

**“PERSPECTIVES ON DEFENSE TRANSFORMATION:
CHANGING THE WAY WE FIGHT”**

GENERAL (RET.) THOMAS S. MOORMAN, JR.

**REMARKS AS PART OF THE CALHOUN LECTURE SERIES
STROM THURMOND INSTITUTE
CLEMSON UNIVERSITY
15 JANUARY 2003**

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Good evening ladies and gentlemen, distinguished guests, faculty and students. It is both an honor and a pleasure to be with you tonight and to speak to you about how our Nation is transforming the way it defends itself both at home and abroad. I want to express my thanks to Dr. Bill Hunter and the patrons of John C. Calhoun Lecture Series and to Dr. Bob Becker and the Strom Thurmond Institute for the kind invitation and especially the opportunity to be back at Clemson. I also want to thank Colonel Bob McGarity for that most generous introduction.

As Bob McGarity indicated in his introduction, the Moorman family and Clemson have been inextricably connected for about 110 years beginning with my grandfather who was a member of the first graduating class of this institution in 1896. A career Army officer, he returned to his alma mater in 1934 to serve as Commandant of Cadets – he and my grandmother lived in the red brick house just behind the Clemson House. Three of their children – Marie, Bob, and Betty – lived in the Clemson community and worked here for many, many years. The last of that group, Betty, still lives here and I am deeply grateful to the organizers because it is an opportunity for Barbara and me to visit with her. I only wish I had time to stay and watch the Tigers play at the new Littlejohn.

My dad was one of the children who did not live here but rather went to West Point and served in the Air Force for 37 years in assignments throughout the United

States and overseas. Nevertheless, as a child I visited my grandmother, aunts and uncle at Clemson most every summer during the fifties. And I have vivid and warm memories – eating chocolate ice cream at the dairy, watching eleven cent movies, playing pool and ping pong at the Y, golfing with my Uncle Bob at Boscobel, taking all day trips to Oconee State Park to swim, and watching the Freshman cadets - “the Rats” – arrive serenaded by the shouts of upperclassmen.

Like my dad, I chose the military as a career and served 35 years in the Air Force. My career was primarily focused on the military space program. Fortunately, there was an Air Force ROTC group here and as I became more senior they often invited me back to speak to the cadets. When my son John was trying to decide where to go to school, his heritage made Clemson a natural choice. As an aside, his wife and my wife have had to learn to accommodate orange in any decorating scheme. At any rate, because of my visits either to talk to AFROTC cadets or while John was here, I had the opportunity to see this university grow into the great institution that it is today. Accordingly, one of my proudest moments was receiving an honorary Doctorate of Laws from Clemson in 1995.

What I would like to do tonight is to share with you a few perspectives on how and why the Defense Department is changing - both the way we fight and the capabilities we employ. It also involves encouraging a culture of experimentation, innovation, and risk taking in the way we think about defense. I realize this is a weighty topic which probably only could be covered properly in a three hour course. Consequently, I will just be hitting the high points and looking forward to your questions.

Defense transformation is a high priority for the Bush Administration and the President has spoken about this subject several times, most notably in two speeches right here in South Carolina at the Citadel. During the 2000 presidential campaign,

President Bush announced a commitment to “[create] a military of the next century,” which could “protect America’s peaceful interests, not just across the world, but across the years.” He went on to say that his “real goal is to move beyond marginal improvements – to replace existing programs with new technologies and strategies – he said that he wants to use this window of opportunity to skip a generation of technology,” something that will “require spending more – and spending wisely” and “will require a new and greater emphasis on research and development.” The events of September 11th simply focused those goals. Speaking again at the Citadel three months after 9/11, President Bush said that “what’s different...is our sense of urgency – the need to build this future force while fighting a present war...Yet we have no other choice.”

That commitment has been reflected in Department of Defense rhetoric, policy and programs. For example, the desire to transform drove Secretary of Defense Rumsfeld to cancel the \$9 billion Crusader Artillery System. In his eyes and in the eyes of other senior leaders, the Crusader was a Cold War system which was an inappropriate response to the threats of the 21st century. Following the termination, Secretary Rumsfeld defended his position in saying that the Administration was “seeking to adopt ‘transformational’ technologies that will give the U.S. military weapons that are mobile, precise, and able to track and strike targets over vast areas from long distances.” Personally, I think the debate over how and how rapidly to transform the U.S. military will define the defense budget issues for the next several years. The most vexing and daunting issues will be those dealing with the pressure to cancel or reduce certain legacy weapon systems which were initiated many years ago to deal with threats as we saw them at that time.

Currently, each of the uniformed services has major transformational programs. Make no mistake, the depth of commitment in Washington is best measured by dollars and resources invested. Accordingly, over the next five years the Army will devote \$20

billion to transformational systems, the Air Force \$30 billion, and the Navy \$40 billion. These investments will go towards a variety of capabilities – for example, better and more comprehensive intelligence, improved and more timely communications and information systems to support the fusing of multiple sources of data to permit better decision making to employ smarter and more accurate weapons. But I am getting ahead of myself.

So the watchword in the defense business today is “change.” One could argue that change and innovation have always been central foundations for what many now call “the American way of war.” America’s unique ability to harness the promise and progress of technology has long been a key strength not only in the realms of industry and international trade, but also on the battlefield. Scientific breakthroughs have been translated into military technologies that have allowed our forces an edge over less sophisticated opponents; witness the invention of the airplane early in the last century. Likewise, breakthroughs in military technology have been translated and transitioned into applications in the civilian and commercial world that have changed each of our lives – and the examples here are endless (the gore-tex lining in the jackets you wore here this evening, the satellites which communicated the words you spoke into your cell phone, the email you wrote to a friend.

In many ways, transformation seems merely the modern guise of a continuing American commitment to constant change, to constant creativity and innovation, and to the constant adaptation of the promise of technology to the way we fight. “Transformation”, therefore, is in some ways nothing new. Doolittle’s idea of launching B-25’s from an aircraft carrier was certainly transformational. The ability to harness the energy of the atom’s enormous destructive power for warfare was certainly “transformational.” The first picture of an airfield in the USSR (Mys Shmidta), secretly taken from space and returned to the earth in August 1960 in the darkest days of the Cold War, was certainly

“transformational.” A far more recent example is the stealth technology which rendered a small number of our fighter-bombers in Desert Storm nearly invisible and permitted deep penetration of Iraqi airspace. While we have always been innovators, I would argue that the imperative for change is greater now than it has ever been.

Why Transform?

So why is today’s defense transformation such an imperative? There are several reasons. Let me begin with what I have already teed up and that is to keep up with the dramatic changes in technology. The United States must react to these changes to stay ahead of our potential enemies. Being overwhelmingly ahead in technology hopefully will allow us to deter conflict. If conventional deterrence fails, our technological and operational superiority will allow us to win swiftly and decisively with minimum casualties in any conflict scenario.

Having said this, staying ahead is no mean feat given the rapid rate of change and our potential enemies’ relatively easy access to militarily significant technologies. Nowhere is this rapid change and ready access so pervasive as in the information technology world. The noted futurists, Heidi and Alvin Toffler, have observed that our society has transitioned from the Industrial Age to the Information Age. This Information Age is affecting everything we do, so it is not surprising that it is profoundly affecting the “American way of war”.

Today, we lead the world in the ability to collect, analyze and employ information. But technology is racing ahead to a degree that “leap ahead” technologies have the potential to change not only the national security tool set, but also the way future conflicts will be prosecuted. Those who are conversant with computer speak will resonate with the following. Moore’s Law, which predicted the doubling of transistors per square inch on integrated circuits every eighteen months, has held for almost four

decades. Experts predict the law to hold for at least the next two decades. The latest Cray supercomputer is capable of 52.4 teraflops, or trillion mathematical calculations per second. By 2010, the company anticipates an “X1 system” capable of a petaflop – 1,000 trillion mathematical calculations per second. Half a billion people use the Internet today, double the number of three years ago. The information they access (which is doubling every six months) travels via optical fiber networks at rates 200 times faster than was possible just five years ago. Each of these continuing breakthroughs heralds profound change in the way we fight. For instance, military professionals forecast information-based systems far more capable than today’s. These advances could include:

- Global networks with voice, data, and imaging capabilities 50 times greater than today (based on advances in data compression, processing, frequency management, miniaturization and sensors). These networks will rely on a combination of fiber optics and satellite communications.
- Autonomous weapons, enabled by artificial intelligence, automatic target recognition algorithms, and multi-spectral miniature sensors.
- Sophisticated devices to protect against computer attacks.
- Data cross correlation or fusion at rates 10^4 times faster and more accurate than today, based on advances in processing and software.
- Data storage capabilities a thousand times greater than today (due to miniaturization).

Such advances in essence force us to fundamentally reconsider how we fight by opening the door to ways of doing things that heretofore were viewed as impossible.

While I stress the revolutionary world of cyber, nevertheless, it is important to note that breakthroughs in information will by no means completely replace traditional kinetic or physical methods of warfighting. Ships, planes, and ground vehicles are not soon to disappear, and our Armed Services’ greatest resource will always be its people.

I also don't mean to imply that future conflicts will all be sterile and devoid of significant casualties. Although war will remain an often bloody, brutal test of wills, reducing the carnage of warfare and saving the lives of our young servicemen and women is a noble goal. So hands will continue to be wrapped around wheels or joysticks and fingers will continue to squeeze triggers. But the embodiment of transformation is that that hand around a joystick could be controlling an unmanned aerial vehicle or drone circling an enemy position hundreds of miles away. And that trigger finger could belong to a U. S. Special Forces Sergeant riding a horse with friendly forces – calling in air strikes based upon precisely locating the target in Global Positioning System (GPS) coordinates with a laser range finder and passing those coordinates to a satellite which transmits the target data to a B-52 flying somewhere above him at 30,000 feet. That unusual mix of the old with the new was demonstrated in breathtaking fashion in our conflict against the Taliban in Afghanistan. People often think of transformation as modernization or advances in weapons systems. It is also about innovative thinking and flexibility – doing things differently to adapt to the situation may require the synergistic combination of capabilities. That's what happened in Afghanistan. But again, I get ahead of myself.

A look at history provides another compelling reason to change.⁷ From time immemorial, there have always been military capabilities which constituted the world standard, for example the Roman Legions, the British Fleet, Napoleon's Armies, and the German "Blitzkrieg" of World War II. With Desert Storm, the U.S. has become that world standard – the force that is overwhelmingly the most powerful and most envied. That force also protects and benefits from the most advanced economy. Our economy plus our military capability make us the most powerful country on Earth.

That being said, each of states whose those military capabilities once constituted the world's standard reached their zenith and then, for whatever reason, allowed those

superior capabilities and the associated advantages to erode away. I believe there are several reasons why. First, being 'number one' often breeds complacency – “If it ain't broke, don't fix it.” Not taking advantage of new ideas and technologies also offers those who would do us harm a relatively fixed target to engage. There is another axiom that applies here: “winners of conflict rarely learn – it is the loser and the less powerful, potential adversary that learn.” Accordingly, one must believe that the world's militaries and their associated planning staffs and war colleges have been studying recent U.S. military performance in detail over the last 12 years – extracting their own lessons learned from the American experience in Desert Storm, Bosnia, Kosovo, and most recently Afghanistan.

This makes one think of another reason to transform – the new and multi-faceted threats of the current era. Countries or groups have unprecedented access to military-related technology. Moreover, future adversaries will look for asymmetrical means to attack U.S. vulnerabilities. The terrorist threat and the events of 9/11 are the obvious manifestations of this. Today's terrorists are extremist Muslims who are trying to change the political order of free world democracy led by the United States through asymmetrical means. Our open society also creates our vulnerability. Tomorrow's asymmetrical adversaries may well seek to take advantage of the vulnerability created by our tremendous dependence on computer and information systems. And thus bombs and bullets are replaced by cyber warfare.

Transformation in the Near Term

So there is a mandate or imperative to change. Fortunately, the U. S. military has not been complacent since Desert Storm. Many warfighting concepts and new capabilities have been introduced over the past decade or so, some of which are really 'transformational'. These new systems and processes could well be showcased, if we once again go to war against Iraq. For example (and these are in no particular order):

- Network Centric Warfare – The first change I want to point out is something called Network Centric Warfare (NCW). This concept is in its early stages but is based upon harnessing information age technology – the explosion of available data, communications capabilities to deliver that data anywhere, and the computational power to turn data into information and knowledge. One could argue that warfare has always been about having more information or widely shared battlespace awareness about your enemy and a means to act upon this information. Today the U. S. has an extraordinary number and variety of platforms and sensing systems to provide that battlespace awareness. It also has a variety of ways to transmit that information to a network of users such that commanders and decision makers can make decisions faster and more accurately than our adversaries. ‘Empowering’ our forces through the network therefore translates to real combat speed and an ability to more effectively synchronize the application of power. This concept is only a few years old but our forces today are infinitely better networked than during Desert Storm.
- Precision Weapons – Back in January 1991, I know most in this audience sat transfixed in front of your T.V.s and watched Desert Storm unfold. Perhaps the most dramatic and surreal images were of the precise bombing in which we saw the crosshairs on the rapidly approaching target and then an explosion as the bomb impacted a headquarters or bunker. This was in stark contrast to World War II and Vietnam where we sent tens, if not hundreds, of aircraft to hit a single target. Basically, the equation now is ‘one bomb, one target’. With the introduction of laser and satellite-guided bombs, the promise of airpower was achieved. The change from Desert Storm is that the use of precision munitions has become the norm. The following statistics underscore this. In the Vietnam, precision guided munitions or PGMs were introduced late in the war so less than 1% of the bombs dropped were PGMs. In

Desert Storm, the figure was 9%, in Kosovo 30%, and in the next conflict, it could be as high as 90%. Thus, aircraft delivered bombs and cruise missiles are unbelievably effective against fixed targets. Our “Achilles Heel” in Desert Storm was mobile targets such as Scud missile launchers. And it is still a difficult targeting problem today.

- Unmanned Aerial Vehicles (UAVs) – UAVs or drones have been around for 40-50 years, but it was an immature technology, whose time had not yet come. However, because of intensive investment in the 1990s, UAVs have really demonstrated their worth over the past several years. Their efficacy as a system of choice stems from two characteristics – low cost and the fact that humans are not put at risk. Originally conceived as a complement to manned or space-based surveillance and reconnaissance systems, the performance of the Predator UAV in the Kosovo conflict and Afghanistan has been excellent. While the Predator flies at low altitude for relatively short durations and is thus tactical, the Global Hawk UAV is a high altitude (above 60,000 feet) more strategic platform. The best illustration of the potential of Global Hawk is that it flew largely autonomously from California to Australia on a non-stop, 22 hour flight, loitered briefly, and landed. One of the dreams of the UAV advocates has always been that it would become a strike platform. This dream began to become a reality when a Predator equipped with a Hellfire missile hit a car filled with Al Qaeda members in the remote desert area in Yemen. With this dramatic proof of concept, several aerospace companies are developing Unmanned Combat Aerial Vehicles (UCAVs).

The Longer Term Promise

Up to this point, I have been talking about “things” – equipment, technology, and weapons systems. Transformation is also a mindset. It is about changing culture, and most would agree that cultural change is the most difficult thing to affect in organiza-

tions. As I mentioned before, all one has to do is look at history to see how difficult it is to affect change in military establishments. The idea is to institutionalize a culture of constant change. To make this work, an institution needs to incentivize innovation by funding experimentation and operational prototyping. It also means that risk taking has to be rewarded. Quite frankly, some believe we have become a 'risk adverse' military. Perhaps it is a consequence of the 'CNN effect' - when something goes wrong, it's on T.V. and everyone knows it. A classic example is how the fate of the missile defense program hangs in the balance every time there is a test. Contrast that with the Spring and Summer of 1960, when we had 12 straight failures before we successfully launched America's first reconnaissance satellite, Discoverer.

By the way, the best experimentation is that which is hard or pushes the known parameters of something, and that where failure is tolerated as a necessary initial by-product when testing bold concepts. If the experiment is done right, then people can visualize the potential for an operational system. I think there has been significant progress in changing the culture. First, our senior uniformed leaders are looking for innovative, "out-of-the-box" thinkers. Each Service Chief is pushing this area hard, and General Tommy Franks, the individual who will command our forces should we go to war with Iraq, I understand has been very willing to innovate.

So now, if we are able to establish a culture of innovation, risk taking, and experimentation, what might the future hold? Here the possibilities are endless. I will only touch on a few where I have some direct knowledge.

- Information Management – For the Network Centric Warfare concept to reach maturity, the country must improve our ability to manage these massive amounts of data that are available throughout the network. Each year we collect more and more information. By any metric, the curve in projected increases in data is very steep. On the other hand, our analysis capability and our ability to fuse this data with other sources are improving only modestly. What this means is we will need improvements in data mining - how to

access relational databases. We also will need artificial intelligence engines that let machines talk to machines. The secret is to get the right data – fused information of decision quality – to the right place – commanders and decision makers – at the right time.

- Missile Defense – Missile defense technologies are clearly transformational. A missile defense system requires the capability to ‘hit a bullet with a bullet’. While the velocities are extraordinary, the problem is compounded by the probability that countermeasures will also be employed. As this audience knows well, the President has committed to a goal of building an operational system in which would include 16 missiles in Alaska and 4 in California by the Fall of 2004. This will provide an initial ground-based capability against threats from across the Pacific. Ultimately, there are plans for other missile defense systems with different technologies. One especially exciting and clearly transformational capability that is currently being developed is the Airborne Laser Program. This system mounts a chemical laser inside of a modified 747 to shoot down ballistic missiles during their boost phase. Recall that I mentioned that speed of action was all important in modern warfare. Well, the platform has a sensor to acquire the missile and a speed-of-light weapon to destroy the missile – it is the ultimate in a ‘sensor to shooter’ system.
- Persistent Surveillance – We are constantly getting better in our ability to surveil our enemy. By and large, the frequency with which we can do this is limited by physics and system design – orbital mechanics, and coverage of our manned, unmanned, and space-borne sensors – which limit the extent of our access and time-over-target. We are also limited by weather, daylight, and terrain. Future developments offer the promise of ‘persistent’ surveillance – the synergistic use of manned, unmanned, and space systems to literally “stare” at the enemy constantly to deny him sanctuary. Recall that I

spoke earlier of the problem of finding and tracking mobile targets like missile launchers. New systems offer the opportunity to see these mobile systems move or, because of our capability, make them hide and thus become static. Accordingly, a space-based radar system that will provide a global capability to track moving targets on the ground deep in enemy territory is receiving a high priority in this year's defense budget. In addition, a considerable amount of money is going towards buying more and more capable Global Hawk and Predator drones.

- Transformational Communications – The concept of space communications goes back almost 50 years to the dawn of the Space Age, such that today we depend on a host of dedicated military satellite communications systems and commercial satellites. However, these space-based systems plus our terrestrial capability cannot keep up with demand and the explosion of information. Consequently, the DoD is pursuing laser communications in space that have the potential to provide high-quality, broadband, secure communications to our forces, anytime and anywhere on the globe. The transformational component here, of course, is that the use of laser technology removes communications capacity or bandwidth as a constraint to military operations.

Although many of the future transformation examples that I have described are enablers for all types of warfare whether on the ground, on the sea, or in the air, I must admit that they are biased towards Air Force systems. Therefore, let me turn to two specific examples from the other Services.

- The Objective Force – The Army has been working hard over the last several years to transform itself from a heavy force designed to fight on the plains of Europe against armor-heavy Soviet forces to a new suite of capabilities. The Objective Force, using a family of advanced systems developed under a program called the Future Combat System (FCS), will be a dramatically lighter force – for example, the force is going from a 70 ton main battle tank to

a 20 ton tank-like vehicle. The reduction in the associated logistics support is equally dramatic. This lighter capability will produce a considerably more agile force – one which can rapidly enter the fight upon arrival in a distant theater. Like the other Services, the Army’s Objective Force will rely on advanced reconnaissance and information systems such as UAVs, Unmanned Ground Vehicles (UGVs) or robots, and unattended ground sensors, and it will be plugged into the global network. This will allow the lighter force to engage the enemy well beyond the line of sight.

- The Littoral Combat Ship – The Defense Department wants to be able to project power into contested coastal areas more rapidly and with less dependence on ports. Consequently, the Navy is developing small (considerably smaller than a destroyer), fast (40-50 knots), shallow draft ships that can deploy to carry out specialized missions such as anti-submarine warfare, mine clearing, and dealing with swarms of small, high speed craft. The ships operating in small groups will be networked with and protected by the wider area defenses of the fleet and would carry specialized modular capabilities including unmanned vehicles for surface, sub-surface and aerial operations and surveillance.

Conclusion

As I mentioned, this is an extraordinarily complex subject. And I certainly hope that I haven’t overwhelmed you with military jargon and acronyms. On the other hand, I believe that it is an important topic wholly appropriate given the traditions and history of this great University. Clemson was founded over 113 years ago as a military school and has a rich tradition of offering its sons (and more recently) its daughters to the service of our country. In that light – and on a personal note – I am extremely proud that my grandfather and uncle were 2 of those “sons of Clemson.” I note that this past October you honored Major Rudolph Anderson, Jr., a Clemson graduate of the Class of

1948 shot down while flying a U2 over Cuba during the Cuban Missile Crisis. Major Anderson's sacrifice is especially meaningful to me given my background. A more up to date story involves Captain David McCollum, Class of 1996, lost in operations in Pakistan during Operation Enduring Freedom. It strikes me, though, that the war on terrorism and the tragic events of 9/11 have broadened exposure to the dangers of a hostile world to people beyond simply those in uniform. Here again, Clemson has been directly affected as I understand the University lost an individual in 9/11 – James T. White, Class of 1989.

Transformation allows us the flexibility and adaptability to defend ourselves in a changing world. Just as American ingenuity continues to strive to create the overwhelming advantages that we have enjoyed for so long, so will our adversaries continue to search for our asymmetric vulnerabilities. We, in turn, must counter with strength, with innovation, and with change. Those three concepts would most likely ring true to perhaps even the namesake of this lecture series, who entered the House of Representatives in 1811. I think it is notable that John C. Calhoun spent many of his first days in the House urging measures to strengthen the armed forces of our young Nation and to prepare for a war that (in his words) was absolutely necessary to “redeem America's honor.” That war with England would come a year later.

Today's challenge is also preparedness – preparedness to deal with a dangerous world filled with a variety of changing threats. And preparedness to respond decisively, if necessary, to aggression against our Nation and our interests.

Thank you, and I would be happy to answers any questions.

¹ *Acknowledgement: The discussion here is influenced by the 2002 analysis on “Military Advantage in History” that Booz Allen Hamilton VP Mark Herman and his team did for the Office of the Secretary of Defense/Director of Net Assessment.*