B45

TOWARD A COMBINED ARMS TRAINING CENTER

Speech by MG Paul F. Gorman, DCST, HQ TRADOC, to the PM,
ARTADS - TRADOC Conference, Fort Monmouth, NJ,
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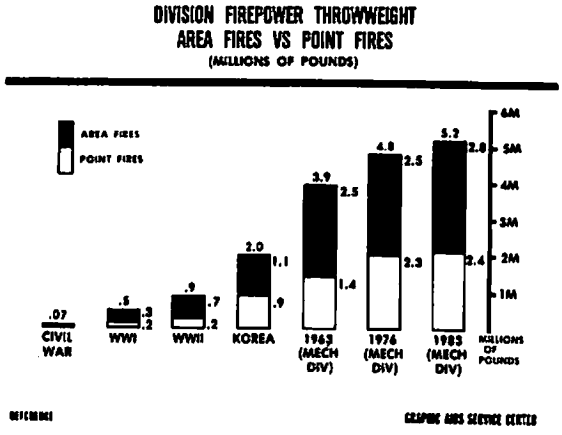
At Fort Hood, Texas, III Corps expressed a requirement for the acquisition of 55,000 additional acres of land for training purposes. Fort Carson, Colorado, has expressed a requirement for the acquisition of 200,000 additional acres of land. Fort Lewis, Washington, has expressed an interest in acquiring more land. Similarly, so has Fort Riley, Kansas. These proposed land acquisitions, at present prices, total some 2 billion dollars worth of real estate.

The Army has been directed by the Secretary to prepare its land acquisition case for 1979. The DCSOPS of the Army has tasked the Training and Doctrine Command to advise him on what the requirements for land for training really ought to be - to articulate to some extent what it is that we should have in the inventory by way of land. I want to show you some of the dimensions of that problem. Then I want to show you what the Air Force came to as it considered problems of training management in the modern era, and then finally conclude by showing you what I infer from all the foregoing as it bears on our common purposes here today.

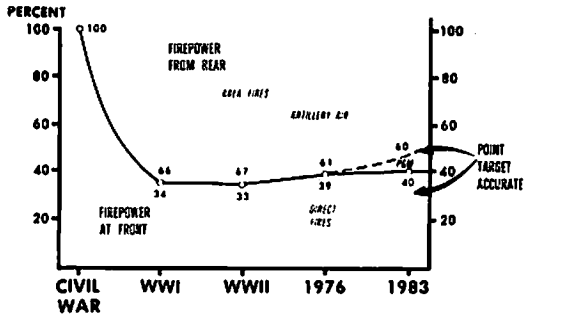
The Impact of Changes in Weaponry



Let's start with weaponry. This is a display of the amount of munitions that a US Army Division can deliver in 30 minutes. It represents, as you can see, a very substantial growth from World War II era to the present.

Another way of looking at the problem is to ask yourself how much firepower originates from the rear versus the amount which originates at the front.

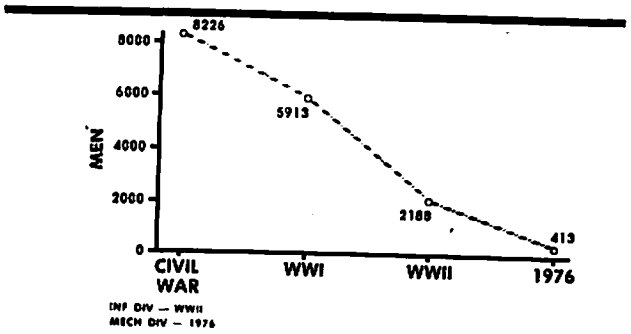
FIREPOWER TRENDS DIVISION



As you can see, from the Civil War era to World Wars I and II, there was a substantial shift in focus of the origins of firepower. There has been, moreover, since World War II, an upward trend in firepower available from the rear. These areas at the right indicate that fires are now pinpoint accurate whether originating from the rear or from the front - referring, of course, to precision guided munitions, such projectiles as cannon launched guided projectiles. Those trends are going to continue. The major impact of these three considerations: (1) the amount of munitions that can be delivered in a given period of time, (2) the fact that they can be delivered from the rear, and (3) the fact that they can be delivered with pinpoint accuracy has had this kind of an effect on tactics.

Changing Tactics

MEN PER KILOMETER OF FRONT DIVISION

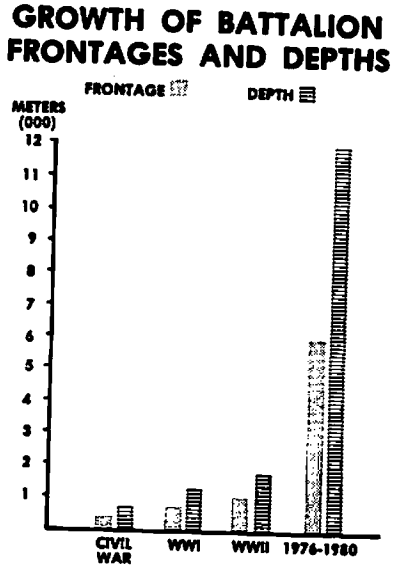


Now, it is the American military tradition to substitute machines for men at hazard in war wherever we can. Obviously, operating men forward under increasing amounts of "throw weight" means you are simply putting men at ever greater hazard. The result has been a search for tactics which depend on less and less people up there in the forward area--divisions have had to spread out. That's what I mean when I talk about the "spread of battle." The density of men is significantly lower now than it has ever been before. This means that it takes more room to deploy divisions, or that a division covers more ground.

Land Areas Needed for Training

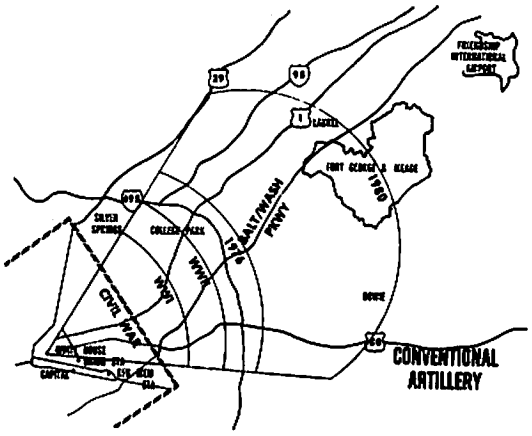
The Army has failed to articulate to Congress a clear concept of how it wants to train. An Army should train the way it fights. In the Civil War, when you wanted to train, you in effect staged a parade. You got a parade ground or a cleared field. You practiced marching onto the parade ground in column, and then deploying from column to line, putting out your skirmishers, advancing, and going through the motions of firing, and then delivering a bayonet attack. That's the way you trained for war. In World War I when the 1st Division practiced for going into combat, that entire division, then some 28,000 strong, was able to conduct its training in an area that was two kilometers by three kilometers. They actually dug trenches, and practiced the business of relieving units in the line, going over the top, etc. As we got into World War II, we began to find that the divisions needed a lot more room to train in. We practiced for a war of movement. As you know, in some of the maneuvers that we conducted preliminary to deployment, we used whole states--the Louisiana maneuvers, the Carolina maneuvers, etc. Whole portions of states were used to support training.

Today we find outselves pretty well confined to division posts with limited maneuver areas. In the meantime, the maneuver areas at the division post have had to accommodate rehearsals for battle with this increasingly more capable weaponry at our disposal. Here is a depiction of what has been happening to the battalion frontages and depths.



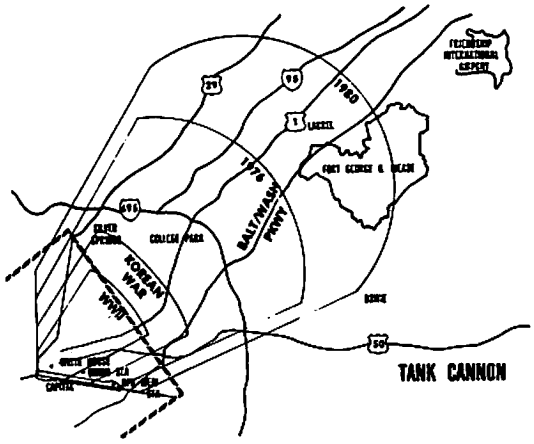
This is not understood in the Congress. What we expected of battalions in World War II is substantially less than we expect of battalions today. These depths and frontages are the depths and frontages of maneuver battalions in Europe today. They are the frontages and the depths in which they would actually do their fighting. If we are going to practice back in the United States to do this sort of thing in Europe, we really need a lot of land, and that need for land is increasingly in competition with the weapons systems.

Developments in Artillery and Tank Cannon

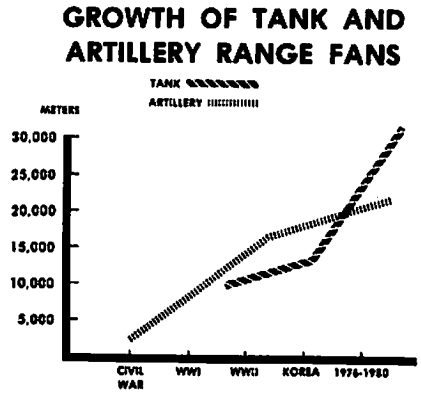


This is the amount of land that you would have needed to shoot artillery safely in the Civil War. There is what you would have needed to shoot artillery safely in World War I and World War II, or today. In 1980, when we go to rocket assisted rounds, we are going to need a lot more room. We will need it too for HELLFIRE, and other kinds of airborne missiles. That's one way of looking at it.

An equally impressive growth in land requirements to support shooting occured in tank cannon technology starting back in World War II, in the Korean War tank, when we went from the 76mm, the 90mm, and up to the present 105mm in 1976. The last line represents the safety fan required for the Mark 735 round, which is the 1978 tank cannon round. It will need a lot of land.



To show these trends graphically, this is what they look like.



Everything we know about the way technology is developing tells us that we are going to need more and more land in order to fire our weapons. And, if confined to present reservations, to do that shooting we will have to consider the sacrificing of some maneuver land.

USAF Training

Now, in the process of trying to figure out what to do about all that, we ran across the fact that the Air Force had confronted many of the same problems. I think all of us have an appreciation of the fact that the Air Force has a problem in three dimensions when it practices air combat, but not many of us understand that they have an acute real estate problem. They just can't take any hunk of air and go practice in it. They have to have the ground cleared underneath as well, and there are relatively few places in the US where they can practice air to air combat, or air to ground combat the way they want to. Their training problem has been further compounded by the domination of air combat by electronic warfare weapons, which has made ECM, or electronic countermeasures, a part and parcel of everything that the Air Force does. So it's not only land or space, ocean or surface space, with a volume of air over it that they require; they have to be in an environment where they can employ very powerful jammers and emitters of one kind or another without interfering with the civil airways, the Federal Communications Commissions' undertakings, or otherwise interfering with telephone, radio, television, etc.

The Tactical Air Force will tell you that their training management evolved in this fashion:

EVOLUTION OF TRAINING MANAGEMENT

USAF	US ARMY
Flying hour program	Army Training Program (ATP)
Specified Events	Army Training Tests (ATT)
Unit D.O.C.	ARTEP
Agressor Squadrons	OPFOR Units
Multi Threat Ranges (RED FLAG)	REALTRAIN, MILES

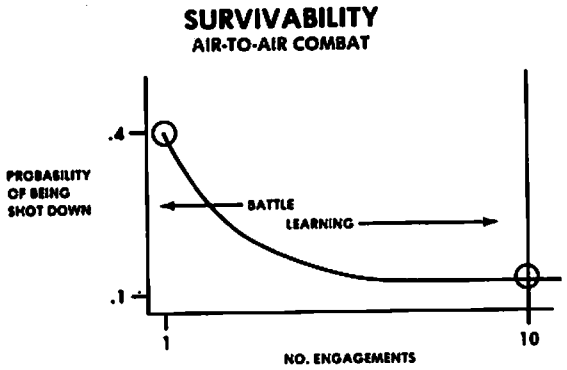
Some years ago they managed training, as we used to manage training, by flying hours. Every pilot was supposed to drill holes in the air for a certain number of hours a year. Then they discovered maybe it would be better if they said "everybody's got to go do certain kinds of bombings, to certain specified standards, e.g., you have to drop two 750 lb. bombs and achieve a CEP of 50 meters." But, they discovered after they had gotten that system installed that combat in Southeast Asia dictated a whole squadron's involvement in just getting a few bombs delivered. When you go

after a bridge for example, some planes have to drop bombs on the bridge, but others have to take care of suppressing the flack, others have got to fly high cover CAP, others have to be there for the search and air rescue. So they went to something that they called a "Unit Desired Operational Capability"--D.O.C.--which was an expression of what the whole outfit had to be able to do with all of its bit performances in there--what do you do when you're bombing, what do you do when you're flying CAP, etc. They then evolved the notion that in order to practice D.O.C. right, they should do it against opposition. So, in 1974, they activated Agressor Squadrons, and equipped these squadrons with aircraft that resembled the Russian MIGs, trained the pilots in the aircraft to fly like Russians, and began to require units that were training toward their D.O.C. to fly against these agressor pilots. Then in the final step of their evolution of training management, they went to what they call Multi-Threat Ranges. There is only one of them in existence at the present--in Nevada--but they are looking to build additional ones.

We must appreciate that when the Air Force explains this, what they are talking about is an attempt to create as closely as possible the combat environment within which their pilots are going to have to fly. As the pilot approaches enemy territory his sensors will tell him that he is being swept by the detection radar, and then he will be picked up by acquisition radars for the SAMs. Then he will begin to get radar emissions from gun systems and other threats. In each instance, he has to use his counter-measures. In all cases he is under the threat of attack by other aircraft in the sky from the Agressor Squadron. The Multi-Threat Range then, is an attempt to require squadrons to run missions against the full panoply of threat that they would encounter if they were actually doing this for real.

Now it is of interest that Army training management has been following a parallel, if following, path--flying hours is the equivalent of the old Army Training Program--18 hours for the platoon in the attack, etc. The ATT corresponds pretty well to the "specific events" approach. The Army Training Evaluation Program is a good correlate to the unit DOC. We have already gone to the establishment of OPFOR units, but in this case, we've done this in a very haltering, penny-ante way and, in my view, we are a light year behind the Air Force. But, it is interesting that we have already begun to do this. And as far as Multi-Threat Ranges are concerned, we have only a finger-edge hold on the problem. But, we are beginning to work toward it with the Multiple Integrated Laser Engagement System, and with such lower fidelity engagement simulations as REALTRAIN.

The Air Force, in explaining why they went this route, use this display. Some years ago at Litton, a fellow by the name of Weiss did a study of what he calls "bellometrics." He took the records of German World War I fighter squadrons, German World War II fighter squadrons, and American squadrons of those two wars, Korea and Vietnam, and ran an analysis of air-to-air combats. He shows figures relating to "decisive combats"--that is to say, an engagement in which somebody got shot down. There's a winner or loser. He found, looking at all of those wars, and all of those statistics, that a curve emerged that looks like this:

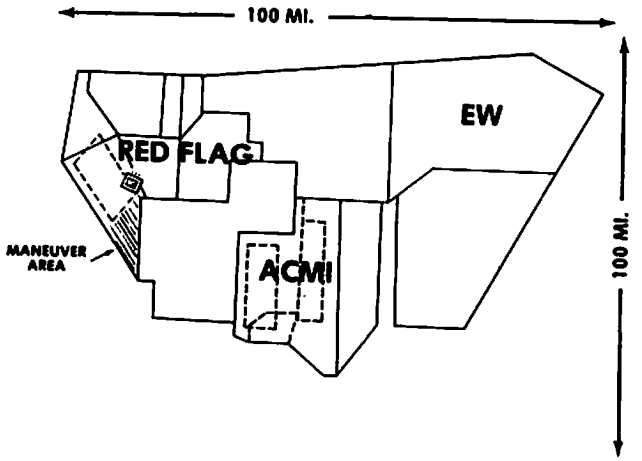


It's remarkably similar for all wars, whether it's German or American. In a pilot's first air-to-air combat, his probability of being shot down is about .4. In subsequent combats, that probability decreases until in the 10th such decisive combat, the probability is down around .1. Now you can draw two inferences from that depiction. You can say either that there is battle learning--that is to say, combat is a powerful trainer--or you could say that this is a case of survival of the fittest. The latter was Weiss' conclusion--that USAF ought to put a lot more attention into pilot selection and training before sending them up there for that first combat. The Air Force, however, says, "Look, we don't know much about pilot selection. We try like hell to do it right, but frankly, we just don't know enough about it. So the next best thing we can do is to assume that we've done all we can in the selection process, so let's turn to the learning hypothesis. If we can devise a way of permitting the pilot to fly his first ten missions in a simulated war--a reasonable approximation of the stress of combat itself--we will make available to air commanders the differential between .4 combat loss experience on first combat mission and .12--30% increase in the number of aircraft that would be available on missions two, three, and so on in actual combat."

Can they do that? There seems to be some evidence that the answer is yes. They have constructed in the Nevada Desert, near Nellis AFB, an instrumented range as they refer to it. This is their Multi-Threat Range.

You are looking at an area that's about 100 miles by 100 miles. Up in the Northeast quadrant of the range they have an EW training ground. The first time the pilot flies through there, he just watches his sensors while they alert him to what's going on. The second time through he is allowed to use his ECM equipment. Third time through they begin to try to jam him, and shoot him down with SAMS, etc. There is no place in the United States where the Air Force can practice this except out there in the Nevada Desert. You can bench test the equipment back at home station, but you can't do it in a flying environment like they are doing it here.

Once the pilots have mastered the EW environment, they are then sent down to the southcentral portion, to the Air Combat Maneuvering Instrumented (ACMI) Range. This is a marvelous kind of affair. They are using on this range a series of 12-15 ground pickup stations which are solar powered and located on top of mountains. Each participating aircraft has strapped up under its wing a pod which is simply a transponder that transmits continuously such data as how fast the aircraft is going, what altitude it is flying at, the G forces that are being exerted on it, whether it is firing or not, and other information. All of this data from the aircraft is picked up by one or more of these ground stations, and relayed to a central plotting facility at Nellis Air Force Base. The plotting facility has a number of CRT displays where the instructors sit. They can see all participants in the exercise. In the master computer, they have available computer generated imagery that can portray the aircraft as it would be seen from a variety of perspectives. The instructor can sit at the console and say, "I'd like to look at the battle from the top down," or he could say, "I want to get over on the south side and see this thing in elevation." Or he could say, "I'd like to be in the cockpit of #4" and watch the combat as that pilot sees it. They can actually punch up these different displays and score them.



Air-to-air combat today, where we are talking about missile firings, takes place in seconds. A decisive combat may be a matter of something less than a minute. It is too fast really for the human intelligence to comprehend what happened--too fast for the pilot to take it all in. But with this instrumentation, they can take that one minute's worth of human experience, and play it back for the pilot a 10th of a second at a time, critiquing him as it goes, and explaining in painstaking detail what it was that he did or didn't do. They tell me that debriefs can last from 4 to 8 hours for each engagement. Now understand that the pilot goes out there, and he is opposed, he fights, he is up against a MIG like aircraft flown by some young captain who has been trained to behave like a Soviet. There is none of this business of standing at the bar afterwards and arguing whether "you got me" or not. The machines capture the whole transaction, and unerringly determine what the probability of hit, kill, etc., would be. When the pilots complete their ACMI exercises, they are fairly competent air-to-air fighters. They know how to handle ECM or EW, and they know how to handle air-to-air combat.

Then they are required to put it all together in Red Flag exercises. Out there to the northwest of Nellis, the US Air Force has created East Germany. They have laid out the Soviet airfields in East Germany and the distances and so forth that would occur, and there are scraped out on the desert floor patterns representing the runways. There are mock-up aircraft out there in revetments. There are guns and SAMs spotted around the airfield just exactly like they are in the real thing, all with electronic emitters on them so that the electronic environment around those physical facilities is the electronic environment around the physical facilities in Germany. The pilots take off from Nellis as a squadron, and they fly the whole mission profile that they would have to fly in order to strike those airfields in Germany. They might be vectored up to somewhere around Salt Lake City, meet tankers, pick up fuel, then come on in via a route where the international border would be, and then strike an airfield. There is a simulated forward edge of the battle area, with arrays of tanks and artillery and trucks. They make good use of polyurethane foam replicas of tanks and artillery pieces, etc. There are target convoys on roads--one convoy is 17 miles long. There are railroad trains, there are industrial areas--a whole series of realistic interdiction targets. Pilots can be fragged for any of those targets, and the name of the game is to get through the opposition, and put bombs on target. They must actually go in and drop ordnance. And they can be scored on how well they do. The sensors that are on Red Flag are not as elaborate as those on the ACMI. Essentially, what they are using there is just a large FAA type radar with a huge plotting board which gives them a multicolor display of the participants, with a 90-second track behind them. They store the information just by taking a television tape of the display itself. The radar will not pick up low level participants, unlike the ACMI which will pick them up at any altitude. I don't think these planes carry transponders,

so the amount of information on what they are doing is a lot less rich than it is down at ACMI. But, you do have the performance measure of "did they get the bombs on target?" They do play air-to-air combat--they can be shot down. But again, they have a difficulty here, in that a lot of times a pilot will be "shot down" and go ahead and complete his bombing, and that tends to clutter up the exercise. But, they sort that out down in the critique area.

Again, however, the debriefs constitute the learning experience. They run a raid. They are critiqued in detail on what they did or didn't do, right, wrong, indifferent. They are then fragged for another mission, and they go out again. This sort of environment permits them to run all the sorts of combat performances that they need to rehearse. Reconnaissance aircraft can be sent in. CAP aircraft, suppressive aircraft, ECM aircraft, bombers--all can have a role. They can even do search and rescue. If a pilot gets shot down out there, then lands at Nellis, he can be picked up by a helicopter, and taken back out to be dropped in the desert where he would have gone down. Then this squadron has an air search-rescue operation to get the downed pilot out.

The TAC is convinced enough that it's on the right track to have scheduled every squadron in the Tactical Air Force to go through this drill. It's 3 weeks in length. Every squadron in the Air Force will be put through this thing once every 18 months in rotation--two squadrons at a time--and they are persuaded that they are in fact operating on that ten-mission curve that I showed you earlier.

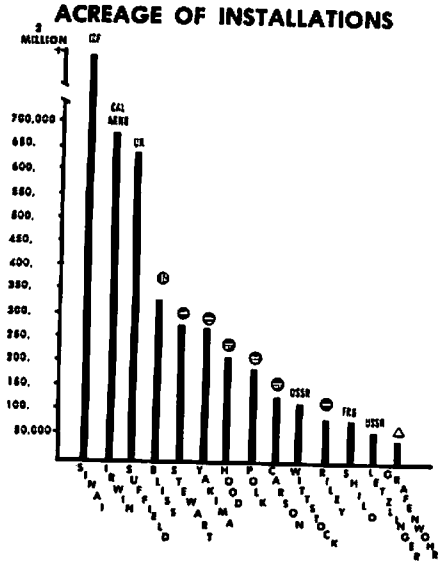
Army Participation in Red Flag

General DePuy has been responding to two influences. In the first place, General Rogers, when he was down in FORSCOM, had come to General DePuy saying, "What are we going to do about this land situation?" General Rogers, being a former Chief of Legislative Liaison, was keenly aware of the political price that the Army pays everytime we launch one of these land acquisition operations in the Congress. He, on the other hand, was fully appreciative of those weapon system factors that I showed you earlier. We do need more land for training, and his question to General DePuy was, "What can we do to solve it?" Perhaps, he said, we need a continental range. Maybe we ought to take one or more areas in the United States, designate it as a major or central range area, and do all of our land acquisition around that. For instance, we could acquire more land around Fort Drum, and build that up on the thesis that, (a) it's good politics, (b) it's European-like terrain, and (c) it's mainly Federally-owned land and, therefore, cheap. The other influence on General DePuy, of course, is General Dixon. The Tactical Air Force's approach has been to say to us, "This Red Flag thing is great; we would like to have Army participation.

Wouldn't it be marvelous if we could do actual troop-support, forward air control operations? Wouldn't it be great if we could get Army helicopters and Army artillery involved in anti-aircraft suppression?" Of course, there are no Army troops near Nellis, and the instrumentation is not now sophisticated enough to handle helicopter participation. Nonetheless, the 6th Cavalry down at Fort Hood is going to send helicopters up there to participate in a Red Flag operation.

Availability of Land for Training

Here is a depiction of land available for training for several nations. This is the Israeli Defense Force portion. One of the advantages of owning the Sinai Desert is that you have a lot of room in which to train. This is Fort Irwin, CA. Fort Irwin is located about the same distance from Las Vegas and Nellis AFB as the Red Flag ranges are located north. Irwin is south and west, Red Flag ranges are to the north, about 100 miles away. Suffield is up in Canada, and it is leased by Great Britain. There is a place called Shilohe, not too far from Suffield, to which German troops fly for training in North America. Fort Bliss, shown here, is a large installation, but much of it is taken up with missile impact area. There is a substantial amount of expensive instrumentation out there on that range, but it's a perfectly flat table top, tactically uninteresting land. Although large, Bliss is not a particularly good place to conduct maneuver training. It also has severe environmental constraints. The other areas are under FORSCOM control as shown. This is the Soviet training area in Eastern Germany. This is another one in Eastern Germany.



There is a point to be made about these, though. Soviets maneuver off of those reservations at will, and apparently without maneuver damage constraints--that's just a place where they start their drills. This is Seventh Army Training Center of 55,000 acres, and I think you can see

that here, where the bulk of the Army is, we are least well suited in terms of training areas. I put this up here because I want to point out that, as we have looked at this problem, this European aspect has become more and more interesting to us.

An Army Red Flag?

We have been attempting to come to grips with the problem of how to train for modern battle, and we've had some modest success with engagement simulation down at very low levels--I am talking here of platoon and company. However, we have been able to demonstrate steep learning curves, which suggests to us that in fact there is a phenomena like that of the Air Force for Army--that there is some kind of battle learning that we can achieve if we went to a multi-type range. I want to talk about just one small example of this to show you what I am talking about.

Down at Fort Hood, Texas, TCATA has an instrumented range. They have had a lot of problems with it. It is a large fixed installation. It depends on towers--triangulation from multiple towers. It has a big central processor, a position locating and reporting subsystem that talks to that central processor, and a weapons effect simulation system (WESS) which is laser based, and which is relatively crude--that is to say, it simply establishes communications between fire and target. The central processor determines P_H and P_K, and reports via radio link whether the kill occured.

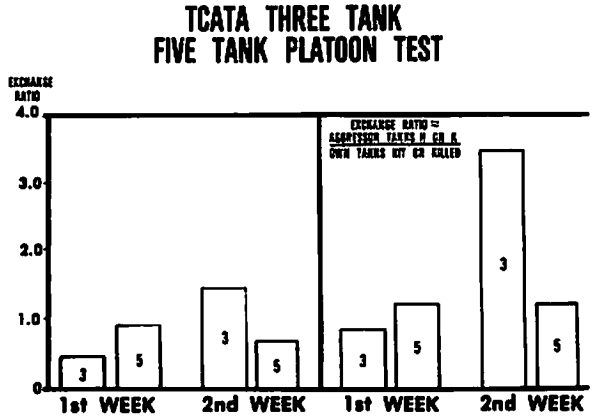
Nonetheless, this system was used for a recent test which was designed to determine whether in the new Army division we should have three tanks per platoon or five tanks per platoon. Now the test design called for two weeks of battle involving two platoons: one of them configured in the five tank configuration, and one in the three tank configuration. In both cases, they were assigned series of missions, and pitted against odds of something like 4 to 1. For example, they were required to defend against an attacking force that outnumbered them by something like 20 tanks to five, or twelve tanks to three. The instrumentation then kept track of the outcomes of the engagements.

At the end of the first week of the battles, the two platoons were switched. The platoon that had been operating with three tanks at week one, was then issued two additional tanks and it went through the second week of combat with five tanks. The platoon that had been five tanks full in the first week lost two, and operated in the second week as the three tank platoon.

That brings up two important points about the test design that you have to understand. First of all, the three tank platoon is doctrinally foreign. None of the participants knew anything at all about fighting

three tank platoons. They have been trained to fight five tank platoons, so, for anything we say about three tank platoons, you have to understand, the bias would be in favor of five tank platoons (from the point of view of experience, training, etc.). The second thing you have to understand is that the controllers reported that during week two when the three tank platoon picked up two additional crews, and went into that second week of operations, those two additional crews were invariably the first two killed. The conclusion of the testers was that this represented the experience differential between those crews which had not had the advantage of that first week of mock combat, and those who had been through the first week of mock combat.

It also accounts for this performance here where you see the difference between Week One and Week Two in terms of number of hits per shot--these ratios--and these, the kill ratios. The three tank platoon in the second week was five times more lethal than it was in Week One--A phenomenal spurt. The TCATA testers pointed out that there was a profound difference in behavior by these tankers as they became experienced in the business. They devised tactics to fit the situation. They learned how to fight their tanks. For example, they learned to fire in volleys--to dismount a soldier, put him forward until the enemy targets were well in view, and then to bring the tanks up simultaneously, fire a volley, back off and then go to another position. They became very expert at cutting those odds down and as you can see, in Week Two, they are up where they are beating the 4 to 1 odds. You can, indeed, fight outnumbered with a three tank platoon and win. But, for our purposes, that was profoundly interesting training that occurred down there.



It suggests to me that the route on which the Air Force has been moving is exactly the route that the Army ought to go. From everything else we know about training, feedback brought to bear on learning pays off. Experiential learning such as that in such exercises as CATTS could indeed make field exercises a lot more remunerative.

I would like to point out, however, one aspect of this business which TAC has not put a lot of stress on, but which I would consider to be one of the most valuable outputs from an Army Red Flag. It relates to collecting basic data. Do you realize that our tanks do not have meters on them? We don't know how far our tanks go on a tankful of gas. As a matter of fact, we don't have any way of metering gas because the tank trucks that we have issued to our troops don't have any mechanism on them for counting output. Everything is bulk handled. We don't know what we get, then, in terms of efficiency for the tanks anywhere, including TCATA. We haven't instrumented the tanks themselves, the way the Air Force did when they put transponders on those aircraft. We really don't know, then, what you have to input to get output, technically. It seems to me that we are at that point in sophistication, when we are about to field a tank that will cost upward of 2 million dollars, that we ought to be a lot better informed on what it costs to operate in the tactical environment. We don't know much about the interaction of artillery with maneuver. We work artillery in one place, maneuver in another, but rarely together, and we seldom collect hard facts. We don't understand the interfaces very well. One of the reasons why the Combined Arms Center hasn't been an effective integrating center is the fact that it does not have a lot of data being turned in by ordinary units trying to do their job in a well simulated operational environment, as opposed to the special circumstances that tend to surround quote "tests" unquote. USAF is beginning to discover that Red Flag is a gold mine of this sort of information on what it takes to keep a squadron flying and functioning. Supposing the Army were to act to reclaim Fort Irwin for Active Component training, and equip it to complement the USAF facility at Nellis AFB.

It appears possible to expand significantly the capabilities of engagement simulation for US Army forces. Firstly, the Army's forthcoming Multiple Integrated Laser Engagement System (MILES) will be able to simulate all the Army's direct fire weapons, both day and night.* Secondly, MILES could be combined with PLRS** (position locating and reporting system), with TOSS*** (automated tactical operations support system), and with TACFIRE*** (automated tactical fire control system) to produce a capability

* In engineering development by PM TRADOC of DARCOM. Expected to be fielded in 1979. More versatile, rugged, smaller, and much cheaper than WESS.

** Under development by PM ARTADS of DARCOM.

*** Under development by PM ARTADS of DARCOM.

to follow and record, for tutorial purposes, maneuver on the ground. Such equipment would also facilitate advanced indirect fire simulation, casualty assessment and recording, and the logging of personnel and logistical transactions. (The US Marine Corps already has in operation such similar instrumentation to control ground and air maneuvers at its Twenty Nine Palms Reservation southwest of Las Vegas****). Thirdly, some combination of MILES and PLRS, plus the sort of instrumentation and simulators that TAC uses in ACMI, should permit portraying the enemy electronic and air defense environments, and working out procedures for combining US Army and US Air Force assets against the high threat which would exist on the forward edge of the enemy's battle area. For example, cooperative suppression, joint helicopter-fighter tactics, and Army designation of targets or control for TAC air strikes, could be acted out. Fourthly, it would be possible to reproduce the offensive EW capability of Soviet-equipped forces so as to challenge thoroughly the electric countermeasures employed by US forces, and to cause them to integrate their own EW with their fire and maneuver.

Much of the sophisticated instrumentation needed is, then, already under development. While we would probably need all the designed capabilities of MILES, the full military characteristics of PLRS, TOSS, or TACFIRE might not be required, and less expensive versions, using commercial components, could be adapted. For instance, restrictions on size, weight, power requirements, climatic protection, and electronic security could readily be waived for training purposes. Because the Fort Irwin area has relatively little cloud cover, solar power applications for fixed instrumentation are practical (wind power is also feasible); expensive power lines and vulnerable cables can be avoided.

Significant developmental work would have to be accomplished for EW, artillery fire marking, mine and chemical warfare. But, the Fort Irwin facility would present the Army an opportunity to tackle problems of maneuver control and simulation unconstrained as we have been in the past by the high cost of procuring the quantities of training equipment needed to equip every installation. Fort Irwin could become the Army's laboratory for advanced training technology.

**** The USMC Tactical Warfare Assessment and Evaluation System (TWAES), does not incorporate MILES or anything like it, and works best for maneuvers afoot. But TWAES demonstrates that modern technology can handle the complex situations of ground warfare.

INSTRUMENTATION
FOR FORT IRWIN

FUNCTION	TECHNOLOGY	STATUS
Simulate direct fire weapons	Coded Laser	MILES (PM, TRADE)
Locate, track participants	Radio Transponder Triangulation	PLRS (PM, ARTADS)
Record, display maneuver by participants	ADP	TOSS (PM, ARTADS)
Simulate indirect fire weapons	ADP	TACFIRE (PM, ARTADS)
Targets	Laser or Microwave radio links to mechanical pop-up targets; impact automatic scoring	Commercially available or TASO fabrication
	Polymethane foam	TASO Fabrication
	Hulks	DARCOM depots (e.g. M114)
Measure fuel consumption	Fuel meters on dispensing trucks	CS^3 (PM, ARTADS)
Evaluate parts consumption	ADP	
Measure ammo consumption	Radio transponder from on-board acoustic sensors or MILES counters into ADP	Could be added to MILES (PM, TRADE) and linked to TOSS (PM, ARTADS)
Simulate maneuver of flank units	Computer assisted map maneuver	Commercially available

Training at Fort Irwin

Equipped as outlined above, we could conduct training at Fort Irwin which might contain four modules:

Module 1: Intelligence. We should collect at Fort Irwin a pool of Soviet-type equipment, and bring together the very best demonstrations of that equipment in use. (Actual, or on television tape, or shown via miniaturized radio-controlled models.)

Module 2: Electronic Warfare. With simulators or actual equipment, we should demonstrate to participants the capabilities of Soviet-type EW gear to locate, to identify, to listen, and to jam US electronic emitters of all sorts. Together with Module 1, Fort Irwin should become the Army's principal school on Soviet-style warfare.

Module 3: Engagement Simulation. Within an overall USAREUR reinforcement scenario, (so that the mission profile and the threat compares closely), and on instrumented ranges, we should pit force-on-force, with strength ratios appropriate for the mission (e.g., three to one on defense, one to three for the attack). Arrangements should be sufficiently flexible to permit exercising at least a battalion, with options to handle forces as large as a division. In all cases, through use of simulations like the Combined Arms Tactical Training Simulator (CATTS) or Combined Arms Map Maneuver System (CAMMS), it should be possible to exercise the headquarters one echelon above that which is actually being played on the ground.*

Module 4: Live-fire. Here we might present for ground forces target servicing problems in delay or defense, involving cooperation with attack helicopters and tactical air, against target arrays representing the first and second echelon of a breakthrough attack, with its associated EW. Or live-fire exercises could be built around the same target array, but involving a limited objective counterattack. Or, with a different target array, an attack could be staged.

We may need a fifth module for attack helicopters, a multi-threat range where they could perform advanced nap-of-the-earth flying, target acquisition, and engagement against realistic target arrays and EW simulators, before they participate in modules three or four.

* Digitized terrain data for Fort Irwin is available from DMA; action is underway to raise its resolution to 12.5 meters horizontally and 1 meter vertically.

Obviously, such exercises would be expensive to conduct, and would entail large outlays for troop transportation and support, but, let's consider the potential benefits. Obviously, we would improve combat readiness. And, for once, we could measure output against resource input. Moreover, a fully instrumented facility at Fort Irwin could provide for Army the same kind of data and statistics that Red Flag is providing now for the Air Force--specific technical, operational and logistic data gathered while line units are performing their combat functions within a realistic "battlefield" environment.

Let me cite a recent ARPA study* on the quality of information in defense management, which identifies some $176 million annually for DOD studies and analyses, of which the Army spends $70 million. This paper asserts that:

"Overall the quality of military study that employs mathematical-statistical methods is open to methodological criticism on two counts. Models and critical behavior propositions that they contain are not well verified, and usually not validated at all. The input data used in models often have an obscure or unknown empirical foundation, and the relevance of much data (even when it is valid) to the military effectiveness of systems is not known."

I judge that a fair criticism, incidentally.

Now gentlemen, between ARTADS and TRADOC, we can set in motion joint ventures to put the 1980 Army in a much stronger training posture. I invite you to join us.

* R-1827-ARPA August 1976, Incentives and Information, Quality in Defense Management, by J. A. Stockfish.