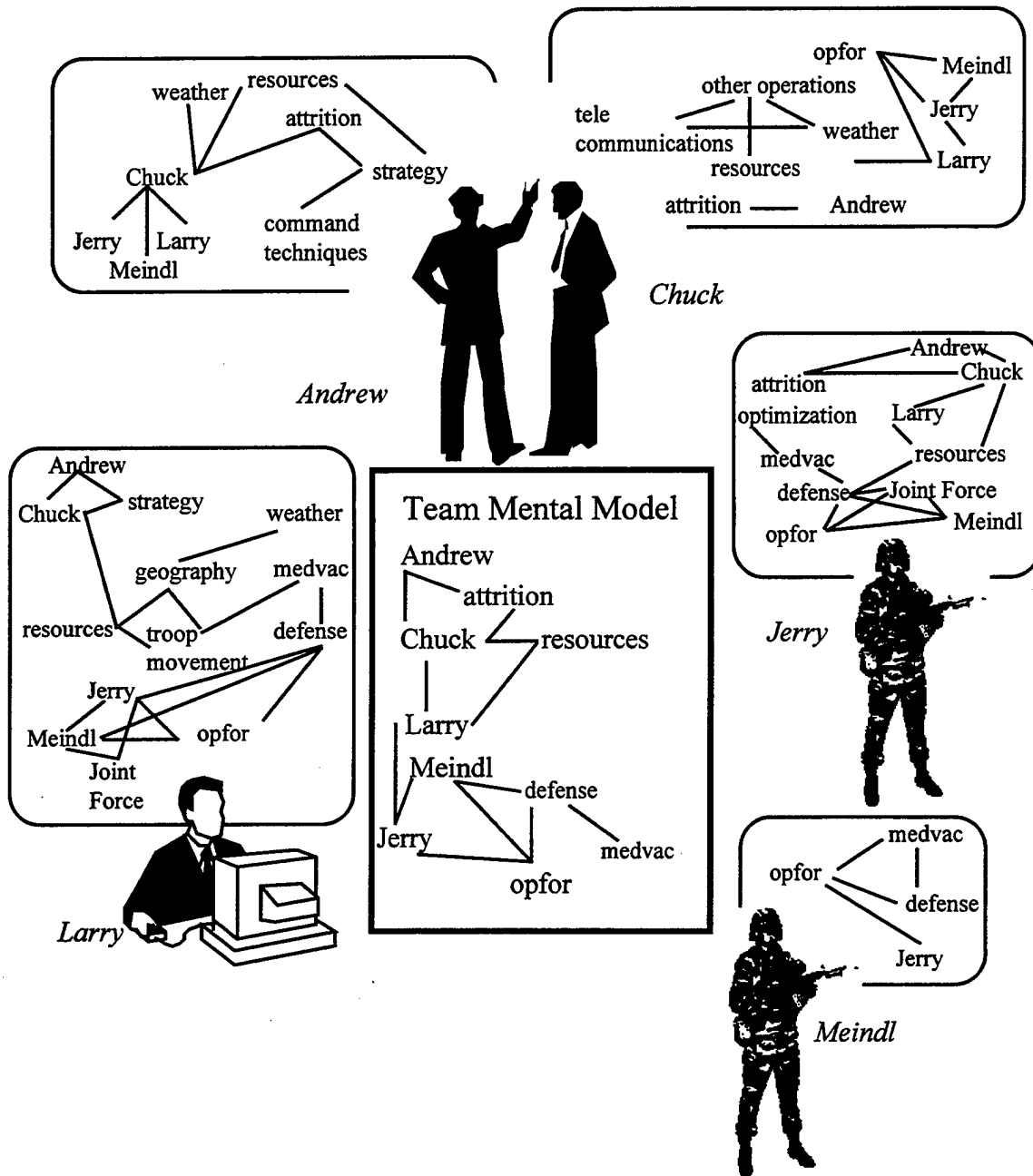


Figure 2. Knowledge and Interaction Within Teams

These three aspects of organizational behavior are non-existent in many current models. Consequently, most models cannot be used to explore the organizational consequences of altering the C3I architecture. For example, such models cannot be used to examine the potential impact of altering the existing knowledge network (who knows what, and who knows who knows what), the underlying communication network (who talks to whom), the authority structure (who commands whom), or the resource access structure (who has access to what resources). The approach taken here begins to

overcome these limitations. In this paper a model of organizational units that has these characteristics will be briefly described and used to explore issues of design related to army after next such as the designing for C³I adaptability and flexibility. This model is called ORGAHEAD (Carley and Svoboda, 1996).

Illustrative model - ORGAHEAD

ORGAHEAD is a framework for examining the impact of the C² architecture on performance for stylized distributed choice and classification tasks (such as radar based entity classification), and simple situation assessment task. In ORGAHEAD organizations are characterized as heterogeneous, complex, dynamic nonlinear adaptive and evolving systems. Organizational action results from interactions among adaptive systems (both human and artificial), emergent structuration in response to non-linear processes, and detailed interactions among hundreds of factors. ORGAHEAD units can adapt their C² architecture dynamically over time in response to changes in the task or expectations about future performance. ORGAHEAD is a multi-agent model, in which the agents are constrained both cognitively and by their position in the C² architecture. Agent capability and the C² architecture jointly determine the distribution of knowledge or resources across agents. Agents either learn through experience or they follow standard operating procedures. At the structural level, learning occurs through the alteration of procedures and linkages among the agents, such as who reports to whom and who does what. ORGAHEAD has sufficient versatility that the user can specify the initial C² architecture of one or more units, basic training procedures, constraints on agent abilities, the type and likelihood of allowable strategic changes, the maximum frequency of change, the rate of risk aversion, the organization's goal criteria, the task environment, and several types of change "triggers". Thus, the user can vary the authority structure, the degree of training received by the agents, the amount of information the agents recall, the rate of structural change, and the ways in which the C² structure can change, the type of task environment and its complexity. The design of ORGAHEAD draws on existing cognitive, knowledge-based, information-processing theories of individual behavior and is consistent with decades of research on organizational performance.

Within ORGAHEAD the C² architecture is characterized as a series of inter-linked networks that constrain and provide opportunities for action (see Figure 3). These networks includes the authority structure, the task-resource structures (defining which resources/skills are needed for which task), the resource access structures (defining which agent has access to which resources/skills), the task assignment structures (defining which agent is assigned to work on which subtask). Each agent on the operational side gathers information, makes recommendations, does tasks. The commander on the strategic side determines whether and if so how to redesign the C² architecture.

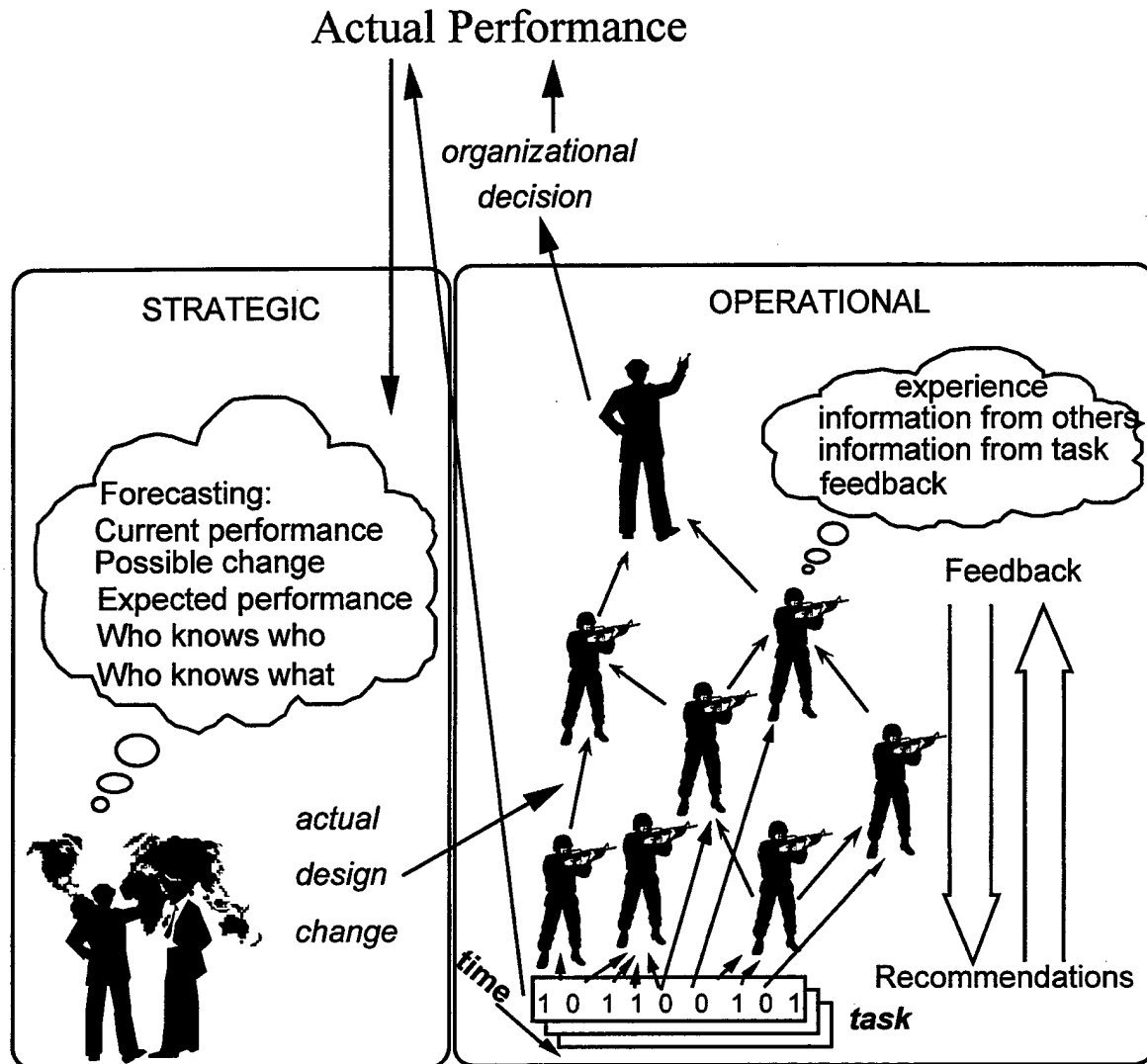


Figure 3: Strategic and Operational Decision Making

Aspects of the ORGAHEAD model have been validated in two contexts. First, the relative interaction between architecture and cognition was validated using data collected in a human experiment. Second, using a comparative statics techniques predictions about the relative impact of different architectures were examined using archival data. In both cases, ORGAHEAD proved to be a reasonable predictor of unit level behavior.

We can use ORGAHEAD with some confidence to explore various issues in the realm of command and control and information warfare. Such explorations can be conducted by running virtual experiments in which ORGAHEAD is used to simulate the behavior of a large number of units that differ on various dimensions, such as span-of-control, distribution of resources, and level of training. The results from these virtual experiments can be analyzed statistically to generate predictions about unit performance under different circumstances.

Relation to command and control

ORGAHEAD can be used to examine how to design C^2 architectures for high performance, adaptability, flexibility etc. In this paper, only a few questions related to design, adaptability and flexibility will be examined. First, however, it is important to note that the term performance is measured as accuracy, the fraction of time the unit makes the right decision. This is conceptually related to kill-ratio. Adaptation is used to refer to changes that the unit makes to its C^2 architecture, often in response to stressors, that serve to maintain or improve its performance. Flexible units are those that easily redesign themselves and alter who is doing what. Given these definitions let us proceed to ask a few questions about how to design a C^2 architecture for effective performance.

[1] What is the value of multiple levels of command? Do units with flatter command structures perform better than do more hierarchical structures? It depends. Simulator results indicate flatter structures tend to "learn faster" and to perform better in stable environments. However, they may not be as good in unstable environments. Initial exploration suggests that hierarchical C^2 architectures are robust in the face of various stressors such as changes in ROEs.

[2] For a particular task, is there a single right design? No. There may be several right designs. It has been repeatedly demonstrated that different tasks require different C^2 architectures. Moreover, simulator results using ORGAHEAD indicate that for a particular task there may be several optimal designs. Many different combinations of personnel, task decompositions into subtasks, and determinations of who can talk to whom, report to whom, and who does what can accomplish the same goal. Thus, from a planning perspective the issue is not what is the best design, but what are the relative costs and benefits of the various C^2 architectures all of which exhibit the same potential performance. One area where this idea of equifinality has particular import is in the area of training.

[3] Are high levels of personnel training a necessary pre-requisite to high performance? No. Simulator results indicate that units can trade "distributed" or structural learning and memory for individual learning and memory. That is, units can achieve high performance if the personnel are trained by providing them with a wealth of experience, and then left in intact groups to perform as needed when missions arise, largely following the dictates of their experience. In this case, the CEO is essentially providing only minimal direction and the unit is determining on its own how to carry out the order. The key, here is that the personnel are highly experienced and that the unit as a unit is left in tact. Or, units can achieve high performance with less training of personnel if they employ appropriate SOPs, frequently rotate personnel, frequently alter who is doing what, and rely on the set of roles, and procedures surrounding the roles, to carry the knowledge about how to do the mission. In this case, the CEO is providing detailed orders or providing orders where the response is dictated in the SOPs. In this case, rotation of personnel does not harm performance and may even help. These results, are for cases where the unit is operating in a known environment. Whether they would hold for a completely novel situation is not known. Nevertheless, these results are saying that for most activities there are at least two equally good ways to organize to achieve the same level of performance.

[4] Will a top performing unit stay at the top? No, but it will probably stay near the top. Simulator results indicate that there is a fragility to success. That is, a small change in the C^2 architecture can have a dramatic negative (or positive) impact on the unit's

performance. Examples of small changes are slight increases in the span-of-control, limited downsizing, giving one individual an additional task or resource. One reason for this is that within unit's personnel get used to both knowing what to do, and knowing who knows how to do what. Changes affect both types of knowledge and so have a more deleterious impact than minor disruptions in what information is available. Such dramatic changes, although possible are in general not very likely. Simulator results also indicate, that there are general trends that units tend to follow. Thus, top performing units tend to remain near the top and improve slightly over time; bottom performing units tend to become worse. This leads to an increasing divide between high performing and low performing units. This increasing divide occurs despite the fact that in all units individuals are gaining experience and getting better at what they do. The reason for the increasing divide is that units get trapped into patterns of changing that pushes them into downward or upward spirals of performance. For example, maladaptive units often get stuck spending time changing personnel; whereas, adaptive units often spend more time tuning themselves by changing who is doing what or reporting to whom.

[5] Does flexibility guarantee adaptability? No. Adaptive does not equal flexibility. We know that as units enter combat it is often necessary to change the C² structure in response to external changes such as changing ROEs. A virtual experiment was run in which the task duration, task complexity, environmental stability, size of the unit, number of available resources, and number of shake-ups due to changes in rules of engagement or commanders were varied. Results are summarized in Table 1. Results indicate that, in order of impact, the four factors which most affect sustained performance are: (1) the number of resources available to each agent, (2) the size of the unit, (3) task duration, and (4) the number of shake-ups. This computational analysis demonstrates that in a dynamic environment simply changing is insufficient to improve performance; rather, the unit needs to develop the appropriate change strategies. It also indicates that the factors that promote adaptiveness are not the same as those that promote efficiency. Efficiency and performance can be at odds with each other, particularly in a changing environment. Units with highly efficient C² architectures are inflexible and tend to be maladaptive in the face of environmental change. The tuning process, by which units alter their C² architecture by altering who is doing what or reporting to whom, tends to result in leaner, more efficient, less redundant C² architectures. Shakeups in the command structure, or increased risk taking on the part of the commander, are often required to break the mold and so enable adaptiveness.

Table 1. Impact of various factors on unit level performance, efficiency, and flexibility.

Predictor	Performance	Efficiency	Flexibility
<i>Intercept</i>	0.000	0.000	0.000
Duration	0.032***	0.011**	-0.006
Task complexity	-0.024***	-0.022**	0.009
Environment	-0.015*	-0.020***	0.003
Number of Personnel	0.170***	0.042***	-0.085***

Number of resources	0.265***	-0.224***	0.005
Task complexity – size	0.091***	0.085***	-0.022**
Shake-ups	-0.012	-0.008	-0.004
R2 (adj)	10.9%, df = 7, 20472***	6.0%, df = 7, 20473***	0.8%, df = 7, 20472***

Values shown are multiple regression, standardized coefficients. *** p < .001, ** p < .01, * p < .05

Relation to information warfare

Information warfare can be thought of as any type of conflict that involves the manipulation, degradation, denial, or destruction of information. From an organizational perspective, information warfare has to do with those processes that affect the commander's, staff's, or opposing commander's access to information and so ability to make decisions and confidence in those decisions. For example, the way the commander (or any individual) acts in a particular scenario depends on the information characteristics of the situation, including what other individuals are present, what they know, what they believe, how fast information can be transferred among them, and how they interact. In joint operations, commanders may have staffs with whom they have had only limited previous interactions. Thus, they may not know whom to turn to for what information. By altering what information is available when and to whom the quality, accuracy, and timeliness of decisions is likely to be affected. Using ORGAHEAD we can focus on these organizational factors, rather than the systems, engineering, or computer and other technological factors, that affect this flow of information and so the unit's decision making capability.

Using ORGAHEAD we can begin to address some issues related to the organizational side of information warfare. More specifically, we can assess the vulnerability of a particular C² structure with a particular distribution of knowledge and/or resources, and a specific authority network. Additionally, the relative vulnerability of C² structures as these networks of people and resources change can be examined with ORGAHEAD. Consider the following two questions.

[1] Are attacks on information or on communication lines more effective? In general, attacks on information are more damaging, but only slightly. Simulator results indicate that regardless of whether the personnel are highly trained and are allowed to act on the basis of experience, or whether they are expected to follow SOPs missing or incorrect incoming information lead to lower unit performance than do communication breakdowns or personnel attrition (see table 2).

Table 2. Impact of Different Types of Information Attack on Performance.

Type of Attack	Personnel Follow Experience	Personnel Follow SOPs
Missing Information	42%	92%
Incorrect Information	30%	64%
Personnel Attrition	43%	107%
Communication Breakdown	43%	110%

Values shown are percentage improvement over chance in an unbiased environment.

[2] Are hierarchical command structures vulnerable to attack? Yes, but they are less vulnerable than structures without a buffer between the decision maker and those gathering information. When the unit is under attack and things start going wrong, such as when there is attrition in the force, when communication breakdowns occur, when information is missing, then multiple levels of command appear to stabilize performance. More hierarchical structures perform better than do completely flat structures. Results suggest that the value of mid-level staff is that they provide guidance on which information to trust, even though they themselves may be making the wrong decisions. Further research is needed to see if there is an optimal number of levels in the C² architecture.

Lessons Learned

The past decade has seen the emergence of a new field of analysis - computational organizational theory. The work in this field is leading to the development of simulation engines which can be used as decision aids, planning tools, and theory engines for thinking through the ramifications of changes in C2 architectures and for assessing their vulnerability to various types of information attacks.

ORGAHEAD is illustrative of the type of model needed to do these analyses. ORGAHEAD is limited in that the tasks it deals with are relatively simplistic and do not cover the range of tasks actually encountered in military situations. It is also limited in that it does not adequately cover all communication activity. Nevertheless, the fact that this model has been able to predict the behavior of actual organizations suggests that this approach is viable and can be usefully extended.

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THE RELATIONSHIP BETWEEN ORGANIZATIONAL DESIGN AND ORGANIZATIONAL EFFECTIVENESS

MAJ Jacob D. Biever

June 23, 1998

During the Army After Next Leavenworth Tactical War Game held in November 1996, the Blue commander faced a dilemma. He commanded a notional 8,000 person combat organization that -- in a simulation environment -- accomplished missions in a few days that currently would require perhaps 50,000 soldiers and many days or weeks. This organization's structure employed only three echelons above platoon level. They were roughly analogous to division, battalion, and company. Brigade was omitted. His span of command and control was eight maneuver units. He devised tactics that successfully took advantage of the speed, lethality, and flexibility inherent in the weapon systems, platforms, and organizational structure.

But then the commander found himself in a situation that forced him to modify those tactics. Two powerful enemy divisions were attacking abreast, and he received the mission to destroy them. He decided to destroy them in succession. His force would simultaneously delay the southern division and destroy the northern one. Then he would quickly maneuver and destroy the remaining division. To this end, he split his force into three battle groups for the first phase of the battle. Each received a different mission: delay the southern division and prevent it from assisting its northern counterpart, channelize the northern division through defending some key terrain, and attack the northern division when it crossed the designated phase line.

The commander's plan caused an organizational dilemma. He could not simultaneously execute the duties of three 'brigade' commanders and a 'division' commander. For the moment, 'brigade' commanders and staffs were necessary. He

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quickly created three temporary 'brigade' commands from within. They provided command and control for the three subordinate missions, and he retained overall command. In the ensuing battle, the northern enemy division was annihilated and the remaining division immediately occupied defensive positions lest it experience a similar fate. The halt, though not a surprise, was unexpected and required some quick adjustment. He disbanded the temporary echelons and returned to previous tactics.

During the After Action Review, the participants discussed whether such a temporary command was really possible. The commander believed that, on average, omitting the 'brigade' was advantageous because it provided greater flexibility and responsiveness. The occasional need for an intermediate echelon was a thorny issue. One particular dimension of the problem seemed to interest everyone. Would future organizations -- commanders and staffs -- be effective enough to successfully implement such an arrangement with only hours notice? No one had a ready answer.

The preceding vignette illustrates a conundrum that confronts the Army. New organizations are likely to be necessary in the future, but what are the hidden assumptions and demands associated with them? How can military art, technology, and human and organizational behavior come together in ways that enable the Army to maintain overmatch over the long run? What are the potential pitfalls?

This paper will consider a few of the critical underpinnings associated with future organizational structures. It argues that the future will demand elevated levels of performance relative to the present, and new organizational structures will be feasible only if the Army achieve such an improvement. It briefly outlines some future challenges and three organizational attributes -- shared mental models, individual expertise, and trust -- associated with achieving elevated performance. It then focuses upon four organizational design parameters: span of command and control, modularity, specialization, and echelons. The paper defines them, articulates their importance, and considers them in light of the organizational attributes.

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A More Challenging Future

Military art experts are devising new and better ways of defeating enemies who are expected to improve in terms of technology, tactics, training, and cunning.¹ Currently these efforts focus upon: achieving situation awareness, quickly converting that awareness into action, and lethally striking the enemy with lightning speed.² The various AAN war games indicate that in such an environment, planners and decision-makers would have only a small fraction of the planning time they currently enjoy.

Technological progress is also imposing greater demands upon future organizations. New systems will demand precision employment, which is not always congruent with speed and the decentralized planning and execution that speed implies.³ Sensor and database technology is fusing to provide the information that commanders need to simultaneously employ large numbers of devastating precision-guided munitions and then quickly exploit their effects with maneuver.⁴ Just as important, increasing weapons ranges are expanding the killing zone to hundreds of kilometers.⁵

To many, such an environment seems to demand elevated organizational performance. The whole must far surpass the sum of the parts. Future readiness standards may be more akin to the current literature's mostly hypothetical "high performance organizations" than standards considered acceptable today.⁶ New organizational designs will contribute to achieving elevated standards because they can liberate some of the penned-up human potential and increase organizational synergy. However, organizations are comprised of teams and individuals, and the Army must set an environment in which they can achieve elevated standards.⁷

Organizational Attributes Associated with Elevated Performance

This section describes three organizational attributes associated with elevated performance: shared mental models, individual expertise, and trust. The Army must explicitly take these variables into account when designing organizations because they

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will, to a large extent, determine the wherewithal of the people and teams who man those organizations.

Shared mental models. Like today, teams of teams will comprise the inner workings of Army organizations. They will plan and execute quickly and precisely. They will often act simultaneously. The Army will emphasize teams even more in the future because they will be key to achieving elevated performance.

Each team must achieve a shared mental model of themselves, their environment, and their role in shaping that environment. The model must be congruent and detailed. It is a crucial team trait that facilitates successful collective and distributed problem solving and execution when facing severe time constraints. Highly detailed models increase the amount of complexity that an organization can successfully comprehend and use. When combined with trust and individual competence, teams are able to account for a larger number of variables with less effort. A shared mental model makes team members far more reliable under stress, even the fright and fear associated with combat, because shared mental models improve situation understanding and predictability. If everyone understands their tasks and the roles that their team-mates play, they feel far more confident, and confidence is crucial to minimizing fear and stress.⁸

Outside actors who habitually work with a team can share a less in-depth mental model, but it must be congruent. The entire organization must share a congruent model with enough depth to understand and implement commander's intent. Shared mental models allow organizations to abbreviate procedures and act near simultaneously. They quicken the information flow and allow members to predict and understand others when time is short and extensive communication is not practical. They give deeper meaning to commander's intent and other guidance.⁹

Shared mental models are difficult to develop because they require time and large numbers of collective training repetitions. Depending upon the number of training opportunities and the complexity of the task, congruent and in-depth shared

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mental models can require months or years to develop for the totality of a team's job and environment. Personnel stability is a prerequisite. If the requisite training opportunities and personnel stability are not available, a team will be far less able to cope with complex, dynamic, and fast-moving situations.

Individual expertise. Individual expertise is the cornerstone of elevated performance. It includes more than technical knowledge; it also includes leadership and management skills. Commanders, planners, fighters, and supporters must be expert in what they do, or units will not succeed in future battle. Two keys to expertise are experience and ability. People in all professions gain experience through repetitious, high fidelity practice. Over a long period of time, they become experts.¹⁰ Experts and amateurs are different. Experts possess more confidence, solve problems more quickly, find better solutions, need less information to solve those problems, successfully cope with complexity, and are more mentally agile. Amateurs will be more vulnerable to the cognitive impairment associated with stress, fear, fatigue, and sleeplessness. They solve problems more slowly, need more information to solve them, and are far less innovative.¹¹ Ability defines a person's physical and cognitive boundaries.¹² Most people's achievements never approach their boundaries in any part of their professional life. However, boundaries do exist, and they do effect what people learn easily and what they find difficult.

The key to achieving elevated performance at the individual level is to adroitly combine appropriate assessment and selection systems with extensive experience.¹³ The Army must choose people with the appropriate character and skills for a given position, and the Army must also remove non-performers.¹⁴ Skills require time to master, and complex skills require more time than simpler ones.¹⁵ Soldiers of all ranks must have the ability to achieve a given level of expertise within the amount of time the Army allots to them. They must then receive the training necessary to achieve or at least approach the expert level.¹⁶ Improvements in either will yield improved unit performance, particularly if shared mental models and trust are present.

Trust. Commitment- and competence-based trust are critical components

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cohesion.¹⁷ They facilitate quick action and audacity. A commander who believes in his subordinates will delegate decision-making authority to them, and he will spend less of his precious time monitoring, supervising, and worrying. Trust allows commanders to choose the more audacious and decisive course of action rather than the more cautious one that allows an enemy to again fight another day. Subordinates who believe in their commander will accept his judgments and doggedly implement his intent.¹⁸

Commitment- and competence-based trust provides the psychological armor and individual confidence necessary for excellent performance under severe stress. Trust increases predictability, which significantly lowers individual stress and fear and lessens the chance of human failure.¹⁹ Soldiers know what they can expect from each other and their organization. Without it, soldiers are vulnerable to all sorts of undesirable behaviors. Examples include a deliberate decision not to participate, outright combat reaction, cognitive freezing during combat, and panic.²⁰ Without trust, units tend to wither and fail under the stress of combat, and the enemy receives the opportunity to seize the initiative and begin imposing his will on the battlefield.²¹

Trust must be built, and the Army must ensure it establishes an environment that fosters it. Personnel stability and training are vitally important.²² Meaningful collective training becomes exceedingly difficult when personnel turbulence is high.²³ Such an environment is not conducive to establishing trust. Effective and faithfully administered assessment and selection systems are also essential. Estimates of leader incompetence rates are about 15-30%.²⁴ While this rate is substantially lower than the private sector, one can effectively argue that it significantly undermines trust given the demands of combat and the inherent interdependence of soldiers and units.²⁵

These organizational attributes are critical to achieving elevated performance. They are three of the many important criteria that determine feasibility of various organizational structures. The next section will consider some of the relationships between wherewithal of the people who comprise an organization and the schemata the Army can use to organize them.

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Organizational Design Parameters Which Are Important to the Future

This section focuses upon: span of command and span of control, modularity, specialization, and number of echelons. Each subsection briefly defines the parameter, discusses why it is important, and then considers the impact of shared mental models, individual expertise, and trust.

Span of command and span of control. Span of command is the number of immediately subordinate units that a commander is responsible for properly employing to achieve a desired end. Command imposes a heavy moral and cognitive burden. It involves tasks such as relating means and ends, understanding the future and determining conceptually how best to influence it. It involves great nuance and uncertainty, difficult judgments, emotional encouragement or censure, and the transmission of moral force.²⁶ Control is an implementing function that focuses upon tracking information and responding to objective criteria with permissive or restrictive guidance.²⁷ Foreseeable technology does not promise to ease command burdens in the future, but it holds great promise for assisting control.²⁸

Technology makes information and staffs more accessible. Common situational awareness offers information, but it does not identify all problems or provide solutions. Those who track the progress of artificial intelligence systems do not believe that future systems will be able to handle the contextual, dynamic, and enormously complex problems presented by battlefield realities.²⁹ Technology may be able to provide signs that units are waning and need encouragement, but it will remain a poor substitute for a resolute leader who inspires confidence at the decisive place and time. And maybe most important, technology will not be able to discern whether to take a bold risk, follow a moderate course of action, or to initiate a change when the situation changes suddenly and demands an immediate solution.

Current wisdom dictates that a commander can effectively command between three and seven subordinate units and adequately grasp all of the complexity that

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accompanies them. One of the important purposes of command is to integrate units and capabilities. From that perspective, a larger span of command is better, and some military thinkers express hope that technology will allow span of command to be significantly increased. There is a point, however, at which commanders become overwhelmed and decision quality deteriorates to unacceptable levels. The informal rule of 'three to seven' is intended to accommodate that reality. In tactical units designed for combat, span of command is usually limited to five or less. In supporting units, the span of command is often greater. By most accounts, these unofficial rules serve the Army well.³⁰

To increase span of command, the Army must pay close attention to shared mental models, individual expertise, and trust. Commanders must have highly competent and reliable subordinates who share his understanding of the situation. A common set of graphics and enhanced knowledge of friendly and enemy unit locations will be very helpful, but the commander's subordinates must interpret the information as he does. Otherwise, he will spend precious time monitoring, supervising, worrying, and solving problems caused by errant subordinates. This challenge intensifies as the pace of planning and execution quickens. Commanders and subordinates must quickly handle the added complexity that accompanies a greater span of command, which in turn places a greater premium upon individual expertise. A commander must have the requisite experience and ability to cope with the increased cognitive and emotional burdens. Command of military forces in war is complex and difficult business even under the best of circumstances, and years of training are necessary to achieve expertise. Subordinates will have to discern important details for themselves because the commander and staffs will have less time to explain and monitor. Commanders and subordinates must trust each other because lack of it will eat up precious time through supervision, checking, and centralizing.

In the future, span of command will probably remain limited for tactical units designed for combat under any circumstances. Combat imposes unique cognitive and emotional stresses upon a person.³¹ Together with the projected fast pace of

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operations, greater complexity, the debilitating effects of stress, and sleeplessness, and other challenges, there is little hope that that a commander can adequately cope with a large span of control; however, the span of command may increase somewhat for other units. Examples include combat commands at the operational and strategic levels, and units not designed for combat.³²

Significant expansion of the span of control, on the other hand, may very well be possible. Control focuses upon implementation of fairly objective criteria, which lends itself to technology. Technology promises to effortlessly provide unit locations and status, which is called common situation awareness. This tool will greatly assist subordinate units in meeting commander's intent without supervision from above. Unlike the past, they will see the greater situation for themselves. Consequently, staff officers responsible for control and other similar functions will be able to control more units. Technology also promises to greatly improve the transmission of military information, which will again ease the total burden faced by staff officers. It is an area ripe for substituting capital for labor.³³

Modularity. Organizational modularity is mixing and matching people and units as the situation requires. It is an attempt to optimize resources. Optimization will be important in the future given that the Army will have fewer but more capable platforms. The penalty will increase for each system not used to its full capability. Modularity is also an attempt to achieve the ideal system synergy for each unique situation.

Unfortunately, modularity severely undermines elevated performance. Modularity implies that people will work together who have had little or no opportunity to establish common mental models and trust. Instead, they will rely on a common understanding of doctrine and institutional culture, which will often be inadequate because it is incomplete. When factoring in dynamic situations and compressed planning and execution timelines, the challenge becomes even more difficult. Relative strangers do not work together nearly as well as long standing teams and organizations with low personnel turbulence. Teams made up of relative

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strangers are also far more vulnerable to the debilitating cognitive effects associated with high stress situations.³⁴ Consequently, modularity will remain severely limited in the future. Systems will not operate any better than the organizations and the people operating them. If the people cannot perform to the necessary standard, then the Army loses the benefits of system optimization.

Still, modularity must exist at one or more levels. The Army cannot perfectly predict the future and optimally configure itself beforehand. Potential missions will be too multitudinous and resources too few endeavor, and at some point the costs of such an endeavor would outweigh the benefits. A compromise solution may be to mix and match systems within fixed organizations and keep the influx of outsiders to a minimum. The AAN Project is investigating this idea. Two existing organizations that will likely remain modular are the corps and the joint task force. They integrate and facilitate inter-service cooperation and allocate very scarce resources. All of the services can 'plug' organizations directly into them. These transient units will be commanded and controlled by relative strangers, who like their units, must be quickly integrated into the organization. The greater organization will be the bedrock upon which this integration occurs.

Specialization. General-purpose personnel and units will become less useful. The battlefield challenges and the resulting requirement for elevated performance will combine to limit individual and organizational task lists, which is the equivalent of specialization.

Ultimately, organizations and their people have limits. Shared mental models, individual expertise, and trust require time to develop. Organizations can master a few tasks, become good at a larger number, or achieve familiarity with many. The potentially dire future consequences of committing units to war will be too great unless they have mastered the critical tasks. A unit equipped and oriented upon fighting maneuver warfare is likely to be at risk for taking many unnecessary casualties or even failing if the given mission strays too far away from what they practice on a daily basis. Units given a task list requiring them to fight in both desert

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and jungle environment will probably only achieve familiarization with both, never mastering either since the environments are radically different. This concern becomes even more important if enemies force the US into come-as-you-are conflicts that limit or eliminate preparation time.

Specialization is already a fact in the Army; however, the imperative of maintaining a qualitative edge will likely increase it further. For example, urban warfare may become so skill and teamwork intensive that swift victory at low human cost may be feasible only if the Army dedicates large and specialized units to fighting and winning intense urban battles.³⁵ Given the necessity of highly specific training, elevated performance requirements, and unique equipment, these same units would not be equally fit to fight in a jungle or a forest without major mission re-orientation and training.

Number of echelons. Echelons equate to organizational levels. Today, the Army has between eight and eleven levels that separate the most junior enlisted soldier from the national command authority, depending upon how one counts them. The number of echelons, similar to span of command and control, is a method of dividing responsibility and work between people and organizations. In all organizations, each sorts out how it will use available resources to achieve missions given by higher; they organize, apportion, and integrate those resources, and regulates work flows. They also establish accountability and define responsibility.³⁶

Leaders must not confuse the appropriate number of echelons with other factors that inhibit excellence. For instance, many leaders believe that the Army is too slow, information does not travel fast enough and is often distorted, and echelons are pre-disposed toward inappropriate centralizing. They often believe that too many echelons is the root of the problem. In their minds, deleting the echelons will improve the organization. One must be careful about such logic because these problems have many causes. A lack of shared mental models results in inefficiency, misunderstandings, and confusion between echelons. A lack of individual expertise leads to distorted information and wasted time. Too much personnel turbulence can

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prevent the trust necessary for prudent delegation, which leads to centralizing. Deleting the 'offending' echelons will not solve these fundamental problems, and they will likely lead to others if that echelon is useful.

One particularly tough issue -- mostly unique to the military -- is that some echelons serve critical functions during war and field training exercises, but they are less vital during other periods. Organizational designers must focus only upon combat requirements, and commanders must ensure that echelons act appropriately in daily circumstances. And maybe above all, one must not confuse the day-to-day difficulties of working in a people-intensive organization with the worth of a particular echelon.

Still, the Army may be able to eliminate one or two levels in the future; however, such steps must be carefully studied because the remaining echelons must absorb the complexity and integration burdens associated with each missing level. The work requirements will remain constant; those requirements will simply spread over fewer echelons and teams. In addition to a greater workload, the demands for in-depth shared mental models, individual expertise, and trust will increase for those remaining. Consequently, caution is prudent.³⁷ Private sector experiences provide warning to those who are predisposed toward cutting levels. During the last ten years, many large private sector firms hastily reduced the number of organizational layers only to find that those remaining could not cope with the increased responsibility and workload. Today, many firms are restoring some of those layers. Also, many echelon-cutting private sector firms began with far more layers than the Army. In some cases, firms began with as many as twenty-two layers and endeavored to cut it to eleven, which is similar to the Army. By private sector standards, the Army compares well with most large corporations. The Army should study the matter carefully, and senior leaders should not feel compelled to reduce the number of echelons because cutting is currently in vogue throughout the management literature.

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Summary and Conclusion

If the future does in fact demand elevated performance, the Army must first meet this requirement before it embarks upon extensive organizational innovation. The various possibilities being considered for the future are demanding and appear to be very dependent upon other aspects of the Army. This paper highlighted the relationship between organizational structure and human and organizational behavior. A similar paper could be written using other subjects such as technology or culture.

When designing future organizations, the Army must experiment extensively, and just as important, leaders must be honest with themselves about organizational wherewithal. Unit designs must be congruent with the caliber, readiness, and cohesion enjoyed by the people and teams who will comprise them. Army culture mandates a 'can-do' attitude when presented with new ideas and challenges; however, innovative organizational structures could lead to unfortunate consequences if collectively the teams and people who comprise them, for whatever reason, are unable to 'make it happen.'

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² Huba Wass de Czege and Jacob Bieber, "Battle Command and Teamwork: Realizing the Potential of 2020 Technologies, pending publication in *Military Review*, 1998; Gordon R. Sullivan, "War in the Information Age," *Military Review* 74 (4) (April 1994): 46-62.

³ Stephen Biddle, "Victory Misunderstood: What the Gulf War Tells Us about the Future of Conflict," *International Security* 21 (2) (Fall 1996): 139-179.

⁴ Wass de Czege and Jacob Bieber; Gordon R. Sullivan, "War in the Information Age"; Huba Wass de Czege, "Mobile Strike force: 2010 Potential Force," *Military Review* 76 (4) (July-August 1996): 70-84.

⁵ Robert H. Scales, Jr., "Cycles of War: Speed of Maneuver Will Be the Essential Ingredient of an Information-Age Army," *Armed Forces Journal International* (July 1997): 38-42; Sandra I. Meadows, "In 2025, Fast, Compact Units Will Range Over Vast Arenas," *National Defense* (April 1997): 26-27.

⁶ For instance, see Leland Joe, Jon Grossman, et al, "Characteristics of High-Performance Units: Implications for Force XXI, DRAFT" RAND Corporation Report DRR-1225-1-A, (Santa Monica, California: Arroyo Center, RAND Corporation, January 1996); also, see "Final Report - Information Management Processes in High Performance Units," Fort Monroe, Virginia: Military Professional Resources, 1995.

⁷ Wass de Czege and Jacob Bieber.

⁸ Gordon R. Sullivan, "Delivering Decisive Victory: Improving Synchronization," *Military Review* 72 (9) (September 1992): 2-11. General Sullivan uses the term 'expectation' and 'common understanding' instead of mental model; Caroline E. Zsombok, Naturalistic Decision Making Research and Improving Team Decision Making, in *Naturalistic Decision Making*, ed. Caroline E. Zsombok and Gary Klein, (Mahwah, New Jersey: Erlbaum, 1997), 111-120.

⁹ Peter M. Senge, *The Fifth Discipline* (New York: Doubleday, 1990), 174-204.

¹⁰ Frederick Brown, "Learning in Army XXI," paper presented at the Army Research Institute's *Workshop on Human and Organizational Issues for the Army After Next* at Leesburg VA, 13-15 November 1997; K. Anders Ericsson and Neil Charness, "Expert Performance, Its Structure and Acquisition," *American Psychologist* 49 (8) (August 1994): 725-747; John R. Hayes, *The Complete Problem Solver*, 2nd Ed., (Hillsdale, New Jersey: Lawrence Erlbaum, 1989), 293-300.

¹¹ Hubert L. Dreyfus, Intuitive, Deliberative, and Calculative Models of Expert Performance, in *Naturalistic Decision Making*, ed. Caroline E. Zsombok and Gary Klein (Mahwah, New

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Jersey: Lawrence Erlbaum Associates, 1997), 17-28.

¹² Robert Plomin and John C. DeFries, "The Genetics of Cognitive Abilities and Disabilities," *Scientific American* 278 (5) (May 1998): 62-69.

¹³ Walter F. Ulmer, Jr., "Military Leadership into the 21st Century: Another Bridge Too Far?" *Parameters* 27 (1) (Spring 1998): 4-25.

¹⁴ Donn A. Starry, "Running Things," *Parameters* 17 (3) (September 1987): 13-20; of particular interest recently is emotional intelligence, which one can argue is particularly important in the military. See Daniel Goleman, *Emotional Intelligence* (New York: Bantam Books, 1995).

¹⁵ M. L., McGee, T. O. Jacobs, et al., *Developing Leaders for the New Army*. FT McNair, Washington, DC: Industrial College of the Armed Forces, 1996. Unpublished.

¹⁶ K. Anders Ericsson and Neil Charness.

¹⁷ Faris R. Kirkland, et al., *Unit Manning System Field Evaluation, Technical Report No. 5* (Washington, D.C.: U.S. Army Division of Neuropsychiatry, Department of Military Psychiatry, September, 1987); David H. Marlowe, "Personnel and Manpower: change and Evolution in the Human Dimensions of Military Service," in *1994 American Defense Annual*, Charles F. Herman, Ed. (New York: Lexington Books), 147-161.

¹⁸ Faris R. Kirkland, "Assessing COHORT," *Army* 40 (5) (May 1990): 44-50;

¹⁹ David H. Marlowe, *Cohesion, Anticipated Breakdown, and Endurance in Battle: Considerations for Severe and High Intensity Combat*, (Washington, D.C.: Division of Neuropsychiatry, Walter Reed Army Institute of Research, 1979), in particular, see page 66; Richard H. Sinnreich, "To Stand & Fight," *Army* (July 1997): 15-19.

²⁰ Reuven Gal, *Courage Under Stress*, In *Stress in Israel*, Shlomo Breznitz, Ed. (New York: Van Nostrand Reinhold Company), 1983, 65-91; Winfried Zimmer, "Clausewitz and the Human Dimension of War," *Military Review* 74 (3) (March 1994): 51-56.

²¹ Edward S. Shils, "Cohesion and Disintegration in the Wehrmacht in World War II," *Public Opinion Quarterly* 12 (Summer 1948): 280-315.

²² Donn A. Starry, "On Making a Smaller Army a Better One," *Field Artillery* (February 1991): 20-24; David H. Marlowe, "Personnel and Manpower: Change and Evolution in the Human Dimensions of Military Service."

²³ Starry, "On Making a Smaller Army a Better One," 24.

²⁴ Ulmer; Starry, "Running Things."

²⁵ Ulmer.

²⁶ Wass de Czege and Bieber.

²⁷ Wass de Czege and Bieber.

²⁸ Wass de Czege and Bieber.

²⁹ Paul E. Lehner, "Automated Reasoning for Asymmetric Warfare Simulations," paper presented at the 13-15 November 1998 Army Research Institute's *Workshop on Human and*

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³¹ *War Psychiatry*, ed. Franklin D. Jones, Linette R. Sparacino, et al., Falls Church, Virginia, Office of the Surgeon General, 133-148.

³² Fukuyama and Shulsky; Patrick Ford and William J. Mullen III, *Methods and Results of Data Collection on Span of Effective Command and Control*, Alexandria, Virginia: U.S. Army Research Institute, August 11, 1994. This study surveys span of command and control issues during Operations JUST CAUSE, PROMOTE LIBERTY, and RESTORE HOPE. A characteristic of each operation was an expansion of the span of command and control as the operations transitioned from combat to less violent operations.

³³ Wass de Czege and Bieber.

³⁴ David H. Marlowe, *Cohesion, Anticipated Breakdown*.

³⁵ An excellent example of the modern, and timeless, demands of urban warfare is found in: Timothy L. Thomas, "The Russian Armed Forces Confront Chechnya: The Battle for Grozny, 1-26 January 1995," FT Leavenworth, Kansas: Foreign Military Studies Office; also see Timothy L. Thomas, "The Caucasus Conflict and Russian Security: The Russian Armed Forces Confront Chechnya III. The Battle for Grozny, 1-26 January 1995," *Journal of Slavic Military Studies* 10 (1) (March 1997): 50-108.

³⁶ Jacques and Clement, 102-147.

³⁷ Fukuyama and Shulsky.

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