MG SCALES – INTRODUCTION OF GENERAL PAUL GORMAN

Well, again, General Gray has taught me the value of short introductions. I'd like to introduce another distinguished gentleman who's been in this business a long time, General Paul Gorman, the former commander and chief of the U.S. Southern Command was brigade commander in Vietnam in the early 70s. He was president of the Board for Dynamic Training. Essentially, he designed the army's current training system in the 70s. And, since his retirement he's been operating a consulting, research and development firm at his farm Cardinal Point where he also raises wine grapes. General Gorman.

GENERAL PAUL GORMAN

I want to tell you that those hot summers, Pat, make for great wine. Some years ago, a past director of DARPA called me into his office and sat me down and said, "Think out of the box." I think actually he was talking about breaking the paradigm or whatever the buzzword was back at the time. But he asked me to give him an example of thinking out of the box. So, I projected for him an army without guns. He was flabbergasted. "You mean no guns?" I said, "Why have guns? Why can't you have a fly-out individual weapon that would give you an option of a lethal or a non-lethal attack?" He said, "Nobody ever asked for it." I said, "That's what DARPA is for."

Now, seriously, thinking about forces should require us to question the very fundamentals of our future forces. It should force us to rethink some of the primitive notions like the best way to get a projectile in the air is to encase it in steel and put an explosive charge behind it and run it down a rifled spiral. There is nothing sacrosanct about that idea. But, guns require projectiles, and together they consume some 65% of the cube and the weight of forces today. And, Admiral, we've got lots of very cheap but very dumb projectiles in the inventory today. The notions that you're hearing again and again from your speakers concern precision, the criticality of time, and the importance of early entry so that you begin to influence the enemy's behavior from the word go. All of these ideas are crucial to the presentation that follows.

[1] I'm going to talk to you about an actual program, and therefore I'm a little bit different from your previous speakers. I'm talking about work that's in progress. It's time frame is 2001 to 2005. The point to grasp about this chart is that I am going to be describing a DARPA set of undertakings. There is no reference here to work that has been commissioned in industry. So nothing that I am talking about today is proprietary. I am further trying to get across the point that these government undertakings, which of course, have substantial support from contractors in the field, will be supplemented or will contribute to the knowledge of the industrial teams that have been responding to the request for proposal labeled Future Combat Systems. I want to call your attention to the S on the end of the word system. This is a system of systems, and it has a number of components. I'm going to walk through them for you a little bit. The bottom line on the chart should be read as follows. AFSS is an advanced fire support system. A-160 is a

robotic unmanned helicopter. DRaFT refers to digital radio frequency tags, which may be one of the more important components of this system of systems. Internetted, unattended ground sensors is next. We'll mention each of those elements and give you some further food for thought.

[2] Last summer, a Senior Advisory Group (SAG) convened under Larry Lynn, a former director of DARPA, was tasked to perform the missions listed here. The SAG included a second former director of DARPA, Jim Tegnalia, three members of the Army Science Board and the Defense Science Board, and five retired generals including your last speaker, Al Gray, and myself.

[3] This was, in my view, one of the more important charts that we put in front of the Chief of Staff of the Army when we got all through. We pointed out that the Army had traditionally developed weapons systems by postulating a threat and then developed a technological way of defeating that threat. That was accompanied by models and simulations that were essentially based on duels. You pit the postulated development against the threat and if you could demonstrate in simulation that it was superior, you proceeded with the development. This line of development is a feasible alternative for the Army. One could postulate for example that there is a tank out there called the T-96; that it has a 152-millimeter gun on it; and that it has the equivalent of 900 millimeters of rolled homogenous steel in terms of frontal armor. We can build a tank that will defeat that threat. But we won't be able to get it to many places of the world that were mentioned in the discussion thus far. So keeping up with the Joneskies may not be a relevant course of action for the coming century. The SAG recommended instead that we pursue a course of development with a much greater component of information technology and, which was, — to use Admiral Cebrowski's term— "network centric." And this force should be optimized for force projection or early entry. The idea is to get there firstest with the mostest. Now, notice the time frames here. The Army gave us until 2010 as their sort of objective day for fielding the system and in order to do that, we only had a few years to work on evaluating the technology, a couple years to do some experiments to lead to a decision, but a decision had to be taken by the year 2005 if we were going to develop and field the systems. Now, this is a very much more accelerated time frame than any of recent weapon systems that I know of. But it may be close to being feasible. I'll show you why here in a moment.

[4] This chart makes the point that concepts of operations must be developed in concert with the technology. You heard Frank Fernandez saying that. And these are some of the concepts of operation enablers that might make it possible for us to field the system in that sort of a time line. The problem, of course, is that the weapon systems development is in one part of the institution and the concept of operations work is done in another part of the institution. And that may be a major cultural inhibitor of success. In any event, this idea of reconnaissance, surveillance, and target acquisition being organic at every echelon, very much like Admiral Cebrowski's, notion of expeditionary surveillance or sensors, should be part in parcel of whatever it is we field. It should be highly mobile and agile, not only for moving overseas but, of course, for moving within the theatre.

And whatever we build must have the capability to fight as well or better than today's heavy force -- forcing entry if necessary and maintaining the tactical initiative.

[5] If we had such a force, this is what it would look like after 2010. Today, we have to fight in bursts. With this force we could fight 24 hours a day. Today, we think of land forces in terms a single plane, the surface of the earth. We believe that we have to be thinking three-dimensionally. The point has been repeatedly made, that today there is enormous latency in our indirect fire systems, which we want to reduce as much as possible. I'll show you how that might come about. We want to put a lot of robotics into the system. We want to see a lot more distributed, or networked, applications in command and control. and we want to see a lot more automation and mobility.

[6] One of the notions that is important to this idea is that you cannot have too much redundancy in your sensor system. If the problem is time of detection, it is clear that as that time goes down, the enemy's ability to get the threat to you increases. Therefore, you have to build your sensor systems accordingly. The more sensors that you have bearing on a perspective target, the easier it is to deal with the set of problems that are inherent in making the decision to engage. Usually, you are inhibited from doing that unless you're sure of hostile intent and are able, as Admiral Cebrowski suggested, to assess the problem of near miss et cetera. Bob Scales' point about the mortar is well taken incidentally. My experience is that a mortar in the hands of American infantrymen is probably as dangerous of a weapon as you could possibly imagine encountering on the battlefield. Dangerous to us -- not the enemy. One solution is to hook a version of the FireFinder radar to an automatic weapon system, have it plot a trajectory of the incoming and engage promptly, so that before the mortar round lands your round is on the point of origin of the fire. That's technically feasible.

[7] This chart makes the point that the money that we have been spending on sensors have mainly profited the higher echelons. You heard who does the dying in battles of the past century. Note here that we've been spending a lot of money to keep the guys in the headquarters in the rear in business. But we've done precious little to help the people that are out there where the rubber meets the road.

[8] Close battle is the pay off. If you're going to talk about doing a great deal more with existing forces, or better yet, doing a great deal more with more slender forces, then you've got to be able to deal with that problem, regardless of whether you're talking about symmetric or asymmetric threats. We've got to get away from the idea of depending upon somebody else to keep us informed and develop a capability to think on our own. We must allow our small units to cope with the situation on their own terms. As Al Gray observes, if we do that we will discover that we have a lot more capability in our force than we appreciate. And I'm going to walk you through a quick a analysis that was done on this set of propositions.

[9] This is a depiction of terrain at the national training center, Fort Irwin, California, as seen from the J-STARS. The aircraft in question was over Las Vegas, some 200 kilometers away and at 12 kilometers of altitude. What you can see is shadowing from the relief occasion by the high desert of the Mojave. The enemy operates in these

shadows. You can bet that anybody we go up against will understand the J-STARS and how to cope with it in the same sense. This is a little piece of high ground was supposed to be guarding this pass.

[10] Up here at the top of this chart you see a couple of terms that I've got to talk about. The Moving Target Indicator (MTI) system is an tactical counter part of the J-STARS, directly supporting the infantry commander. The difference here in the postulate or the hypothesis is that we intend to put this MTI system directly overhead of the battle and keep it there. Moreover, we're going to provide multiple MTI systems. Many of you are familiar with the old SOTAS concept. If you use MTI cooperatively, a pair or more, you get much greater probability of detection and much greater probability of classification. If we put the MTI on a rotor wing aircraft, we can in fact, keep the area under constant surveillance, so in addition to picking up movement, we can actually do pixel change detection of what's going on. Digital radio frequency tags are a communications mechanism which are solid state and need little power. They are very cheap and can be distributed throughout the force without fear of compromise because they interact with the MTI radar. They can be devised so that an enemy examining the return of the radar would be unable to detect the message information coming from the radio frequency tag. In effect, the energy from the radar activates the circuitry in here and causes it to alter the return, and the modified return is then interpreted at the radar, and the information is automatically passed on. The radio frequency tag is less than half the size of, and less expensive than, a deck of cards. Radio frequency tags would be issued to provide for blue (friendly force) identification. In other words, by putting the tag on the blue vehicles, each square in the display represents one armored fighting vehicle. So, we insure that, whether the vehicle is moving or not, it can be seen by the MTI. So adding those tags to vehicles will greatly help the visibility for the J-STARS and will enable the system to interpret what it is seeing far more readily.

[11] Moreover, we can activate the tags not only with airborne radar MTI's but with ground based radar by using a second tag up on the ridge to act as a relay and seeding the pass areas. We establish line of sight by dropping a tag up on the mountain such that it can read tags associated with each of the IUGS.

[12] This is a model, a simulation and it shows the number of vehicles detected in the field of view over time. So, you the commander will have real information in real time as to where your problem was. This chart shows you the numbers of detections from the IUG fields reported. You are looking at thousands of detections with sufficient frequency to enable individual tracks on particular targets. Understand that these bits of information say where, what, when. And, even though the sweep rate of the MTI is down around 30 seconds, you can still build track.

[13] Even with the tags on the blue, JSTARS has problems. This chart shows what JSTARS can see at around eight o'clock. He just sees moving vehicles.

[14] When we use tags, his view is improved but ineffective -- this picture is false because of what is under the shadow.

[15] If we were to put MTI on a rotor craft and elevate it up over the battlefield, as you see in this chart, we would be able to pick up anybody that's moving. This enables us to see the red (enemy forces). And , since we are also able to see virtually all of the blues we now have something like a coherent picture of what's happening on the ground. This comes close to giving you the sort of common tactical view that everybody talks about. Conclusion: it really would help to have a system of MTI and digital radio frequency tags.

[16] Here are some comparisons. The first graph shows JSTARS only, then J-STARS with the tags, and then the tactical MTI. You're beginning to get to close to ground truth with this kind of sensor system.

[17] This led the SAG to conclude that we ought to be talking about fielding a force composed of teams -- and I'm not going to use the conventional terms, such as battalion, company, and platoon. Just take it from me that this force can control ground equivalent to what a battalion would be expected to control today. We would issue this force two MTI systems, each aboard a robotic helicopter, with a synthetic aperture radar, interferametric radar, and a SIGINT mapper. This is the A-160 development. It is on an unmanned helicopter. The avionics to fly it have been in test at Edwards Air Force base for the past year where it just passed its rotor tests. It has a unique rigid rotor and it's a highly efficient bird. It is expected to have an endurance of 48 hours and to be able to operate at altitudes of up to 30,000 feet. It is clearly capable of carrying all of these sensors. It has 300-pound payload and a very large bay with lots of power on board to handle multiple sensors of the sort we're postulating. We would operate these birds in pairs in order to get that high probability of detection and identification. We talked about internetted unattended ground sensors; we could get them out there by shooting them in with missiles or mortars. We also talked about mounting the digital radio frequency tags on all the blue combatants and using them to communicate with the IUGS as well. We would also like to see some robotic missile batteries (rockets in a box). The commanders interactive display shows the command and control node. Now, this is the sub-unit, which consists of these platforms (I think there are a total of seven). The combat vehicles may be nothing more than armored HMMWVs. They may be heavier, but must be air mobile. And, with each of those, we would associate a robotic vehicle that would operate in concert with the combat vehicle. There would be two future infantry combat vehicles, which may also be a variant of the HMMWV, or something more elaborate. There would be a pair of, robotic missile batteries on wheels, also be slaved to vehicles like the infantry vehicle. And then there would be a command vehicle for what I refer to today as a platoon leader with two crewmen. This is a very small team, about 18 infantry,crewmen, and the commander. But, notice the importance placed on robotics. We are looking for reconnaissance, surveillance, and target acquisition, and NBC and mine detection capability.

[18] This is a picture of the A-160 plus a vehicle that's actually flying today with the California highway department. It's an electric ducted fan, which flies up under a bridge after earthquakes to look for cracks in the cement. These would give us elevated

platforms. If you take up a 45 megahertz GMTI, and there is one that weighs about 15 pounds, you now have a capability to look under foliage. So, for local security, you would carry this around with you.

[19] The advanced fire support system now operates under the moniker of Net Fires. There is a container, called a container launch unit. The weight and number of missiles are shown in this chart. It is air droppable, can be carried by a HMMWV, and it is robotically responsive to the commander and the target. It carries two kinds of missiles. One is a loiter attack missile (literally a cruise missile) that deploys wings to achieve a maximum range of 90 or 100 kilometers, but the idea is for orbiting over an area on the battlefield. It carries a set of sensors, which could include LIDAR, which would provide very good probabilities of detection and classification. The other missile in the box is the precision attack missile with a much larger warhead and a range of 90 kilometers. It has GPS, INS, and a seeking warhead. But more importantly, these missiles can talk to one another. So, the commander can use the information from the LIDAR-equipped missile to designate the target and the two missiles can interact with one another automatically to put that precision attack missile onto the designated target. Now, this system is being built today. We should have it in tests between 2003 and 2005, and everything points to being able to ploy this by 2010. But it's beginning, to yield a system that would attack the latency issues very directly. How does all of this good communications take place? Digital radio frequency tags and the advantages of using your MTI.

[20] This is a cartoon shows some of the ways that this system could be used. The unit just sets itself up on the ground and gets itself ready to fire. It knows where it is, and it responds to calls from the commander. There's your LAM out here doing detection and imaging. And here are the precision attack missiles coming in to go after the multiple target. No guns. It is a very efficient system in terms of precision rounds on target, mass effects, et cetera.

[21] All of this will require us to have a much better communications pipe into these forward units. For reasons that aren't clear to me, the guys who have the shortest timelines and exchange more information subject to penalty for latency, have had the least amount of communications. The further back you get, the richer it gets. That's all got to change. That's the objective. And there is some reasonable prospect by 2010 we could make that happen.

[22] One of the white hopes in DARPA is something called small unit operation situational awareness system. That's about the size of the radio. It is a wave-form hopper. It has a capability of handling numerous wave-forms. It's consistent with the Joint Tactical Radio System requirements document. It is designed for networking and sets up its own network. It autonomously works to change circumstances. It provides continuous position navigation. This is entirely automatic, and anybody carrying this radio is being plotted, and it has the plot from a differential GPS inertial systems and a time-of-arrival computation. It is designed for distributed information management and, in that sense, it is a way of implementing some of the ideas that we've been discussing

here. This chart shows a notional radio in 2010. I show it to you because I want to make the point that if we are going to be operating anywhere in the world, we have to be prepared to go. A better way to design our radio systems would be to use our packet distribution system and piggyback them on existing radio transmissions. For example, throughout the Kosovo affair, Italian television signals were clearly audible, or detectable, throughout all of Serbia. And, a radio of this sort hunts the spectrum to find such signals and inserts its packet into a red stream or a neutral stream. And the broader the band of the stream, the more the transmission, the easier it is to hide the friendly signal. And at the other end, you pull these packets out, because they are coded, and reintegrate them. Another radio concept is even further out. This is ultra wide band that would allow transmission across all of the available RF links. And the band is sufficiently wide to allow it to work pretty well in cities with relatively high confidence, in that the buildings are not going to inhibit receptivity. This would be coupled with the notion of scavenging wires. Even cities in the third world have wires all over the place for telephones or for electric power, and the idea here is to simply use those wires to pass information from, let us say, IUGS fields inside of the city to forces outside of the city. We will probably be going to very high frequency transmissions sooner or later, up in the oxygen band. These kinds of radio concepts have got to be pushed very aggressively if we are going to handle the range of difficulties that we were discussing earlier in the meeting here.

[23] What this picture shows is a folding map. Here is a soldier with a computer and the commander is looking at the map. And that is all the command and control mechanism that will be required. Can we build this? The technology is here and the communications are here. So, this would enable the commander to operate in a helicopter, tank, aircraft, on the ground, in the cellar, or wherever he wanted to operate. And that approach replaces the variety of screens the commander must integrate between his ears. My point is simply that this should be referred to not as the Tactical Operations Center (TOC) but as the Target of Choice. You want to bring about distributed command and control, where your intelligence function, fire support function, operational planning, combat service support, and aviation control is somewhere in the rear and the commanders are forward. These are virtual battle staffs or virtual TOCs. That's probably quite doable.

[24] The final chart simply makes the point that one way of thinking about what we just described is a classic doctrinal covering force. As a matter of fact, we ran a simplistic war game at the Institute for Defense Analyses with a group of experienced marine and army commanders. The scenario was Kosovo-like, only in this case land forces went in. And what we discovered was that, this FCS force would have been a superb precursor. Al Gray made the point that it was outnumbered. Sure. And how does it operate? It operates like a partisan force would. And if we already had the force on the ground, a Kosovo peacekeeping force that was suddenly subjected to an aggressive attack out of Serbia, this sort of force could very rapidly reverse the strategic balance in the area. And would have a great influence on enemy behavior. Call that a cavalry mission, I guess. FCShas a lot of potential. That's the end of my message. Over to you, sir.