

Interview with Arthur K. Cebrowski

Director, Office of Force Transformation

Drive change or be driven by it. That is the strong philosophy of retired Vice Adm. Arthur K. Cebrowski, director force transformation. In the following interview, conducted for *Defense AT&L* by Frank Swofford, NDIA industry chair at the Defense Acquisition University (DAU), Cebrowski explains why transformation is an imperative for survival and competitive advantage in a changing world. He warns against seeing technology as the only focus of transformation, stressing that just as important is the element of human behavior.

Q Good morning Admiral Cebrowski. It's wonderful to be here today talking with you about force transformation. I would like to start with a general question, and then we'll get into more specifics. Would you give us your perspective of what force transformation is, and if priorities are a part of that scenario, how do they affect the military forces?

A First of all, the reason for transformation is to develop a sustained competitive advantage. It recognizes that the world is changing. In many respects this nation is in an enviable position that we need to maintain. I'm talking in a security context. Since the world is changing, then we, of course, have to change too. Consider, for example, how few of the Fortune 500 companies from 50 years ago are still in existence today. That can't be allowed to happen to us, so from a national security point of view, we have to make the corporate adjustments. That's the objective of transformation: broad and sustained competitive advantage.



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Transformation has many elements. Perhaps one of the most important is that it involves creating or anticipating the future. Either you create your future or you become the victim of the future that someone else creates for you. The United States, by virtue of its position in history, has the ability to create a future that furthers the dignity of man and all the values we hold dear.

When we talk about transforming our defense capability, we're talking about the co-evolution of technology concepts and organizations to achieve a broadened capability base. Evolving organizations—people—to think and act differently is a real and a new challenge. But our people must change so that new technology concepts can be viewed from the perspective of how these capabilities best fit achieving sustained competitive advantage on the battlefield.

Q Are there any priorities that you're focusing on in terms of technology?

A It's a common error to think that transformation has a technology focus. It is only one of many elements. Central to transformation is cultural change—the change in the set of attitudes, beliefs, and values that a group has. Additionally, warfare is all about human behavior. Technologies are not only going to be catalysts to change culture and behavior, but they can also be a result of changes in culture or behavior.

The reasons that we do transformation have to do with changes in context. The strategic context, which has to do with such things as the movement from the industrial

age to the information age, is one of the largest strategic shifts that we have going on today. We have changes in threat context. It's no longer a great power on a great power. The characteristics of warfare are broadened considerably. I think there's a growing trend towards increased perversity in warfare for example. These things have to be accounted for. Third, there are the falling barriers to competition in many areas where we have always felt we were truly in a superior position—at sea, in cyberspace, and in physical space, for instance. We can be challenged in all of those areas and certainly in the field of biological warfare. The largest single factor that changes the competitive landscape from the technical point of view is the increasing availability of very high quality information technology. Whether you're talking about materials, explosives, vehicle design, or whatever, information technologies are the "in" thing for all of the other technologies. So because there are very low barriers to access these kinds of technologies, the barriers to competition for our adversaries are also reduced across a very broad front. So our focus is about strategic need and overall transformation of that strategy. The president and secretary elevated transformation to the level of national strategy, corporate strategy, and risk management strategy.

Q *That, to my mind, is probably the most important thing that any administration has brought to the business of defense because for the first time, we have focused on concepts, strategies, and architecture. It seems to me that's the fundamental change in the way all the military services work together in this business called defense. You mentioned culture. It seems as if culture is the biggest challenge that you have in trying to get the Services to focus on this sort of strategic vision. Is that a fair statement?*

A It's a challenge. Cultural change is an output. It is also as difficult to define output as it is difficult to define input. Culture is described as the set of unstated assumptions that tend to govern the value structure, and hence the behavior, of a group of people. And exactly because

they're generally unstated, they're taken as inherently true. They're not considered or debated, and people can't even necessarily list what they are. So it's not particularly helpful to make a pronouncement that we're going after cultural change. The surrogate for it is changed behavior. That's really what you focus on.

Q *You've been called "the father of network-centric warfare." We spend a lot of time talking about that at DAU. Can you give us a thumbnail sketch of what network-centric warfare is? [Editor's note: See also "Scientific American Recognizes Cebrowski for Outstanding Leadership in Technology" on page 6.]*

A Network-centric warfare is a concept that, at the highest level, is the military's response to the information age. With all the great tectonic shifts in society, from—for example—the agrarian age to the industrial age or the

industrial age to the information age, the sources of power and wealth change. Society makes the adjustment—and it's normally a difficult adjustment and one that takes a long time. There is the chafing between the rules from the old age and those of the new age, but over time these are resolved. We see this going on in society today. For example, we have all of these court cases involving intellectual property. The information age is probably the best example of the chafing that is going to go on. The military is going to reflect that. It has been said that a nation makes war the same way it makes wealth. If the sources of power and wealth change for the nation broadly, they will change in an analogous (but not identical) way within the military. It is not identical because the enterprise is different. It's a rather unique undertaking to look at from the perspective of national defense. If you look, therefore, at what generates power in this age, you find it comes from information processes, from information itself, and is supported and enabled by information technology.



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Arthur K. Cebrowski

Director, Force Transformation Office of the Secretary Of Defense

Retired Vice Adm. Arthur K. Cebrowski was appointed by the secretary of defense as director, force transformation effective Oct. 29, 2001, reporting directly to the secretary and deputy secretary of defense.



The secretary of defense called for the creation of this new office in support of President Bush's broad mandate to transform the nation's military capabilities. The transformation process challenges the status quo with new concepts for American defense to ensure an overwhelming and continuing competitive advantage for America's military for decades to come.

As director, Cebrowski will be advocate, focal point, and catalyst for transformation. He will link transformation to strategic functions, evaluate the transformation efforts of the military departments, and promote synergy by recommending steps to integrate ongoing transformation activities. Among his primary responsibilities, Cebrowski will monitor service and joint experimentation programs and make policy recommendations to the secretary and deputy secretary of defense.

Cebrowski entered the Navy through the Reserve Officers Training Corps in 1964. He is a naval aviator and commanded Fighter Squadron 41 and Carrier Air Wing EIGHT. He commanded the assault ship USS GUAM, the aircraft carrier USS MIDWAY, and the USS AMERICA Battle Group. He has combat experience in Vietnam and Desert Storm. His joint assignments included service as the director, command, control, communications and computers (J-6), Joint Staff. After serving as the president of the Naval War College in Newport, Rhode Island, Cebrowski retired from the Navy in 2001 with over 37 years of service.

Cebrowski was born in Passaic, New Jersey. He is a 1964 graduate of Villanova University, holds a master's degree in computer systems management from the Naval Post Graduate School, and attended the Naval War College.

Network-centric warfare is first of all about human behavior, as opposed to information technology. Recall that while "a network" is a noun, "to network" is a verb, and what we are focusing on is human behavior in the networked environment. How do military forces behave, per-

form, and organize themselves when they're in the networked condition? This is what network-centric warfare focuses on. We find, for example, tremendous value coming from the shared awareness that's available to people who are networked. We also see that the quality of information improves in a networked environment. Timelines can be compressed. When we put the force in the networked environment, we see the de-massification of warfare—that is, the substitution of information for mass. One need look only at precision weapons for an example of that. By virtue of the fact that the bomb or the weapon is now informed, you need decidedly fewer of them than before. You see this operating at all levels of war. You see it in terms of strategic choices. Different strategic choices are available. Different operational choices are available. And certainly tactical-level behavior changes. Ultimately, we end up having to focus at the tactical level because that's where transactions take place. The tactical level is the check-out counter in the great department store of national security. It's at that transaction level that the behavior and the values are really revealed as well as the power of the underlying technologies. That's where you ultimately focus.

Q *One of the bottom lines is that the PEO [program executive officer] soldier is dealing with the problem today. The combat soldier on the ground needs connectivity to know what enemy's over the next hill and who's there as support against the enemy. That's a great application, in my view, of what network-centric warfare boils down to in a practical, warfighting environment.*

A Look at Operation Iraqi Freedom and you could see a multiplicity of these things operating simultaneously. At the individual soldier level, you saw soldiers and marines using the personal role radio—a little lip microphone coming out from underneath the helmet. Once soldiers have that at the squad level or the fire-team level, their tactics can change because they are no longer limited by how far they can shout or see hand signals. The warfighter's set of available tactics is larger than that of someone who is not similarly networked, and that affords an advantage.

If you look at the speed of response in the efforts to target Saddam Hussein, intelligence was developed, decisions made, locations determined, forces assigned, weapons selected, and a strike made, all within about 12 minutes. **[Editor's note: This interview took place before the capture of Saddam Hussein.]** This is an example of the time compression that's available when you put forces in the networked environment. It also shows how the barriers between various elements of the force get broken down. You can achieve a higher level of teaming than you could before. Consider the operations in Western Iraq, which is largely an example of what we call the non-con-

tinuous battlespace—a large number of small forces operating. You can't do that if you're not networked. There are several examples of special operations forces being able to work with Air Force and Navy aircraft and with other sources of force and fire to perform the mission that they had. That's an example of the operational level of war with choices not available to people who are not networked.

Q I have read that you're a student of Eric Beinhocker [MIT Sloan School of Management] and his organizational concept of innovative strategy. Would you please relate his concepts to DoD transformation for us?

A Well if you recall, step one was looking after your core competencies, pursuing basic good stewardship with your physical plant and the team that's executing. This is where you look after modernization, recapitalization, and efficiencies. What you're trying to do is be better still within the competitive space that you have already selected. This isn't transformation. This is just plain good management, being good stewards of the resources the nation's given us.

The second level is to push out the boundaries of current core competencies so that you are able, while performing the same basic missions, to add capabilities that you didn't have before. This is the sort of thing that I'm talking about when you put people in a networked condition—they're able to reach for tactics that they couldn't previously reach for. We've seen this, for example, in air-to-air combat, where we have a lot of data. One of the things we find is that fighters who are networked together and networked with other sensed platforms consistently outperform those who do not have data links. They do so because they can reach for tactics that the un-networked people can't because it's either



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physically impossible or it's not possible without increased risk. I suppose an extreme example is the shift to the non-continuous battlespace, the non-linear battlefield. You're doing air-land warfare as you have before, but you're approaching it a decidedly different way.

The third item is the bold bets. We're not talking about betting the family farm but about placing a bet that can have a profound impact on your future. If you look back, you can see some of these. The decision to pursue the global positioning system is one. That was a decision to enter a new competitive space, to decide that we could compete on the basis of superior navigation and time-keeping. Who would have thought it would be a central feature of military competition? It's a major jump. Of course it's a fairly large investment, but in the whole scheme of investments for the military, it's actually quite small. And the impact was profound. It changed the character of warfare and it changed what societies could do, not just what soldiers could do. Another excellent example of a big bet is nuclear-armed ballistic missiles on submarines being able to sense and communicate through space—stealth.

Those are what you might call big bets. The trouble is that they're all looking backward. The hard part is to identify similar items looking forward.

What might they be? I've got an idea of the areas into which they might fall. We call these "issues of regret" because we believe that 10 or 15 years from now, people may look back and say, "I regret that we never pursued that." The power is potentially so great in these areas. Take non-lethal weapons. Very important. Right now soldiers at a checkpoint are given little more than a toggle switch capability on the lives of people that approach that checkpoint. It's lethal force or nothing. It's a risk calculus we shouldn't have to subject our soldiers to. There's a lot we

Scientific American Recognizes Cebrowski for Outstanding Leadership in Technology

Arthur K. Cebrowski, director of DoD's Office of Force Transformation, has been named by *Scientific American* magazine as one of the "Scientific American 50." The annual list, which recognizes outstanding leadership in technology, appears in the December 2003 issue.

John Rennie, the magazine's editor in chief, explains: "Every year we watch how certain individuals and organizations play pivotal roles in directing that future's emergence. The *Scientific American* 50 is our chance to shine a light on these incredibly deserving leaders in research, industry, and policy."

Cebrowski was named a policy leader in defense because of his work over the last year in the network-centric approach to warfare. Network-centric warfare is the U.S. military's response to the Information Age by shifting emphasis from platforms like ships, aircraft and tanks, to unleashing the knowledge embedded in robust and distributed networks.

"What we are seeing, in moving from the industrial age to the information age, is what amounts to a new theory of war," Cebrowski said. "We have come to call that new theory of war 'network-centric warfare.' It is not about the network; rather, it is about how wars are fought and how power is developed."

The *Scientific American* 50 spotlights leaders of the year in areas such as research, business, and policy. These leaders are named in categories such as agriculture, chemicals and materials, communications, computing, defense, energy, environment, and medical treatments.

Editor's note: *The above information is based on a press release issued by the American Forces Press Service in November 2003. That press release drew in part on a Scientific American release.*

don't know about non-lethal force and its application. It's time and it's appropriate that we broaden the choices we give our leaders and our individual warfighters.

Next, directed-energy weapons of varying kinds. I'm not talking just about laser weapons, but in general about the kinds of weapons that travel at the speed of light. Think back to what happened when we put motorized vehicles on the battlefield and people no longer had to move on

foot or horseback. What a profound difference that made. Then we introduced aircraft. We essentially made an order of magnitude jump from walking and riding to motorized vehicles. We make another order of magnitude jump from land vehicles to air vehicles. Then we increase that power when we go to very high-speed air vehicles, say in the form of very high-speed weapons. Very high-speed weapons may be traveling on the order of 5,000 feet per second, mach 4.5 roughly, or even doubling that to 10,000 feet per second—but then consider 186,000 miles per second, the speed of light. Each one of these prior changes altered the character of the battlespace. Just imagine the magnitude change you get with speed-of-light weapons! We already have speed-of-light communications. Now what we are looking at is being able to marry the speed of weapons with the speed of communications. This can introduce a profoundly different military world. We can undertake a leadership position in this area or we can respond to someone else's being in a leadership position. The choice is ours.

Biologics is another area we must pursue. The number of battlefield deaths from infection went down throughout the 1930s and 40s as a result of better hygiene and antibiotics. Before that time, infection was the dominant factor in battlefield deaths. With the advent of aseptic practices and antibiotics, the dominant factor became death from the wounds themselves. Then with the advent of precision warfare, we took control of that portion of the physical battlespace and the total number of deaths resulting from wounds dropped. We could lose control of the biological battlespace—and that's not just on the battlefield but in society at large. This has to be a major focus area for homeland security in general. It's another area in which we can see a potential for big bets.

We can see changes in intelligence. Some big bets need to be placed in the realm of social intelligence. That's intelligence about the transactions between people broadly within societies because the frontiers of national security are actually at the fault lines deep within societies. Consequently we need the ability to look, understand, and operate deep in these fault lines to know the mindsets of potential adversaries. We know that this is going to be another area where we're going to want to be looking for big bets. What else?



You've not talked about space.



Space is another one. Space is one of the great common areas, and we have had and still have a superior position in space. The barriers, it's true, are falling, and that's because the capability per unit of mass on orbit is going up dramatically as a result of the power of information technology. Consequently, microstats have become very vi-

able. They can't fully supplant large vehicles in orbit for certain applications, but they can for some. This is an area that looks just like something out of Clayton Christensen's book *The Innovator's Dilemma*. Yes, it is not the top end system, but it is an invasion from underneath with a lesser capability. Over time, that capability is growing. The costs for it are coming under control. It's a different business model. It's a different risk management model. It approaches the market differently. In fact, it creates new markets. This is an area that's ripe for placing the big bets.

Q *Wonderful summary. Let me shift, if I may, in the time we have left to the acquisition side of the business. One of the issues that the under secretary of defense for acquisition, technology, and logistics thinks about probably every day is how to provide—I think this is a Pete Aldridge quote—“a context within which [he] can make decisions about individual programs.” As you know, in the acquisition business we see procurement proposals every day. The question is, how do we make those decisions in the context of your and Deputy Secretary of Defense Wolfowitz's vision about transformation? That has two aspects to it: managing the core business yes, but also finding ways to improve systems within the transformation architecture you are developing. I see problems on both ends. How would you answer that kind of concern on the part of the under secretary of defense for acquisition?*

A First of all, issues concerning acquisition start long before you get to acquisition. When that doesn't happen, we have the acquisition tail wagging the national defense dog, and dysfunction follows. Currently in the DoD, there's a major effort going on to elevate the strate-

gic planning portion of the PPBES [*planning, programming, budgeting, and execution system*], and that's appropriate because you very much need that. We have to shift executive time to the strategic beginnings of this process for maximum impact. By the time system decisions have been made, architectures have been determined, software has been written, and you're already into the development and testing processes, changes become very costly and very difficult. At that point, we're overtaken by the tyranny of the program of record. We need management structures and processes to allow us to diminish that tyranny. There are several factors that happen when you do this. One of them is that we come to realize that there's a difference—a substantive difference—in approach based on the product category that you're pursuing. If you're pursuing—to go back to Beinhocker's model—a Category I item, which is a modernization or recapitalization, then the processes that we already have in place are very well suited for that. That's the main line of the effort, but that is not the transformational effort. That is not where you find disruptive concepts or technologies.

For Category II and III efforts, we should be looking at different processes with different metrics. For example, if you're doing modernization and recapitalization, you already have a great deal of information on the performance of existing capabilities. You can change those capabilities, use the same metrics, and make a determination as to whether or not you're being appropriately rewarded for pursuing the new program. When you introduce a new capability, you have two fundamental problems. One is that you cannot cost it reliably, and the second is that you do not have a metric for its performance comparable with the



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previous system. Because you are pursuing the Category II or Category III change, you're going to get profoundly different behavior changes—behavior that's in a different category. How does one, for example, compare the value of this tactical toolbox versus some other array of tactics that a different technology would provide? You therefore need a different approach; you obtain operational articles as soon as possible. Many elements of acquisition get pushed very early in the process. You produce operational articles. You put them in the operating forces. You start gathering data. You start to see what the performance or the behavior change is, and when you see that happening on the ground, then you can start making judgments about its value. Furthermore, by virtue of the fact that you are introducing items sooner, you're getting costing information sooner. Even though this might not be fully consistent with what you're hoping for in terms of an end-state capability, you don't have a basis in experience and in data to make a judgment about this end state. You may want to change course. Look at the example of the high-speed vessel. This was just a ship taken up from trade and it saw combat action. When you look at it on its face value and you use the metrics that we normally use to determine utility of the ship, it doesn't measure up. One would never pursue it according to the old rules. But once we actually put it in the hands of the Navy, the Army, the logisticians, the naval special warfare forces, all of a sudden they realized its value. They could do some things that they couldn't do before. By virtue of the fact that they then developed hands-on experience with this ship, they could say, "Well, I need this, I need that, change this, modify that," and we're moving into the next phase. It started out as a very disruptive lease that the institutional department did not want, and we now have four of them in operation. I think we're in the



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process of procuring a fifth. All of them are different. We're all changing. We're learning as we go and essentially using this methodology to create our future. Of course there are spin-offs as well because you can look at these designs or technologies in this application and you can say, "Wow, they had payoffs. Maybe I should try something similar over in another application." It encourages people to look for different approaches. You can do that with a ship. What else can you do it with?

Q *Absolutely. We've traditionally looked to DARPA [Defense Advanced Research Projects Agency] and advanced concept development to push new concepts. Do these innovative teams seem to you to be working in the context that you just described for this application?*

A Yes. There is no one best methodology or approach. In the traditional acquisition approach, we frequently think in terms of developing off-ramps so that we have a way to, you might say, get off the program short of encouraging financial or technical problems and get something in the field. In your Category II and III changes, in those places where you're talking about disruptive technologies, what you're actually trying to do is create capability on-ramps.

When you have a vehicle that you essentially lease, you know you say, "Well there's no new technology here. This is all existing." Once you put it in the operating force, then you start turning to your other agencies, your government laboratories, DARPA, ACTD [Advanced Concept Technology Demonstration] approaches and the like; they can then build on this.

Q *Build those on-ramps?*

A That's right. Create the on-ramps and your capabilities grow from there. Next there's a difference in perspective and time and in time scale and technology scale in these various things. DARPA explores technology concepts. They do a marvelous job of it. They create the technologies that will be the technical catalyst for transformation, which is very, very powerful for us. The approach of the Office of Force Transformation is from the operational concept point of view. We try to look at behaviors that will be a catalyst for profound changes in capabilities. So largely then what one can do is back up and look for the technology concept pairing.

Q
Well put.

A We have an approach to doing this. Sue Peyton with her ACTD program has another approach. Her approach looks at a recognized need, at maturing technologies, does the pairing, and hopes to bring that capability to fruition. My approach is to look at unarticulated needs. That is the place where the institution has not been enlightened! There is a need to look at methodologies that the institution has not considered pursuing.

Q
Now a couple of last questions. We have a new acquisition strategy approach that is either evolutionary or spiral. Spiral seems to fit your model somewhat better in the sense that spiral gives one opportunities to create new on-ramps as one learns by doing. We're grappling with how best this might help the transformation process. Have you seen any examples of that so far?

A
What would Mike Wynne point to? How would he answer that?

Q
I don't know how he would answer that. We've been out talking about those two complementary parts of the process, and in my head, spiral development was always a place where if someone had a good idea and if there was money from ACTD or DARPA sources, you could then go and try it out.

A
That's right. If you apply the spiral approach to an existing system, what you're doing is what folks would have called P3I [*preplanned product improvement*], which is fine. The spiral development that I'm interested in is development upstream of a program decision, not downstream. A P3I is a Category I improvement, a modernization. Done well, it creates more capability. What we look for in the spiral, perhaps more than anything

else, is the creation not just of capability, but of new knowledge. The creation of opportunities that are our on-ramps that we talked about. So you can't logically separate experimentation from this process. Similarly, you cannot separate the requirement into a separate process.

Q
Exactly. Good point.

A
And then, because you're in the business of creating on-ramps, the need is the dog and the acquisition is the tail. That's what you want to get to.

Q
One last question: Lessons learned from Crusader? Any comments you would make about that?

A
Not from an acquisition point of view. The cancellation of Crusader was the result of the realization that our acquiring of capabilities has to be consistent with the strategic contexts in which we plan to use them. From a need point of view, it seemed to be a mismatch. Another thing: there are modernizations and recapitalizations over time operating on a basis of decreasing returns on investment, aggravated by a decreased utility as the strategic context changes. That itself is further aggravated by the very long capability cycle times. To the extent that we do not shorten capability cycle time, modernizations and recapitalizations tend to have decreased value, and spiral development approaches have increased value. I'd rather refer to spiral development as continuous adaptive acquisition. Further, it's meant to be continuous because learning has to be continuous. We want to be on a learning curve, not a step function—particularly not a step function where you only make a step every 15 or 20 years. We want it to be adaptive also because the need will change as the strategic context changes. I think we have to shed the concept of first in class, wherein our methodology is subordinated to the industrial age concept of economical production run.

Q
That is certainly a different way of thinking.

A
So the notion that the first thing to come off the line has to meet the requirements documents specifications and be fully combat-capable and supportable is, I think, inconsistent with the way capabilities are developed in this age.

Q
Thank you very much, Admiral Cebrowski. We appreciate your time.