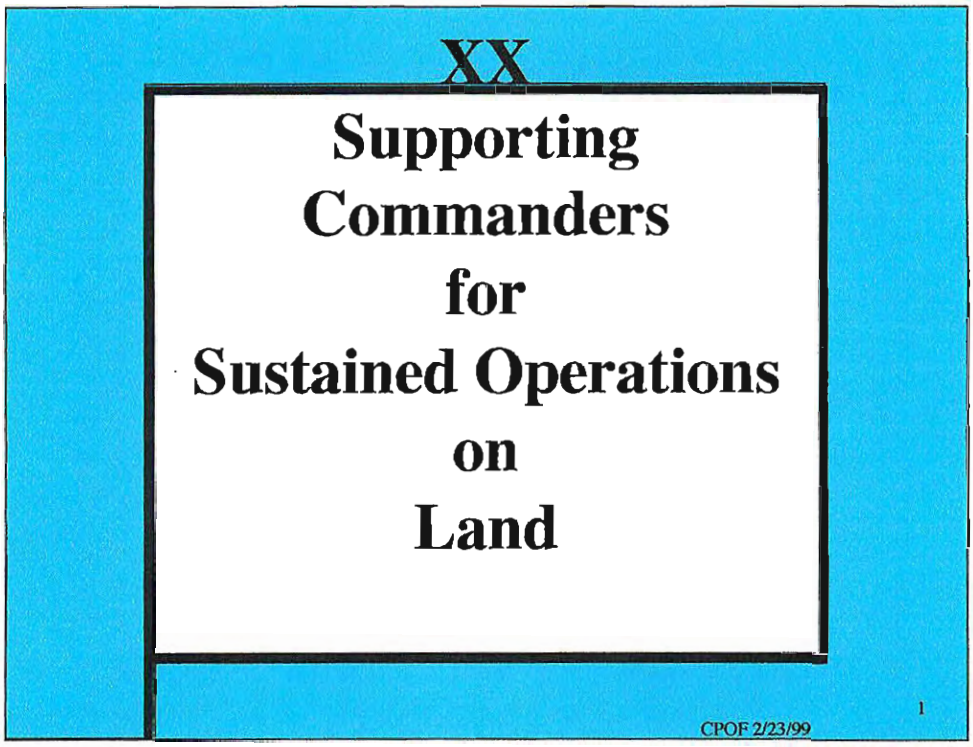

Presentation by General Paul F. Gorman, U.S. Army (Retired) at DARPA's conference on Command Post of the Future, San Diego, CA, 23 February 1999.

...The levels of war — tactical, operational and strategic — are... defined more by the consequences of their outcomes than they are by the echelon of involvement, although, as a general rule, the higher the echelon, the higher the level of war...At the operational level, military forces attain strategic objectives through... campaigns and major operations...On the battlefield, the primary focus of the tactical commander is winning battles...in which he executes maneuvers and fires to achieve a specific objective...

U.S.Army Field Manual 100-5, Operations

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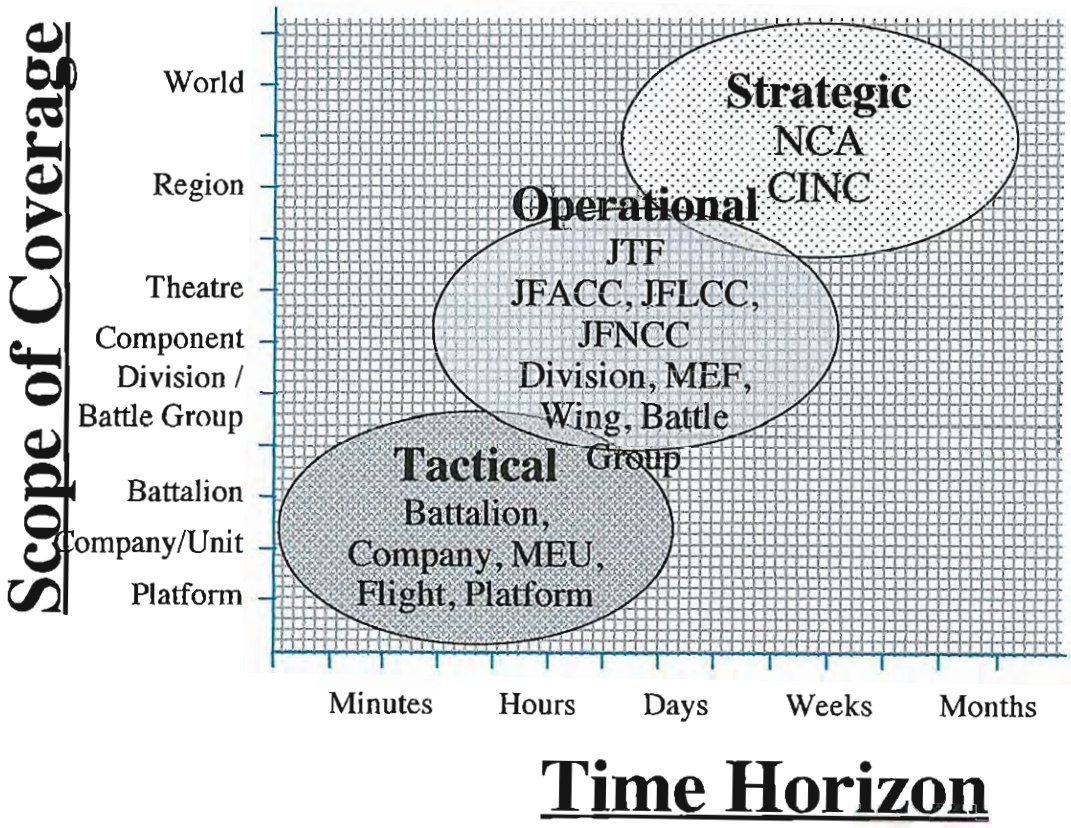
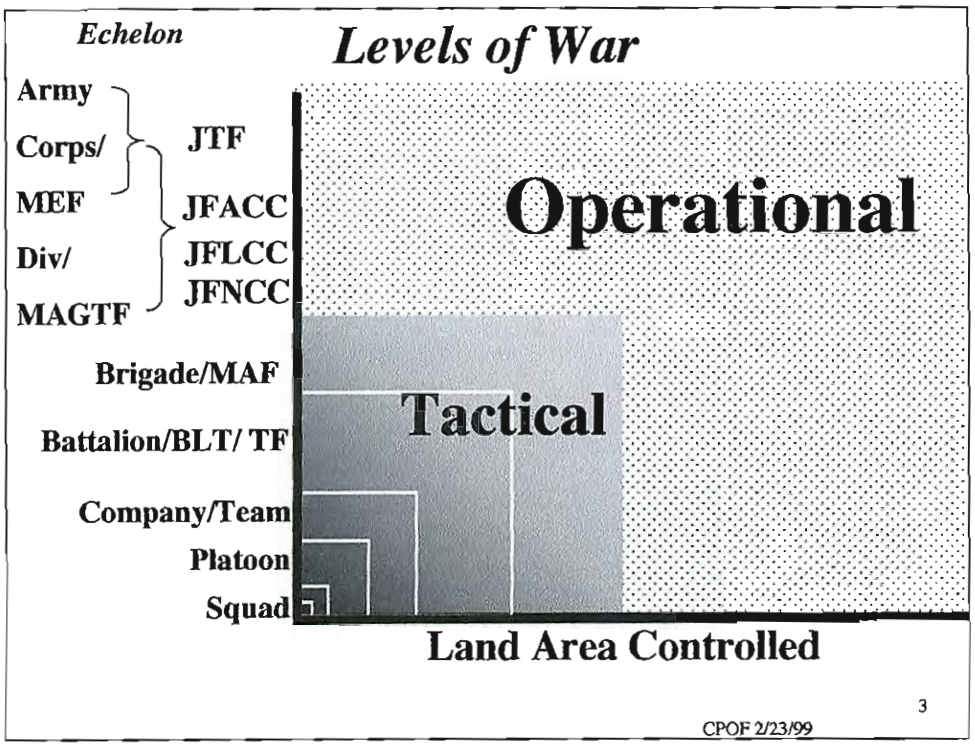
CPOF is focused on Operational Level of War



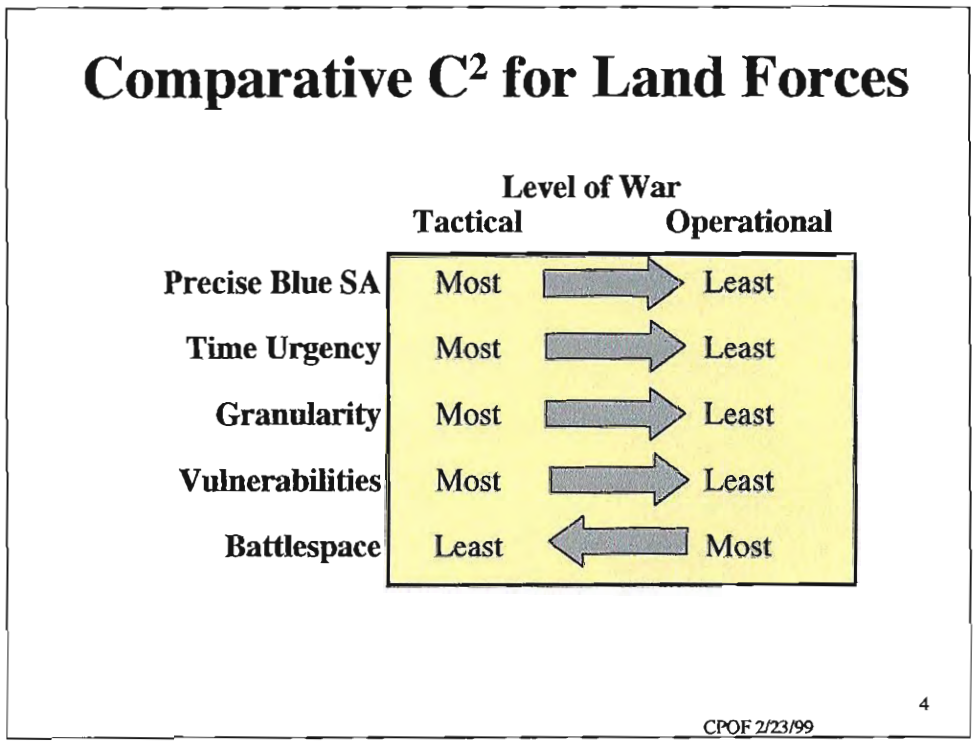


"At the operational level of war, large unit commanders mass or maneuver tactical formations to bring the enemy to battle on the best terms possible. Attacks in depth with air-delivered weapons, missiles and airmobile troops isolate portions of the enemy force for attack or break up the continuity of his operations....

Tactical operations are the conduct of battles and engagements within the context of campaigns and major operations. They are the domain of corps and smaller units. They are supported by higher echelons of command who set the terms of the battle and provide support for it. Brigades and smaller units may fight engagements — smaller, separate actions—either as part of a battle or as separate actions.. Tactical success is measured by the success of failure to achieve aims set by higher commanders.

Battles are large engagements involving brigades and larger forces. They may be localized, brief or intense or they may involve numerous engagements ovber a large area that take days to resolve.In any case, their effects are felt over a large area, and actions outside of the area of direct, sustained combat can greatly influence their outcome.

The conduct of battle differs from that of campaigns and major operations in some important respects. Speed of response, ability to change direction, and sensitivity to short-term events are among these differences. Conduct of both depends upon initiative, agility, depth, and synchronization..." FM 100-5



This diagram highlights some of the key differences.

"Blue SA" (situational awareness) refers to the precision with which friendly elements may be located by tactical decision makers.

"Time Urgency"refers to the control of maneuvering land forces, including rotary wing aviation. (Time urgencies for control of fixed wing aviation and missiles is greatest at the operational level.

"Granularity" refers to the numbers of entities under control and to the details of the environment that must figure in tactical decisions for land forces: terrain, the works of man thereon, and the resident population and their chattel.

"Vulnerabilities" refers to the relative lethality of the sone of tactical operations on land, where, in general, more enemy weapons bear, and most friendly casualties occur.

"Battlespace" refers to the area of land control over which is at issue between the antagonists, and to the airspace over it.

Essentials for Command Control

Priority	Tactical Level*	Operational Level#
1	Blue SA	Red SA
2	Maneuver Visual topograph e.g., 1:50,000 UTM	Operations Visual Joint Opns Graphic e.g.,1:250,000 lat/long
3	Control of artillery and missiles	Control of attack air and air defenses
4	Red SA	Blue SA
5	CSS	TPFDL, CSS

* Observed in TES
\# Unobserved

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The five priorities listed for the tactical level of war were derived by IDA observations of mock combat at the National training Center, Fort Irwin, CA.

Those listed for the operational level were derived from conversations with experience senior officers, but have not been otherwise verified.

"CSS" is combat service support: logistics, personnel, medical, etc.

"TPFDL" refers to the time-phased force deployment list, the planning document that governs overseas force projection.

What Does the Commander Require?

A fused, real-time, true representation of the battlespace — an ability to order, respond and coordinate horizontally and vertically to the degree necessary to prosecute his mission in the battlespace.

Gen. John Shalikashvili, CJCS, 1997

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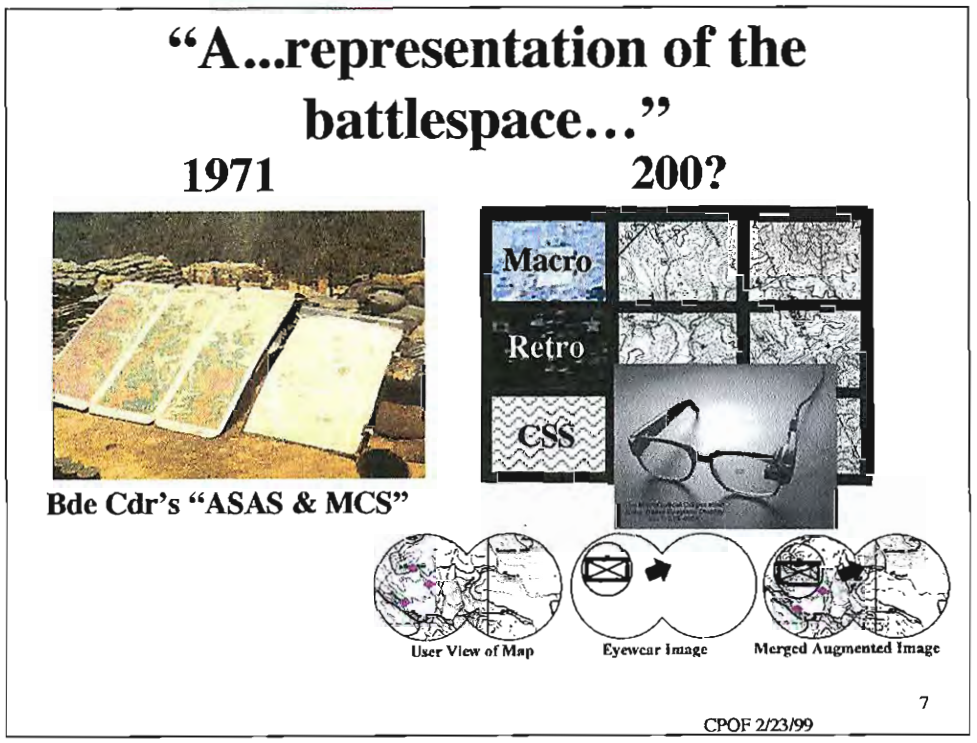
The visualization of the scheme of maneuver, as FM 100-5 points out, is "the central expression of the commander's concept for close operations. The scheme of maneuver—

- Outlines the movements of the force.
- Identifies objectives or areas to be retained.
- Assigns responsibilities for zones, sectors,or areas.
- Prescribes formations or dispositions when necessary.

Identifies maneuver options which may develop during an operation.

The commander's scheme of maneuver usually determines the subsequent allocation of forces and governs the design of supporting plans and annexes. Fires, barriers, air defense priorities, electronic warfare (EW), deception efforts,combat support, and combat service support (CSS) arrangements are normally guided by and coordinated with the scheme of maneuver..."

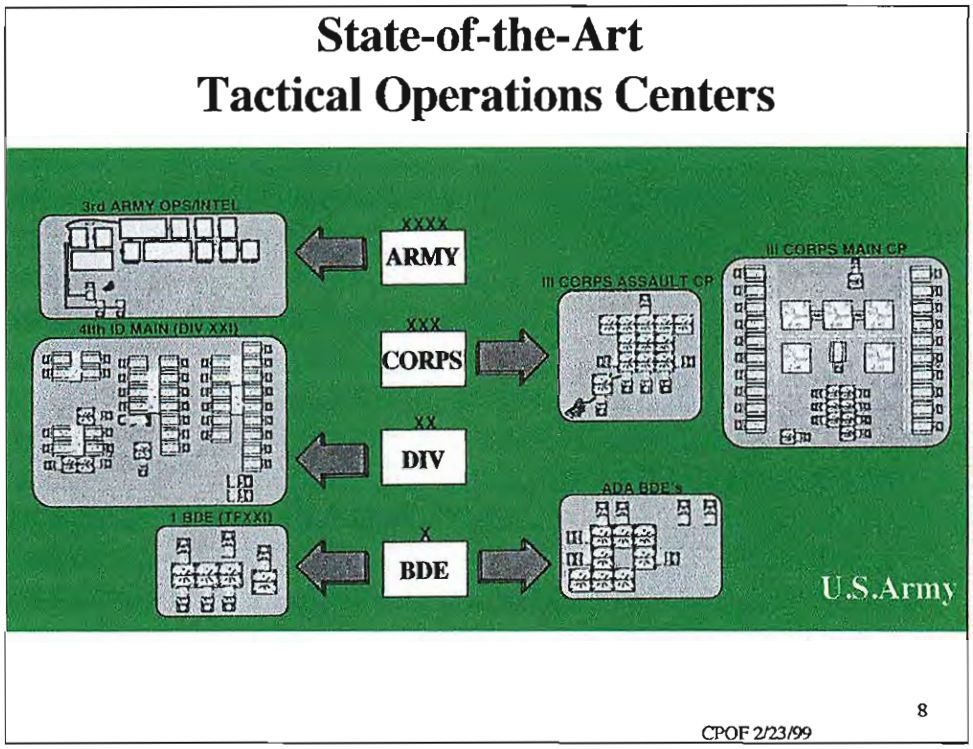


On the left are two portable command support devices used by the commander of 1st Brigade, 101st Airborne Division, in northern I Corps, RVN, 1971. Both are designed to be carried about the battlefield, on a helicopter, or in a jeep, or on foot.

On the left of the 1971 picture is a three panel, aluminum-backed stack of acetate overlays atop a color-contoured tactical map (1:50,000). The overlays recorded past activity of the enemy as observed by various sensors and units. This retrospective was inherently valuable in dealing with an enemy that operated in a fashion inverse to U.S. procedure: the North Vietnamese inserted their logistic infrastructure into the battlespace first, over a period of months, perhaps years, and introduced combat troops only when all was in readiness to support them. By tracking records of sightings and findings, it was possible to anticipate where they were planning to strike, and in what strength.

On the right of the 1971 picture is a comparable single-panel map and overlay showing the current position of all friendly forces in the same area —U.S. and allied— plus all operations planned for the day: fires and maneuver. These are described as being precursors for today's computerized All Source Analysis System (ASAS) and Maneuver Control System(MCS).

The 200? Picture depicts a segmented display for visualizing the scheme of maneuver and fires, designed to be used with a set of glasses capable of providing a "data lens," that is enabling the viewer to interrogate an icon on the map and see what it is in detail (depicted is an example of a purple diamond-shaped icon that the data lens interprets as a rifle company moving NNE.



The Army is spending hundreds of millions of dollars on standardized Tactical Operations Centers that consist of vehicles and canvas shelters erected over and between vehicles, equipped with large numbers of computers, and powered by many generators.

Such facilities are potentially vulnerable, and will be discussed in the following charts.

Developing Improved Support for C2

- **Design for idiosyncrasy**
  - *f* (service) (command team)(environment)(mission)
- **Threat = <u>decapitation</u>. Hence, design for—**
  - C3: command, control, collaboration
  - D4: dispersed, distributed, downsized, deleted
- **Provide for both categories of decisions:**
  - Deliberate (e.g., estimate of the situation, FM 101-5)
  - Time-stressed (e.g., G. Klein's RPD model)
- **Facilitate teamwork**
  - Intra-staff relations (e.g., Olmstead's "integration")
  - Joint interactions (e.g., Joint Pub 1)

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This is a list of possible improvements that DARPA's CPOF program might usefully — from the Army's perspective— develop.

These will be discussed in the order listed on the following charts.

Command at the Operational Level	USN ★★★	USAF ★★★	USMC ★★★	USA ★★★
• **Entities managed**	10^1-10^2	10^2-10^3	10^3-10^4	10^4-10^5
• **Freedom of action**	greatest			least
• **Command M.O.**	centralize			decentralize
• **Communications**	assured			tenuous
• **Tactical Mobility**	ease			difficulty
• **Doctrine**	*f*(materiel)			*f*(behavior)
• **Blue SA**	precise			fuzzy
• **Red SA**				
– **Operational**	worst			best
– **Tactical**	best			worst

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The array above compares typical service-components of a JTF, each under command of an officer of three-star rank. These are likely to be quantitatively different by orders of magnitude among numbers of *subordinate movable elements* (referring to groupings or personnel and materiel responsive to a single human intelligence: ships, planes, tank crews, infantry squads, supply detachments, survey parties, and the like).

However, more militarily significant than the order-of-magnitude shift in quantity within the array from left to right is the quality among the depicted differences: speed, range of operations, flexibility and maneuverability decline, and difficulties of command, control, and intelligence increase. Forming a Joint Task Force involves artful exploitation of complementing capabilities of each component, and commanding and controlling service components to that end is the prime purpose of joint doctrine, tactics, procedures and techniques. Land forces —USMC and Army elements —are inherently more difficult to plan for, to project abroad, and to coordinate once deployed.

It is reasonable to ask why employ land forces, given their disadvantages relative to naval or air forces. The answer lies in the difficulty of exerting control over land and people from the sea or from the air alone. When the mission of a Joint Task Force entails such control, then it must be provided with appropriate means. Land forces are essential when the objective includes any of the following:

—To deter the use of violence for political purposes(evidence U.S. determination, enhearten allies, inhibit the manufacture or use of weapons of mass destruction)

—To affect the governing of territory and population(provide humanitarian aid, forestall or redress aggression, destroy or neutralize usurping armed forces, separate combatants)

— To secure bases for air or sea components

— To assure precise, discriminate use of firepower

—To terminate conflict on terms favorable to the U.S.(delay, disrupt, or deceive hostile armed forces enable decisive fires and dominant maneuver)

However appropriate and efficient centralized command and control may be for the JTF itself, or for its naval and air components, its land component functions best with decentralized command structures. Indeed, Command Centers or large Tactical Operations Centers constitute a vulnerability for land forces, exposed as these would be to threats ranging from terrorist or guerrilla attacks, through direct or indirect fire, to actual capture. Hence, TOCs for land forces should not resemble those of sea or air forces, but should be, rather, highly mobile, dispersed or distributed.

Battle Staffs are Highly Idiosyncratic

- Experiments with 12 maneuver battalion (heavy) commanders and staffs of 8th ID in FTX *Cardinal Point II* (summer 1978) — four battles in 96 hours of live/constructive TES
- ARI evaluators and OE OCs, using two sets of MOE: (1) military; (2) behavioral (Olmstead) Results: two distinct groups of six each
  - MOE sets produced consistent ratings
  - Both groups exhibited strong upward "learning curve"
  - Lower half finished where upper half started
  - Some results confounded previous assessments

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Cardinal Point II was an FTX for the entire 8th Infantry Division Mechanized that included Tactical Engagement Simulation (TES) for eleven armor and mechanized infantry battalions, and the divisional cavalry squadron. The setting was the Saarland region of Germany along the French border, and the mission to delay against an attack by a Soviet-type division out of France, then a deliberate defense, followed by a counterattack, pursuit and exploitation. The simulation required the battalion commander and his company commanders to reconnoiter the ground, fit their plan to the terrain, and then to fight the battle, the battalion commander in his command post and the company commanders at a simulation center.

Evaluators from the Army Research Institute for the Social and Behavioral Sciences observed the commander and his staff throughout, aided by Officer Controllers drawn from the division's Organization Effectiveness cadre. The Military MOE were seven in number, e.g., ground controlled, exchange ratios, supplies consumed, time to accomplish mission, and adherence to the brigade commander's concept of operations. The behavioral MOE were drawn from the Olmstead model for staff teamwork. The results showed a strong and consistent correlation between the military and behavioral MOE.

The exercising battalions were all received top readiness ratings by their brigade commanders and by the division commander. The commanders were all command-select lieutenant colonels, graduates of the Command and General Staff College—front-runners among their contemporaries. But there were profound differences in their performance, as cited.

There were cases of commanders who had stood out for their individual professionalism who simply had not built a coherent staff team, and whose units were "lower half."

And there were cases of less well-regarded commanders that had genuinely worked at building teamwork, whose units performed exceptionally well, and emerged in the upper half.

Design to Reduce TOC Vulnerability

- Large "Operations Centers" present distinctive images and are also broad spectrum emitters
  - Multi-spectral imagery commercially available
  - Pattern tracing or "tracking" can pinpoint even a well hidden TOC
  - TBM or MLRS-type weapons are obtainable
  - Infiltrators/terrorists are "low tech" attack option
- Therefore, modularize to enable use in buildings, cellars, caves, and minimize to prevent tracking
- Also minimize manning: TOC signature ~ f(numbers of people)

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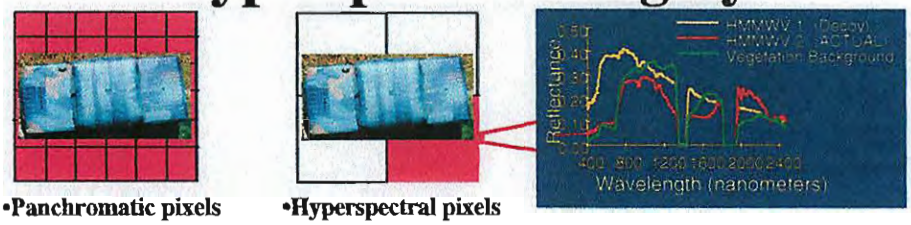
The next chart will discuss multi-spectral imagery.

Radar tracks of attendees at TOC briefings flag the general location, and ELINTcan pinpoint a TOC.

Even relatively small adversaries can obtain first class intelligence and lethal weapons.

Hence, enable CPOF to spread out, and to function with fewer persons

Hyperspectral Imagery



•Panchromatic pixels
One HMMWV
• One pixel to detect
• 24 pixels to classify

•Hyperspectral pixels
•Spectral signature of HMMWV in one pixel
• Detects, classifies, and identifies material

• Spectral signature of HMMWV
• Compared with decoy, background
• Amenable to automation

- ♦Not yet perfected, but technology moving rapidly toward high probability of detection (P_d), low false alarm rate (P_{fa})
- ♦Can be on aircraft as well as space craft
- ♦Commercial: U.S., Germany, Australia, Japan, France, ROK, Russia, India, China, Brazil, Taiwan

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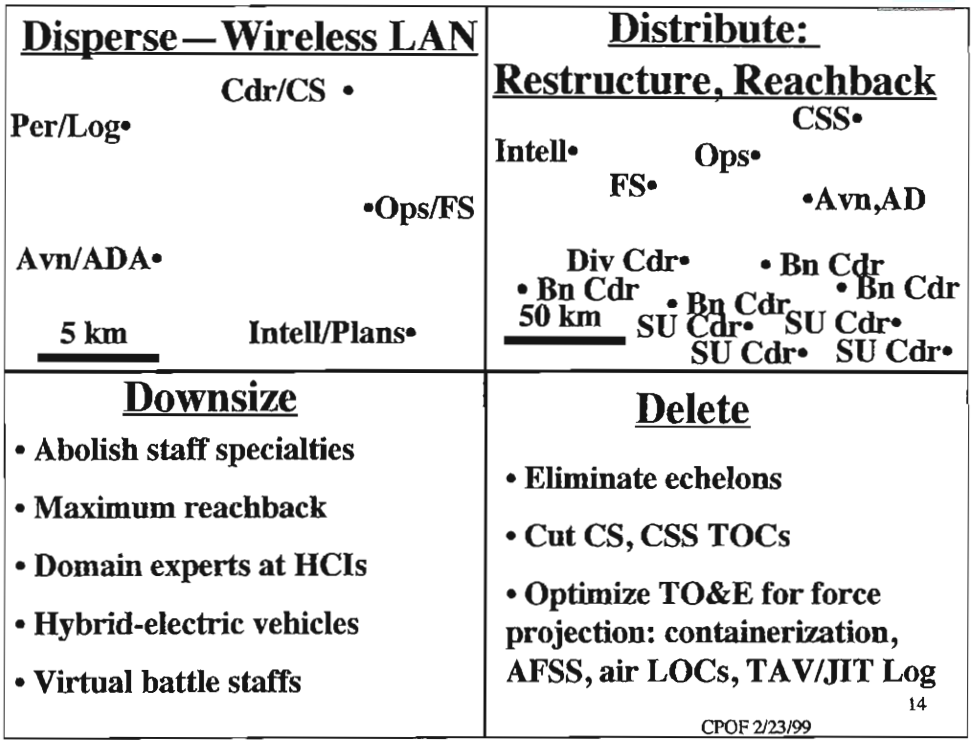
Hyperspectral imagery takes less expensive collectors, and processing of the imagery will eventually be automated.

While not a threat in 1999, it seems certain to be available to adversaries in 2009.



Here are four approaches to reducing vulnerability.

"Dispersal" entails spreading a Tactical Operations Center over a larger area to make the components easier to hide and harder to find. Dispersal requires some sort of broad-band wireless LAN. As the experiments described in the paper A Command Post is Not A Place showed, digitization is not a prerequisite for dispersal, and virtually any TOC can (and should) be dispersed. In a dispersed TOC, briefings are on demand, and all staff sections can "eavesdrop" on the transactions between the division and brigade commanders.

The question obtrudes whether dispersal is dysfunctional for teamwork, depriving staff members of contact with others, and denying them periodic updates on unit operations. After Action reviews of all exercises during the experiments established that the technologies adopted actually improved teamwork, broadened contacts, and improved staff understanding of both the commander's intent and the division's performance.

"Distribution" is dispersal over longer distances, plus reorganization to eliminate unit TOC's altogether. This configuration allows commanders to operate forward supported by functional staff groups to the rear. The latter can each include a personal representative of supported commander. If reliable, robust and fast communications are provided, this arrangement could potentially facilitate networking.

"Downsizing" entails personnel policies that reflect the information age, and are aimed at mimimum manning of whatever C^2 architecture may be adopted.

"Delete"means to introduce technology that obviates the need for certain TOCs, particularly those that now perform CS and CSS functions that can be automated.

Decision-Making

- Mission, Concept of Operations, Intent
- Deliberate Planning: Estimate of the Situation
  - Full definition of the mission
  - Collection of all pertinent information
  - Development and analysis of optional courses of action
  - Decision
- Recognition-Primed Decision-making
  - Novel situation: immediate action required
  - Expert discerns familiar elements
  - Evaluates in mental simulation one or more actions
  - Decides and implements

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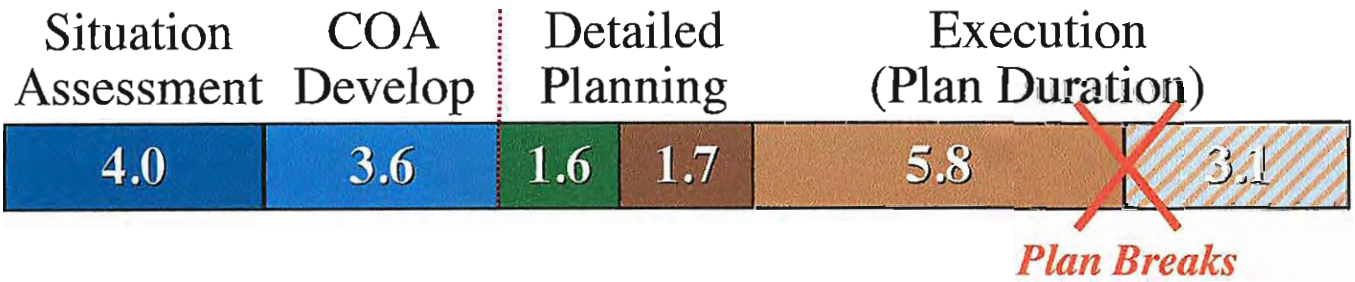
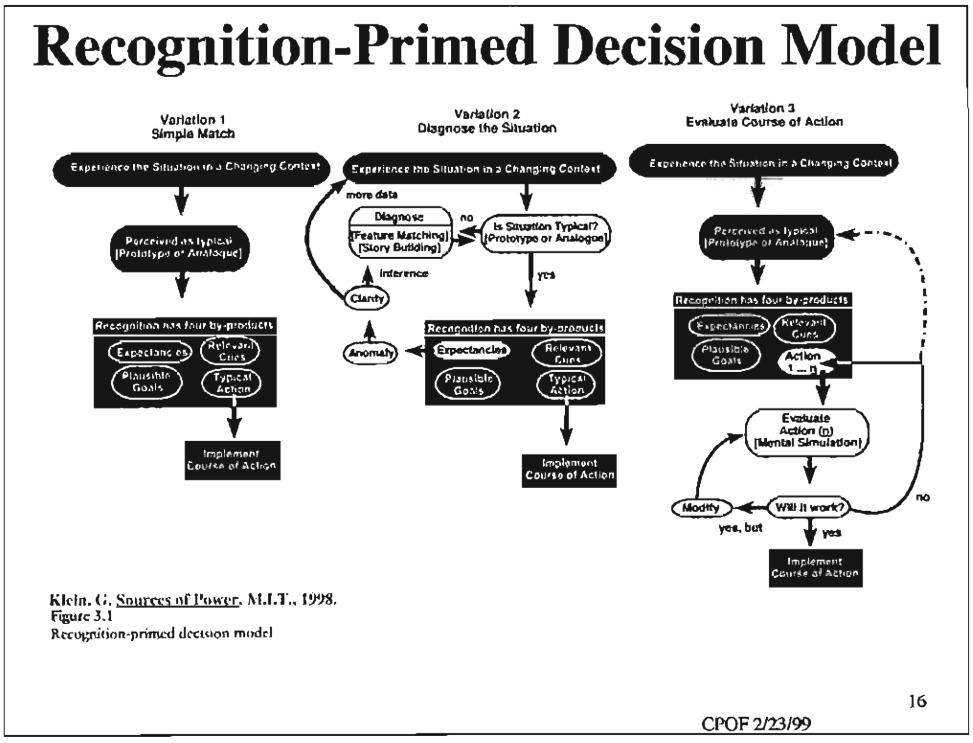


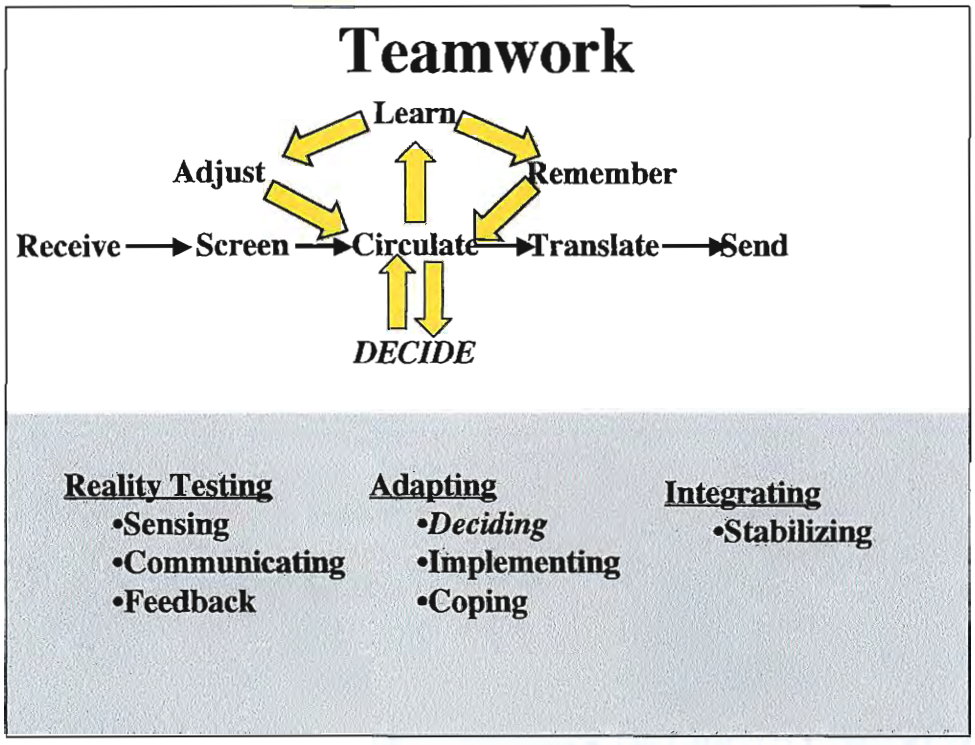
Plans, no matter how artfully contrived, "break" under the twists and turns of the unfolding tactical situation. Sooner or later, all commanders face making-decisions under intense time urgency for which their staff can provide only marginally useful assistance. This is where seniority and age —and, it must be added, sound training — pay off, and the commander makes decisions drawing on experience, intuition, instinct, or hunch.

Development of decision-aids must, then, go beyond automated course of action analyses within the rubrics of FM 101-5 and the doctrinal Estimate to address the case where time forecloses elaborate staff process.

In either case, understanding of the intent of the higher commander is crucial for success, so provisions for assuring that understanding must take priority.



The model of decision-making under urgency shown above is from a recently published book by an acute observer of people in dangerous and stressful jobs formulating a plan of action and implementing same.



The model of teamwork within a military staff at top above has been taught at the Command and General Staff College. The bottom model is that of Dr. Olmstead; "stabilizing" refers to adjusting the team to a new situation or course of action.

Both models make the point that some conscientious effort ought to be directed at understanding what staff members can do to assist the flow of information within the staff and to the commander. Understanding this teamwork is central to automating it, or to developing collaboration among remotely located team members in dispersed or distributed command posts.

Concerning the latter, face-to-face Video Tele- Conferencing (VTC), however well enabled with color and motion, is meaningful only among persons who know each other only slightly, and have not trained together. Hence, it probably is apt for joint operations, but less pertinent within tactical units. Particularly for the tactical level, a visualization of the the terrain with the scheme of maneuver thereon, is what is needed to underwrite collaboration at a distance.