

15 Sep 1980

A COMMAND POST IS NOT A PLACE

Summary

A field experiment in video-conferencing, using commercial video, TACFAX, and millimeter wave radio in conjunction with issue radios, points toward a capability to disperse a division Main Command post over a circle 6-10 kilometers in diameter, and to make a remote TAC CP, for all intents and purposes, part of the Division Tactical Operations Center.

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## A COMMAND POST IS NOT A PLACE

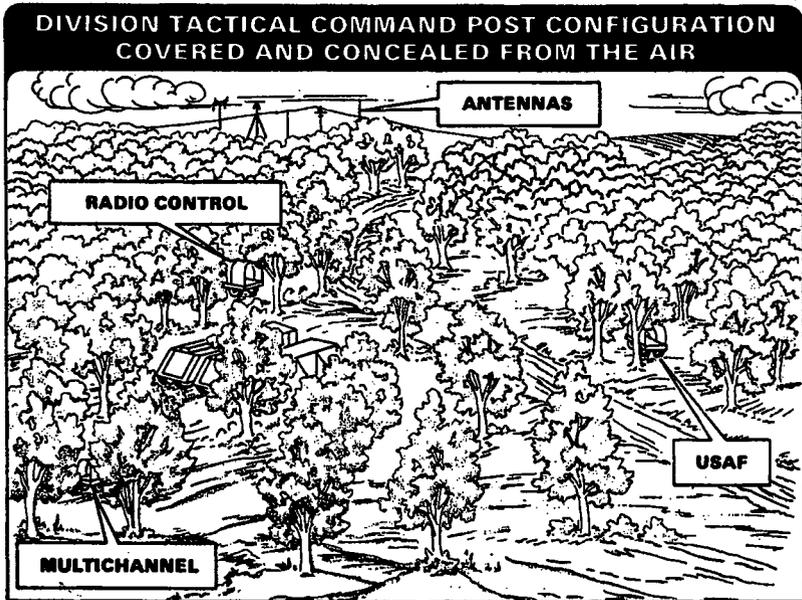
Or need not be. Within the past two years, Army experiments have pointed toward techniques and equipment which could free a general commanding a division or larger formation in the field from the gemmating congeries of vehicles, radios, antennae, generators, cables and people surrounding his place of business. And while computers are part of the problem--yet more vans, more thermal and electronic teltales, more vulnerable flesh per acre within the command post--for the foreseeable future computers are unlikely to be part of the solution. This paper reports good news--the experiments,\* have shown that collocation of staff elements with each other and the commander may no longer be either necessary or desirable--whether computers are in play or not.

### Theory and Doctrine

In the first place, why have a command post at all? I have little doubt that, given American romanticism about leading in battle, most division commanders would prefer to operate from a TAC CP, roaming around up front in a jeep, popping up in the nick of time at each Schwerpunkt, a genuine force-multiplier like the piece "Rommel" in the commercial board game AFRIKA KORPS, which adds to the striking range of any other piece with which it is positioned. Yet, while a division commander must be forward from time to time, the bewildering pace of mechanized battle and the propensity of the new, powerful intelligence systems to terminate at the Main Command Post, raises his risk in prolonged stay away from Main.

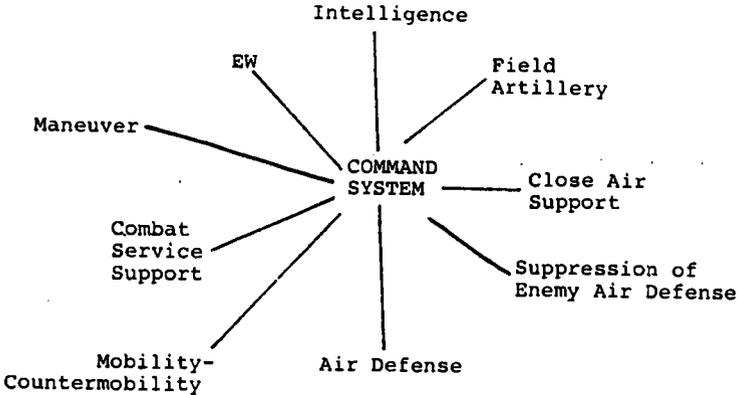
Until the Army finds out how better to communicate with the roving commander--a subject to which this article is in part addressed--he who commands from up front, or from a TAC CP, however often he may, by that practice, better sense the battle by eavesdropping on FM nets, or by presence boost performance in a microcosm, relegates to subordinates crucial macrocosmic decisions on concentration of force, fire, maneuver or sustainment. Or to put it another way, the would-be Rommel must purchase opportunity to follow and influence action in one maneuver sub-element at the price of an ability to sense and direct developments in all the several functional components of his command. These have been described as a series of

\* The writer is advantaged by his experience in USAREUR, but has been led to believe that no substantial inconsistencies exist in results from a similar trial in FORSCOM.



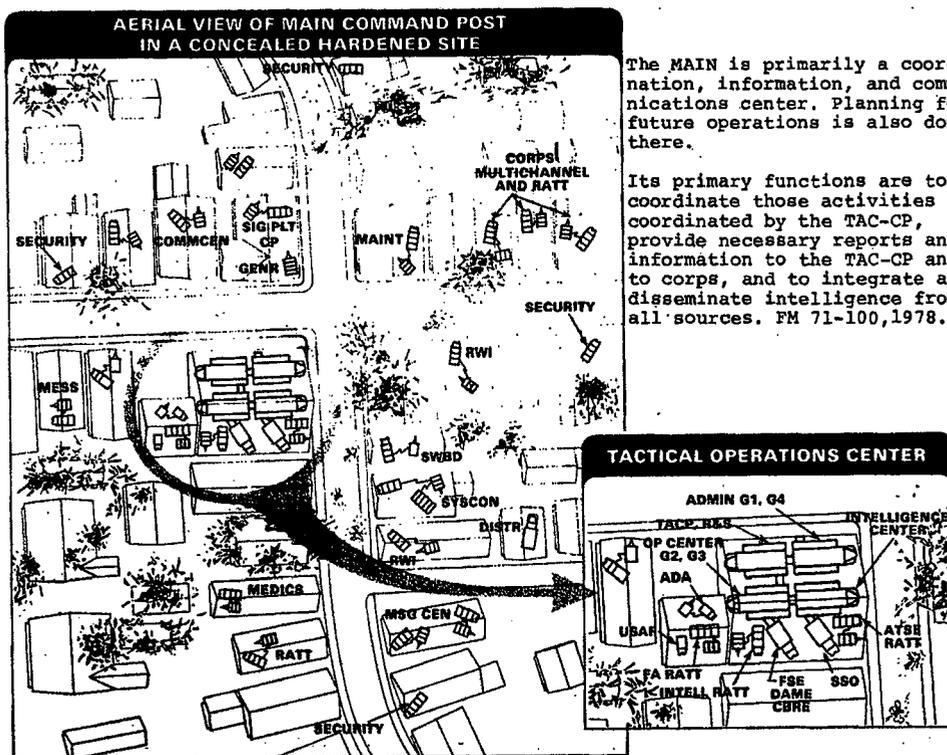
"There will always be a tendency to expand the functions and, so, the size of any command post. This particularly so in the case of the tactical command post since the commander normally takes station there. Therefore, it is necessary to guard against expansion lest the command post becomes cumbersome, less mobile, and more identifiable by enemy information-gathering agencies. Four or five armored command control vehicles should be sufficient for operational needs." FM 71-100, p. 7-11(1978)

"stand-alone" or "closed-loop" subsystems, inter-linked by the command system, of which the commander is, of course, the key component: It is the commander and his closest staff officers who bring about that synergy of information and response which multiplies the combat power of any one subsystem.



When I was about to assume command of a division, I sought out my predecessor for his advice. I vividly recall that foremost among the few topics he chose to address was a stern enjoinder to forget all the doctrinal lore about commanding-forward, and to discount the advantage of monitoring the FM of units in contact, so as to "stick with your VHF," meaning to operate from a place where I could use secure multi-channel voice communications with subordinate, flank and supporting units. In practice, he seldom left his Main Command Post—and he was respected for his tactical adroitness

afield. I noted, subsequently, on maneuvers in Europe, that most other division commanders who tried to operate forward, whether from an APC, a jeep or a helicopter, invariably lost effectiveness proportionate to their time away from Main. Battle staffs for support of commanders forward, such as at a TAC CP, no matter how skillful, were usually handicapped after 24 hours or so by awkward access to the flow of information through Main, and limited in communications, were vulnerable to jamming and other commo breakdown.



And my own experience parallels theirs.

Now, whether the commander operates forward or not, the Main Command Post of a division or corps is a dangerous place. Soviet doctrine assigns high priority to finding and neutralizing or destroying such a command post. And it ought to be easy to find—a monstrously large gaggle of distinctive vehicles and emitters, with a further "signature" of the comings and goings of command helicopters, and the vehicles of messengers, liaison officers, and visitors. And it is vulnerable—canvas shelters, and soft-skinned, out-size vehicles, awkward off-road, for which either cover or concealment is hard to provide. Why do we so expose our vitals?

A commander requires some means for processing the flow of information upon which he must base his decisions—a flow which has become increasingly rich as intelligence and communications have modernized. That means is the "command system" referred to above. FM 71-100, Armored and Mechanized Division Operations (1978), indi-

cates that "commanders generally organize command posts to suit themselves," and "the staff assists the commander by providing information, data, counsel, preparing plans and orders as he may direct, and by exercising such supervision over the execution of his orders as he may prescribe."\* There are other perspectives on how the "command system" functions. In one view, the system performs seven tasks:

Sensing—finding out what is happening

Communicating information—passing information among  
subsystems

Decision-making—determining what action to take

Stabilizing—adjusting the several subsystems to a new  
situation or course of action

Communicating implementation—directing action

Coping—dealing with the unexpected

Feedback—ascertaining the results of directed action

These tasks can be aggregated into three, as follows:

Reality Testing

- Sensing
- Communicating information
- Feedback

Adapting

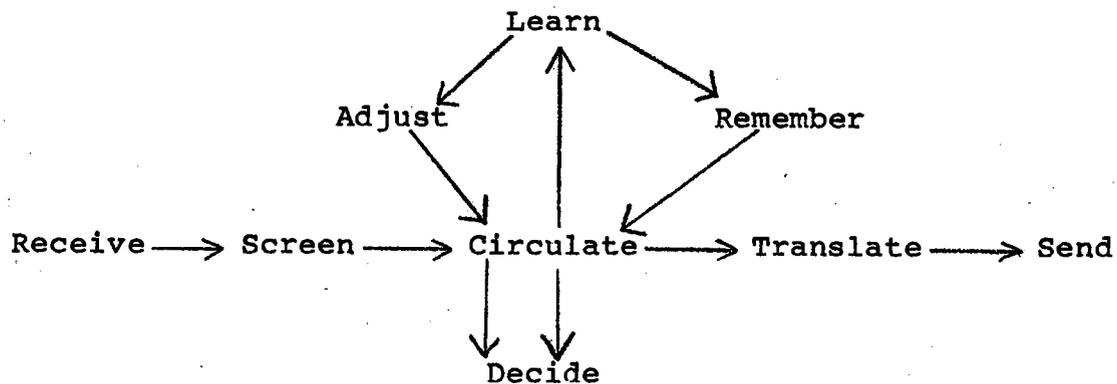
- Decision-making
- Communicating implementation
- Coping

Integrating

- Stabilizing

\* See also TRADOC Pamphlet 525-2, 20 June 1980, Tactical Command Control

From another perspective, the "command system" functions like this:



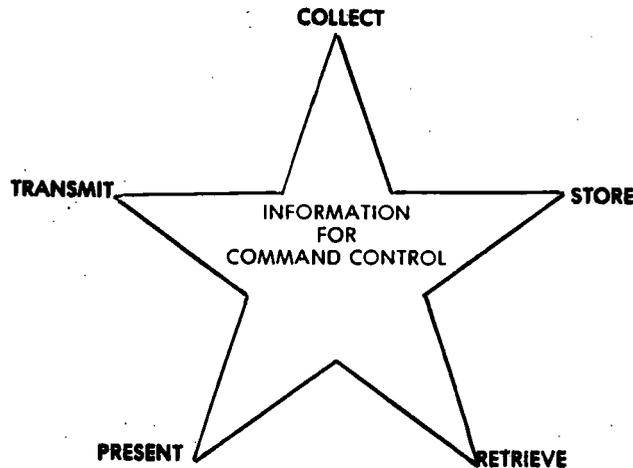
Here reality testing is described as the "receive" and "screen" modes, plus the internal communication (among subsystems) via the "circulate" mode. The "learn", "remember," "adjust", and "decide" modes are the adapting and integrating actions. "Translate" and "send" are the way decisions are communicated to those who implement, an adapting function.

These functions are all essential for the generation and direction of combat power, and are usually summed as C3 -communications, command, control. In practice, they inevitably reflect the personality of the commander, in terms of how the commander prefers his interface—an interpersonal relationship or the lack of same—or in terms of how he performs his role as the dominant judge and decision-maker. A commander who relies on his intuition, or who makes snap-judgements on fragmentary information (*a coup d'oeil*, or *mit Fingerspitzengefühlen*) cannot, or may not choose to, assimilate more information. A commander who prefers long-winded, elaborate briefings may elicit much extraneous information. C3 is then a demand - supply relationship in which the commander is the causal factor. Providing information in battle is, as we all know well, a struggle: the humans in the system tend to stop if they sense a lack of demand, or receive no feedback that information provided proved useful. Hence, even the most mechanically versatile C3 system is crucially dependent upon the ability of the commander to shape and to drive the system to inform his decisions.

#### EXPERIMENTS IN EUROPE

The experiments referred to at the beginning were conducted during scheduled CPX and FTX in 1979 and 1980. They were rather

narrowly directed at how information flows within a command post, rather than why, but they may have shed light on how to increase incentives for human C3 nodes to perform efficiently. The following construct describes the information processing for C3 in the experiment:



(1) To collect information, to bring into the command post data about the enemy, the environment, own forces, etc., either for the purpose of sensing a need for decision, or for ascertaining the results of a previous decision.

(2) To store information, since almost all inputs are relatively meaningless for decision until aggregated or collated with other information, and analyzed.

(3) To retrieve information for analysis.

(4) To present information to the commander for decision.

(5) To transmit information or a decision based thereon outside the command post to higher, lower, supporting, or supported echelons.

These five functions are not necessarily sequential. Collection, or intake, from a subordinate commander could be followed immediately by transmittal, or output, to a superior-tasks most command posts perform relatively well. Storage, retrieval, and presentation, however, are more problematic for most units, and difficulties here lead to big command posts: to compensate for awkwardness and inefficiency in these functions, staffs and subordinates have to congregate. In effect, following the usual practice, units

habitually store information between the ears of officers and NCOs, or on an acetate overlay with grease pencil. The commander "retrieves" by sending for the Ops Officer, the G-4, or whomever, and that information-bearer "presents" information by confronting the commander directly, orally and visually by chart, overlay, or message form. The archetype of this methodology is the "commander's briefing," which in most divisions is the staff's diurnal flowering, its show-and-tell for the commander.

Of all the evil habits etched on the Army's consciousness by the Viet Nam years, that of the scheduled briefing is one of the more debilitating. Late in the war, in one putatively light division of I Corps Tactical Zone, the daily briefing had become high theater--in a huge, bunkered amphitheater, on a stage under spotlights, each event of the day was chronicled by a Greek chorus of briefers, crisp alike in speech, pointer technique, and movement. These strutting and fretting young officers had no other duties: each day they would retrieve information collected and stored for them by operations duty officers and NCOs, and rehearse their presentation. When the overture began (scraping chairs and a mounting buzz of conversation among arriving divisional dignitaries), each would strip, mount a chair, step down into fresh-starched trousers so as to leave knife-edge creases intact, button on a matching board-starched shirt, nervously flex his telescoping pointer a time or two, and, in turn, stride into his performance, exuding professional aplomb. Of course, these briefings served a very useful function, presenting to key leaders and staffers salient information on the division's situation--enemy, own forces, logistics, personnel, and communications--and permitting all present to share the commander's reaction to same--in itself, not infrequently a dramatic performance. The latter often culminated in stormy guidance for staff planning, orders for subordinates, or instructions on requests to "higher." But however useful such an information processing procedure may have been in the context of war afoot in the jungle, it is dysfunctional for combat between mobile, mounted formations where fire, maneuver, and EW capabilities on both sides presage a fluidity and pace for which such infrequent reality testing, adapting, and integrating would be utterly inadequate. Moreover, the assembling of key auditors would induce grave vulnerability for the division as a whole.\*

\* If these were the only prices the briefing charade extorts for effective C3, the practice would be too expensive. But it usually also induces bad staffing: principal staff officers develop Pavlovian responses to the briefing event, and tailor their work for the grand finale, regardless of the actual flow of battle. Too, the commander may be misinformed by the neatness and polish.

Therefore, as a matter of urgency, we must outlaw the large-congregation "commander's briefing," do away with the practice altogether.

Some armored/mechanized commanders have chosen to command from the Operations van of their Division Tactical Operations Center -- the DTOC's "pit," the tumultuous center of its activities. The commander is "forward" vicariously, for amid the ringing phones, barking radios, and shouts, the hustling and bustling of watch officers and NCOs, he can "sense" excitement, even get a "feel" of battle. But the practice has the grave disadvantage of mutual interference between commander and staff. When combined with the periodic briefing, it assures that the commander cycles between information too structured, and information totally unstructured.

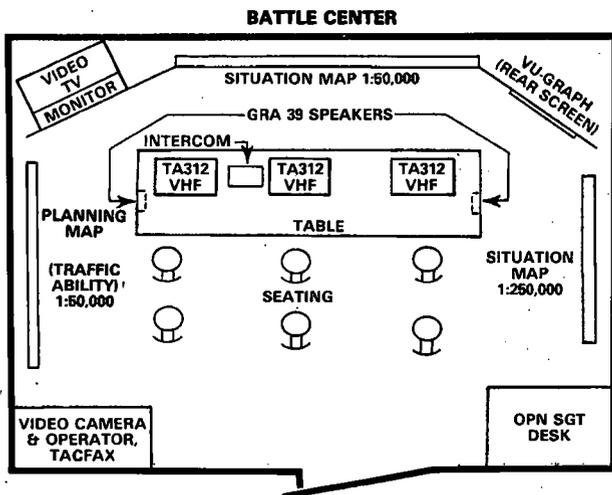
### The Battle Center

But what can take the place of such practices? Suppose that a commander could bring together his key staffers and subordinates for a real-time exchange of information and decisions at any moment during the 24 hour day without their leaving their place of duty? The CP experiment mentioned at the outset demonstrated that a corps or division commander can be provided with a facility--the division in Europe labeled it a Battle Center\*--in which he could call for staff briefings on demand, and from whence he could talk to key subordinates afield, or interact with his staff for estimates of the situation, or for issuance of planning guidance or instructions. In the European experiment, the divisional signal battalion, in addition to its customary intra-headquarters telephones, provided staff vans with television cameras and monitors, and facsimile transmitters. Additionally, millimeter wave radios, broad-band line-of-sight carriers of both multichannel VHF and the video signals, were used to separate physically key command post elements some 3 to 5 kilometers, eliminating cables. Thus equipped, the Battle Center--a single expando-van truck--no longer had to be in the same location as radiating antennae, and could, in fact, operate quite on its own, since it was used only by the Command Group and two or three Operations Sergeants. For information processing, these communications means were interrelated as follows:

\* This could be the "battle coordination team" in TRADOC Pam 525-2, p.10, that: "...continuously analyzes the operation: coordinates intelligence collection efforts against enemy forces in the division area of influence and interest; and develops courses of action which provide for interdiction, deception, and repositioning of forces, reallocation of logistical support, and offensive action..."

Function	A. FM/VHF/TWX	B. Facsimile	C. Television	D. Millimeter Wave Radio
Collect	•	•		
Store		•	•	•
Retrieve		•	•	•
Present		•	•	
Transmit	•	•		

Information input and output were facilitated by adding the usual radio linkages (A), tactical facsimile devices (B) capable of sending or any divisional land line or radio carrier, fully encrypted, a monochromatic 8 1/2" x 14" chart or diagram in about 2 minutes. Statistical data and periodic summary reports were stored, kept current in staff sections in the 8 1/2" X 14" format, so that they could readily be transmitted by facsimile. For retrieval, circulation to the Battle Center or among staff sections, the same 8 1/2" X 14" format could be set in front of a television camera (C); alternatively, the camera could be trained on a map or other display. A videotape recorder permitted audio and visual storing of important transactions with the commander. Hence, television (C) served commander or staff officer alike as a means for both retrieving and presenting information stored anywhere in the command post, elements of which could be physically dispersed via substituting mm-wave radio (D) for the usual cables.



The Battle Center, one van, was laid out like this, with the "decision graphics" posted on the 1:50,000 map to the front of the commander's table, and a video monitor immediately to its left. The table had inset telephones and speakers for audio communications, either internal or external.

The "tacfax" or tactical facsimile employed was the AN/GXC 7A, with these characteristics:

TACFAX

Size 19.6" X 16.9" x 7.9"

Weight 47 lbs

Power 115/230 VRMS, 50 watts

Paper size 8 1/2" X 14"

Printing 8 shades grey or B&W; hard copy or transparency

Speed was a function of the encryption equipment used and desired definition:

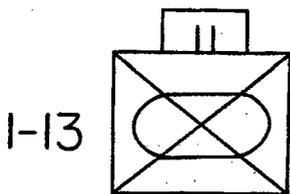
**TACFAX AN/GXC-7A OPERATING CHARACTERISTICS**

COMMUNICATIONS CIRCUIT		CONNECTION	INTERFACE	COPYTIME MINUTES (FULL PAGE)	GRAY SHADES
	FIELD WIRE	WD-1	TA-312	4.6	8
	PHONE NETWORK	AUTOVON DDD	ACOUSTIC COUPLER	4.6	8
	VHF	VOICE	AN/VRC-12	4.6	8
		X-MODE	AN/PRC-77	2.3	
	VHF RADIO SECURE	X-MODE (WIDE BAND)	KY-8/28/38 KY-57 AN.VRC-12 AN/PRC-77	4.6	BLACK AND WHITE
			KY-57	2.3	
	HF RADIO	VOICE	AN/GRC-106	4.6	8
	HF RADIO SECURE	VOICE	KG-30 MODEM AN/GRC-16	4.6	BLACK AND WHITE
	MULTI CHANNL SECURE	WIRE (VOICE)	KG-27 AN/TRC-145	4.6	8
DIGITAL	MIL-STD 188 CIRCUITS	2400 BPS	4.6	BLACK AND WHITE	
		4800 BPS	2.3		

Note that with the VHF 2 minute copy times for a full page of black/white are possible. A sketch, diagram, or report arriving in the Battle Center could be handed to the commander in hard copy, or, as a transparency, be displayed to the right front of the commander's table.

## Decision Graphics

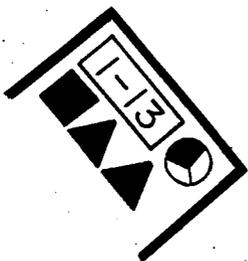
Presentation via TV proved challenging. The color television equipment—ordinary, relatively inexpensive commercial gear—could not transmit in enough definition the detail, clutter, and reflections of the usual maps and acetate overlays posted in grease-pencil with standard signs and symbols. But it proved possible to simplify and emphasize for the TV's eye: to layer-tint or color-contour the macro-relief of terrain, inter-visibility, or trafficability on the maps, and to post the situation in a symbology equally prominent. And these steps together turned out to be important to the commander's eye as well, so useful that they were termed "decision graphics"—a vivid depiction of most tactically relevant aspects of the terrain plus a bold portrayal of both friendly and enemy situations. The non-standard symbology not only simplified the map visually, but also conveyed more commander level information at a glance. Thus, the standard symbol for a mechanized battalion task force designed for an era with more time and less demand for information, looks like this:



Standard  
Symbol

Note that one cannot tell whether the unit is attacking or defending, how much armor is present, how many teams it disposes of, or what its effectiveness overall may be.

A "decision graphic" provides all such information; here is a "stick on" symbol for the same task force:

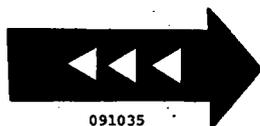


Decision  
Graphic

The symbol depicts a defending task force and its orientation and center of mass, identifies the parent headquarters, shows a task organization of two tank teams and one mechanized infantry team, and indicates (pie chart) the commander's estimate that, while he has taken losses, he can still accomplish mission.

Here are some other examples:

Tank regiment advancing



Depleted tank regiment advancing



Motorized rifle regiment advancing



Infantry task force  
defending. Two mech  
inf teams, one armor  
team. Task force fully  
capable of mission.



Armor task force  
defending. Two tank  
teams, one cav troop,  
one mech inf team. TF  
depleted but capable  
of mission.



### TACFAX Reports

Reproduced below are examples of formatted reports transmitted by TACFAX. First, the twice daily Commander's Situation Report (SITREP) which accounts for task organization and major weapon systems, and gives each commander's evaluation of effectiveness. The effectiveness reports are recorded as dots under the "Cdrs Eval" (Commanders Evaluation), and "E" columns for each major weapon system, a judgemental scale in which a code of one to 3 dots is a scale of difficulty in performing mission (corresponds to the "pie-chart" on Decision Graphics):

CDR. EVAL & CODE	DECISION GRAPHIC	COMMANDERS ASSESSMENT.
		OF ABILITY TO PERFORM MISSION
		"NO PROBLEM"
•		"SOME DIFFICULTY"
••		"MAJOR PROBLEMS"
•••		"CAN'T"

Note that the SITREP "location" indicates center of mass of each unit, and shows principal weapons on hand "OH" compared to TO&E "B" (for base). The second report, Battle Summary (BATSUM) is sent on demand.

COMMANDERS SITUATION REPORT															
UNIT	MSC	TASK ORG			LOCATION	CDRS EVAL	TANKS			TOWS			SQUADS		
		M	T	C			OH	B	E	OH	B	E	OH	B	E
TF 1-13	2D BDE	2	1		ND 3386		16	17		19	20		17	18	
TF 2-13	3D BDE	2	1		ND 3799		13	17		15	20		18	18	
TF 1-39	2D BDE	2	1		ND 3581		9	17		11	20		17	18	
TF 2-28	1ST BDE	2	1		ND 3170		16	17		20	20		17	18	
TF 1-87	2D BDE	2	1		ND 3585		17	17		20	20		18	18	
TF 2-87	1ST BDE	2	1		ND 3177		9	17		17	20		19	18	
TF 1-68	2D BDE	1	2		ND 3280		24	37		6	6		9	9	
TF 2-68	2D BDE	1	2		ND 3078		28	37		5	6		9	9	
TF 3-68	3D BDE	1	2		ND 3375		35	37		5	6		9	9	
TF 5-68	3D BDE	1	2		ND 3490		24	37		5	6		9	9	
TF 4-69	1ST BDE	1	2		ND 3373		34	37		6	6		9	9	
TF 3-8	3D BDE	1		4	NE 3503		43	45		16	18		14	16	
UNIT	2-20	2-81	1-83	3-16	1-333										
OH	18	9	17	10	6										
BASE	18	18	18	12	6										
EVAL		0	0	0											
COMMAND POST LOCATIONS															
UNIT	MAIN	TAC	UNIT	MAIN	TAC										
V CORPS	ME 7523	NE 1015	DIVAR	MD 9783											
2 ID	MD 9591	ND 0587	DISCOM	MD 9179											
1ST BDE	MD 9968	ND 1170													
2D BDE	ND 0281	ND 1779													
3D BDE	ND 0590	ND 2299													
TACTICAL AIR SORTIES															
UNIT	OH	BASE	EVAL	TIME PERIOD	ALLOCATION	FLOW									
	10	21	0	0300-0600	10	5									
				0600-0900	15	17									
				0900-1200	20	18									
				1200-1500	30	18									
				1500-1800	20	20									
				1800-2300	10	3									
				2300-0300	10	1									
NUCLEAR															
<input type="radio"/> HOLD	<input type="radio"/> SR	<input type="radio"/> SR													
155 RDS: 36	8" (S) RDS: 12	8" (L) RDS: 6													
CHEMICAL															
<input type="radio"/> HOLD	<input type="radio"/> SR	<input type="radio"/> SR													
VX RDS: NONE	GB RDS: NONE														
TIME PREPARED															

## BATTLE SUMMARY

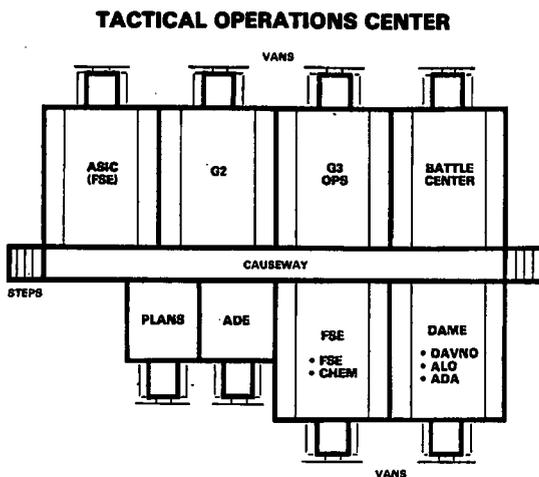
ENEMY SITUATION: <i>Enemy Continues Attack With Regiment + IN The 1st BDE Sector</i>		
FRIENDLY SITUATION: <i>Division Continues To Defend Along Pk Apple TF 2-28 Attached To 1st BDE EFF 0600Z</i>		
UNIT	LOCATION	SITUATION
1ST BDE		As Above
TF 2-28	ND 3170	
TF 2-87	ND 3177	
TF 4-69	ND 3379	
2ND BDE		No Contact Since 0500Z. Estimated Battalion Size Unit Moving Southeast Along Hwy 203 Via ND 274906
TF 1-13	ND 3386	
TF 1-39	ND 3581	
TF 1-87	ND 3585	
TF 1-68	ND 3280	
TF 2-68	ND 3078	
3RD BDE		No Contact Since 0200Z. TF 2-13 And TF 5-68 Below 50% Strength
TF 2-13	ND 3799	
TF 3-68	ND 3375	
TF 5-68	ND 3490	
TF 3-8	NE 3503	
DIVARTY	NVC; SR CHEM; HOLD	
3 CAB	CRITICAL Shortage OF TOW ROUNDS	
TAC AIR	0600-0900 HRS; 15 SORTIES 0900-1200 HRS; 20 SORTIES	
8TH ENGRS	PRIORITY TO REPAIR OF MSR	

Reports such as the foregoing, like Decision Graphics, are not doctrinal: they are non-standard, not enshrined in Field Manuals or taught in schools. But they proved to be easy to teach, and very easy to use. In short the Battle Center system seemed a culturally relevant way for soldiers to communicate, exploiting our strong ideographic propensity, and eliminating much alphanumeric copying which is always error-prone. (These observations may point to a solution to the problems which computer-based systems have encountered at the human-machine interface.)

Intra-CP communications used cable and the Norden millimeter-wave communicator, a solid-state transceiver about 5" X 5" X 9", weighing 5 pounds with batteries, the latter good for 15-20 hours of continuous operation (it could also operate from 12 volt vehicle systems, drawing 6 watts). Tripod-mounted, highly-directional pairs of these could pass VHF and full-color video signals up to 3 miles, line-of-sight range. These links eliminated cable, made fast displacement more achievable, and provided line-of-sight security.

### CP Configurations

In the simplest configuration the Battle Center was appended to the Tactical Operation Center, as shown below:



Here, the Battle Center served to permit briefing on demand, to obviate large-gathering briefings, and to provide the CG, or the officer acting for him, with a quiet place to think, to plan, or to communicate. In effect, the Battle Center became the "bridge," where the CG could keep an eye on progress, issuing orders as appropriate, isolated from the engine-room-like noise and confusion in other TOC vans.

For the staffers, the TV distribution system offered the major advantage of their being able to monitor exactly what the commander is dealing with, to anticipate tasks, and to interact with him as necessary. Staff awareness, intra-staff communication, and staffer interest went up—participatory management increased, and the training value of any experience heightened. This turned out to be a useful way to break-in the overall concept, to train commanders and staff alike, weaning them from scheduled briefings, and teaching them how fast-breaking battles ought to be managed.

One division staff officer noted that the system also solved some of the more acute problem of displacing the Main CP. "When the \_\_\_\_\_ division sent 60+ helicopters toward the Main CP during Reforger'7\_\_\_\_, the G-staff was required to relocate quickly. The TAC CP was up and operating, but the key staff arrived at the TAC with different versions of the battle. With TV in the Main CP, the CG could have announced to all: 'I am moving to the TAC. Helicopters at the pad in 05. TAC Team join me. Chief of Staff move the Main to the designated alternate.' Everyone aboard that helicopter would have been on the same sheet of music. TV has great potential for lending sanity to such usually frenetic moments in the life of Headquarters Commandants, NCOIC, and the like."

At the USAREUR Communication-Electronics Conference of November 1979, the division Signal Officer who had been participating in the experiment reported to communicator colleagues as follows:

"[In re TACFAX]

-The device not only works, it works well! It not only works well, it tends to revolutionize procedures within the DTOC and CP's.

-Commanders and their staffs almost immediately recognized the advantages and changed their way of doing business - for the better - to take advantage of this capability.

-Handwritten orders, assessments, reports, sketches, quickly became the accepted method.

"Tactical facsimile is a Godsend because it provides a quantum increase in responsiveness that is immediately evident to the user - at long last we've provided an improvement over the message center/commcenter maze and it isn't buried in the middle of an automated system - it's literally up front, sitting on the G-3's desk, operated by G-3 personnel and all this without a selling job - it sold itself, immediately!

"Admittedly our experience has been somewhat limited by numbers of devices and to multichannel operation. We've primarily used the tactical facsimile between the major headquarters of the division. For example, the Division TAC CP is on radio listening silence except for a single AN/TRC-145 shot - the facsimile operates on one channel of this shot - secure - continuously providing detailed updates to the TAC CP, - insuring that the TAC CP has identical information to that held at Division Main so that it can take OPCON without missing a beat.

"Throughout the division, new reports and displays have been designed because of tactical facsimile. Its value is clearly recognized by all and it drives operational changes.

"My biggest problem with tactical facsimile is not having enough.

"It is transportable, relatively simple, operates on a variety of power sources, takes virtually any combination of paper/carbon - I need more just as soon as I can get my hands on them.

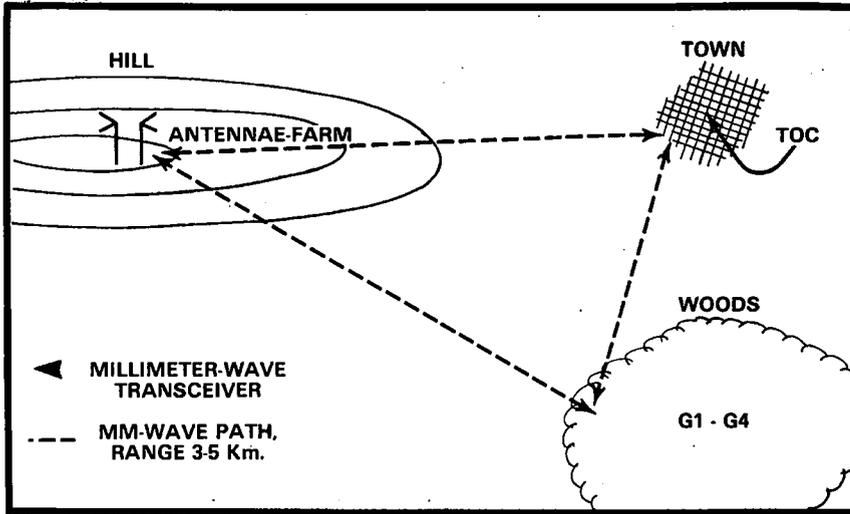
"The TV receivers in each staff section display the CG's battle map. Staff sections can immediately see new information, correct erroneous information and keep abreast of the entire current situation.

"The scanning, display, presentation and assimilation of information is a continuous process within the DTOC and rarely are special charts or formal briefings required.

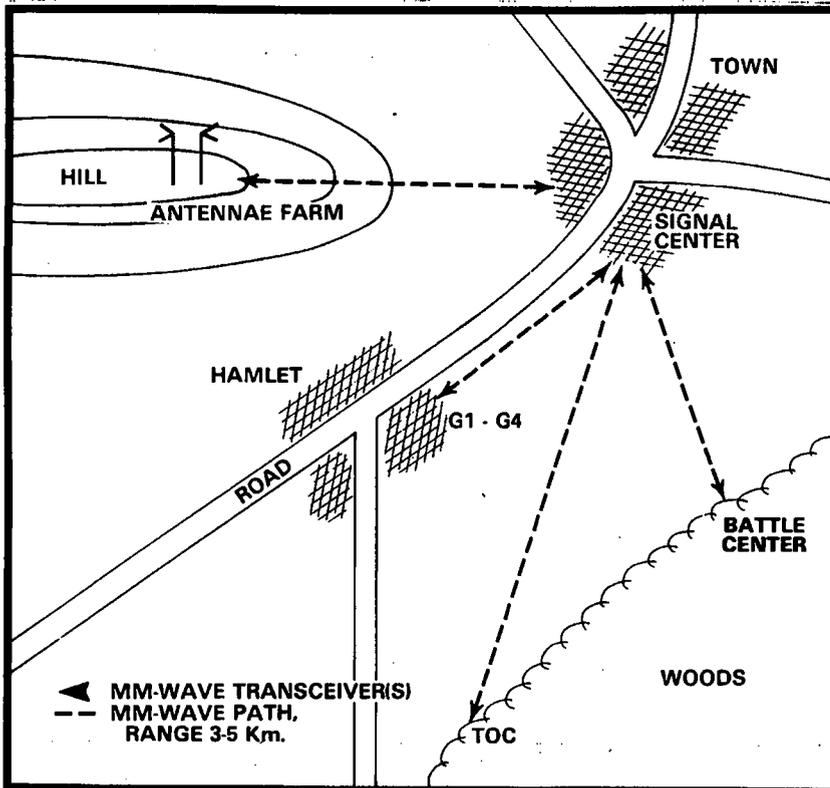
"The combination of TV and facsimile gives another distribution means that, as much as possible, are compatible and efficient. The use of standard information displays, their availability to all on a continuous basis and the ability to reproduce/transmit the displays via facsimile add tremendously to the entire communications process - we literally operate off the same sheet of music. Communications is not an afterthought, an adjunct - it's totally and continuously imbedded in the command and control apparatus."

"We have had the millimeter wave radio for only short period of time and comparatively little work has been done with it, but we have done enough to recognize that it has tremendous potential - particularly for what is referred to as "down the hill" applications. This radio is a broadband, line of sight radio that operates at extremely high frequencies. It has a limited range, but within that range it has the capability of extending up to 100 voice channels using our conventional PCM multiplexing equipment. Since the radio can also be used in conjunction with our normal multichannel secure equipment, we can establish our communications nodal on a hilltop, offset our CP down in a more protected area (EW as well as physical) and then relay our command control circuitry via the millimeter wave radio instead of by conventional, time consuming cable runs. We used these radios on a operational system in NATO FTX CONSTANT ENFORCER (Fall, 1979) and it performed excellently on a continuous basis during an 8 day period. We have also passed color TV over the system with good results. We definitely need an alterna-

tive to the present cable capability and the millimeter wave radio looks extremely promising."



The "down the hill" application referred to locating the antennae farm ("communications nodal") apart from the rest of the CP, perhaps as shown (left).



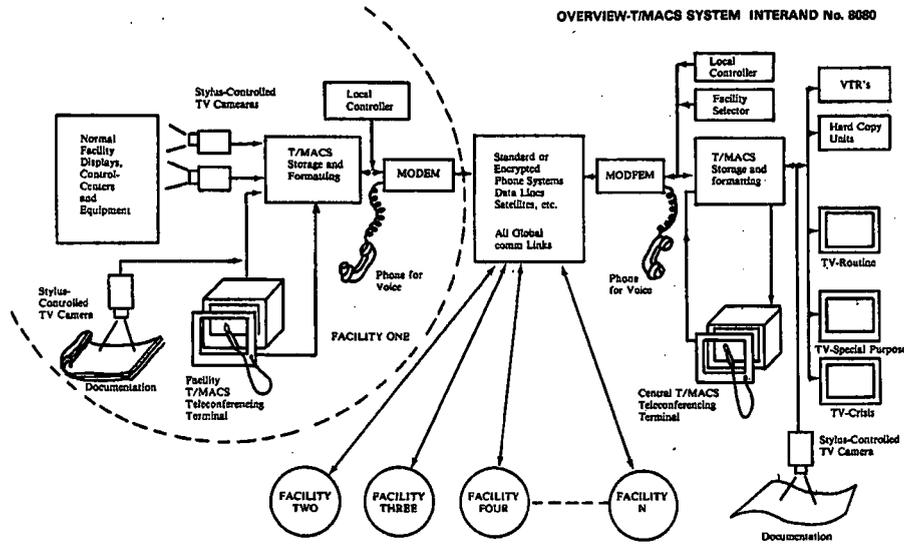
But it would be possible, given enough of the millimeter wave radios, and training for users, to disperse CP elements even further, perhaps like this (left).

Once it becomes possible to pass video signals over the long-range communications system - the VHF- the Battle Center can be detached from the DTOC

to serve a division commander forward as his TAC CP, and provide him the same rich information he would have at his disposal at his Main CP.

It does appear feasible, with special TV equipment (e.g., band-

width compression, or slow scan) to extend the video-links outside the CP over VHF, so as to supplement communications with subordinate, superior, or flank commanders. A slow-scan TV system, now commercially available, could send images via the existing encrypted voice-grade channels. Moreover, one version of such equipment would permit drawing or sketching directly onto the televised image while conversing, the added graphics being instantly visible to both sender and receiver(s). Here, for example, is a diagram of teleconferencing equipment assembled by the INTERAND Corporation called T/MACS (Telestrator Monitoring, Assessment and Consultation System):



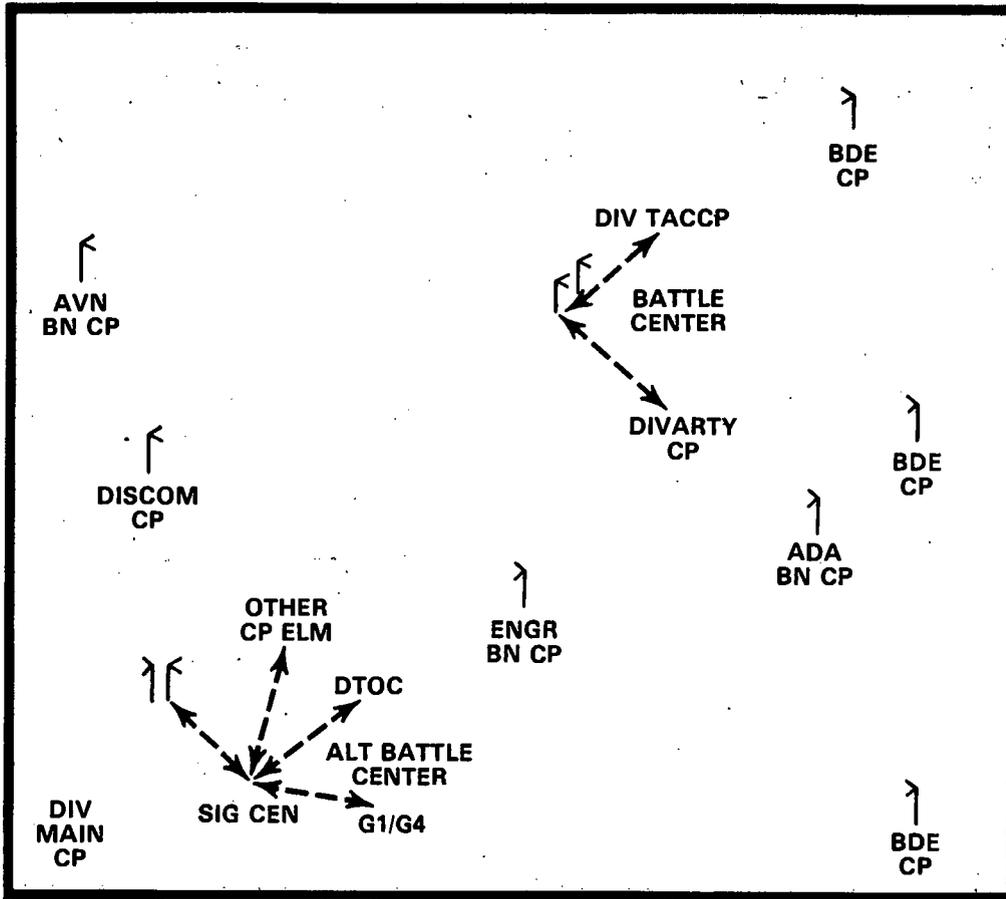
This version has features not necessary for a TOC or Battle Center, such as the stylus-controlled TV cameras, but having seen it working over commercial telephone lines, I am persuaded such interactive-graphics for teleconferencing would be a powerful adjunct to military field com-

munications. Moreover, it is potentially cheap and rugged. With such equipment, it would be possible to position the Battle Center at the TAC CP, tied 24 hours per day into the Main as though collocated with the DTOC. But the commander could, at will, tie into the Battle Center-DTOC "conference" any or all of the command posts shown in the diagram on the page 20.

At a minimum, even without band-width compression for video transmission, each of the CP's could be equipped with a video-disc playback device. Each disc can store up to 56,000 maps, each individually indexed. The transmitting headquarters could index the map display, and, with a T/MACS graphic transmitter, provide graphic overlay information through existing voice circuits, either VHF or FM.

The Army has been waiting a decade for the "automated battlefield," those ADP systems such as TDS, TACFIRE, and BETA which would interact with the commander to insure his communications, his command, his control. But TOS, the "executive system," will not be available for years. It is hard, in the absence of experience, to

argue that such computers will not help C3. But it is possible to state that the manual, video-aided information processing system such as described above might do much of the job we hoped TOS could. Interfaced with TACFIRE, BETA, or even mini computer assisted subsystems, the Battle Center system could enable us to spread out, build our resilience for electronic warfare, and permit commanders to use their combat power to better advantage.



**DIVISION ZONE WITH VIDEO-CONFERRING VIA VHF  
BATTLE CENTER AT TAC CP**

## Propositions

In summary, my experiences lead me to advance these four propositions:

1. TV and TACFAX, supplemented with interactive graphics, are communication devices which:

- Use existing radio and encryption gear.
- Facilitate graphic-supported teleconferencing.
- Are culturally relevant: any general, colonel, captain or sergeant easily adapts to using them.
- Can be purchased and fielded in the near future.

2. Command posts can be dispersed, and with the full suite of such equipment, a TAC CP for a commander operating forward could have all the information available in the Battle Center at Main.

3. Video-conferencing and TACFAX obviate many frequent serious errors introduced by translating map locations into alphanumeric for transmission, and retranslation into a mapped presentation at the other end. Moreover, they free commanders of the tyranny of the Message Center.

4. Whether or not the Army moves to TOS, TACFIRE, or other central processors, a system like that described above would enhance C3I, making command control relatively invulnerable, and more graceful in degradation.

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