



DIRECTOR OF NET ASSESSMENT

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

August 23, 1993

MEMORANDUM FOR THE RECORD

SUBJECT: Some Thoughts on Military Revolutions - Second Version

The purpose of this memo is to put down some ideas about the nature and character of military revolutions and to record where my office is in developing a better understanding of the current, potential military revolution. I also want to put forward some ideas about what ought to be done in the next two or three years. I'm doing this following talks with Bill Perry and John Deutch. Both are quite interested in the notion that a military revolution may be underway, or may be possible. I want to go beyond what I talked about with them to a fuller description of what might be undertaken if they and other top-level officials become convinced that, in fact, we are in the early stages of a major change in the nature of warfare.

A Military Revolution: What Is It?

I put this as a question, because it seems to me that there is often a misunderstanding about what one means by military revolution. The earlier terminology, referring to it as a military-technical revolution, is to be avoided because of the emphasis it puts on technology. Technology makes possible the revolution, but the revolution itself takes place only when new concepts of operation develop and, in many cases, new military organizations are created. There is also a tendency to talk about the military revolution. This could have the sense that it is already here, already completed. I do not feel that that is the case. Probably we are just at the beginning, in which case the full nature of the changes in the character of warfare have not yet fully emerged. The referent of the phrase, "the military revolution," is therefore unclear and indeed should remain to some extent undefined for now. It would be better to speak about the emerging military revolution, or the potential military revolution. What we should be talking about is a hypothesis about major change taking place in the period ahead, the next couple of decades.

Another way in which referring to the military revolution is an inadequate formulation is that we see in the past that usually all the major military nations have the relevant technologies, but each makes somewhat different uses of them. Each country in some sense has its own revolution. To some extent different countries have different military problems and use the new technology differently. Also, even when they have similar problems they may evolve different concepts of operations. When war comes which are the best concepts and organizations may become clear and everyone more or less copies the most successful innovation.

Different areas of warfare change in different ways. The new technologies may change warfare at sea in different ways than it does land warfare. For this reason there may be many revolutions even for one country.

It might be better to think in terms of our moving into a special period in military affairs, a period during which a major transition between regimes of warfare will take place. This seems to me to accord with the Russian usage. They point to examples in the past, such as the 20's and 30's, or the period immediately following World War II. If one looks at the whole sweep of military history, one can pick out special periods where what happens is that the available technology leads to major changes in the character of warfare in various areas of warfare. By contrast, in other periods the technology as it changes is used mainly to do what one is already doing, to carry out the kind of operations that one is already undertaking somewhat better. Then you come to periods of revolution where the character of warfare itself changes. The interwar years may be one of the most interesting periods for us to reflect on today; then, aviation technology, the tank, and the exploitation of various other technologies, such as radio and radar, led to really big changes in concepts of operation, and new military organizations were created to fully exploit the new systems. The character of warfare in World War II is very different from that of World War I. The technologies brought changes in almost all areas of warfare. In fact, some new areas were created: for example, long-range aerial bombardment.

The most compelling lesson that comes from looking at the 20's and 30's and at the first few years of World War II is that some military establishments do much better in developing the appropriate concepts of operation, making the organizational changes, and creating the doctrine and practices that fully exploit the available technologies. If no major wars occur along the way, each country has its own view of how best to make use of the available technology. Then war comes and it becomes clear that some countries' military have done a much better job of thinking through the appropriate concepts of operation and have made the necessary organizational changes. They have a dramatic advantage until the other military establishments can emulate them or make adjustments. This may take several years because of the difficulty of changing existing standard operating practices and the competencies of large organizations.

One of the implications I would draw from this, one that I will return to later, is that the most important competition is not the technological competition, although one would clearly want to have superior technology if one can have it. The most important goal is to be the first, to be the best in the intellectual task of finding the most appropriate innovations in concepts of operation and making organizational changes to fully exploit the technologies already available and those that will be available in the course of the next decade or so. The most important thing that we can focus on in the next several years is the investigation of, and experimentation with, novel concepts of operation and new organizations to exploit the technologies available now and likely to be available in the next 20 years.

As I said earlier, it's probable that we are near the beginning of the real revolution in military affairs. The Gulf War needs to be seen as something like Cambrai. A first trial of new technology and new ways of operating was undertaken. Because we are at the beginning, perhaps in 1922 in the analogy with the 20's and 30's, we cannot fully foresee how things are going to work out. This means to me that our first challenge is an intellectual one. We should not at this moment be rushing off to buy new equipment focused on our understanding as of this time.¹ We are already in the midst of adapting to the geopolitical revolution that has started with the Chapter 11 of the Soviet Union and our refocusing on regional threats. The possibility of a military revolution is superimposed on this already existing major source of uncertainty for our planning. While the technologies available may be useful, and some part of the revolution may take place as we adapt technology and our organizations to deal with the regional contingencies we now foresee, there are longer term questions and issues that should be addressed. What are our goals in the military revolution which may unfold over the next 20 years? What is our strategy for doing well? We have to think about potential emergence² of major threats in the future and how we could postpone their emergence. How are we going to deal with them as they emerge? How can we position ourselves to maintain our preeminent position? A large part of this preeminence will reside in superior ideas with respect to concepts of operation and organizational innovation. Indeed, being ahead in concepts of operation and in organizational arrangements may be far more enduring than any advantages in technology or weapon systems embodying them, and designing the right weapons systems may depend on having good ideas about concepts of operations. History shows the joint complex, interacting evolution of technology, systems, concepts of operations and organizations -- and new career lines for combat specialties associated with new weapons and concepts of operations.

For now, given the uncertainties, we are not sure how warfare will change. There are two major ideas about how warfare may change that seem very plausible. The first is that of long-range precision strike becoming the dominant operational approach. The Russians called

¹Indeed, there is a major capital stock management issue that arises if one believes we are in the early years of a period of major change in warfare. What balance should we have between procurement of already developed weapons now and experimentation with new systems with later procurement? How much for near term readiness versus efforts to explore new approaches for later threats.

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arrangements for such operations reconnaissance strike complexes. Thus far, this idea has been elaborated most in connection with a large continental air-land theater, but it seems plausible that long-range precision strike operations may also play a very prominent role in power projection, war at sea, and space.

The second idea is the emergence of what might be called information warfare. The information dimension or aspect of warfare may become increasingly central to the outcome of battles and engagements, and therefore the strategy and tactics of establishing information superiority over one's adversary will become a major focus of the operational art. Clearly one might wish to be more effective, more skillful in the acquisition and communication processing, the using of information with respect to targets or with respect to the intentions and moves of an opponent. Indeed, in the early stages of an engagement, one would take measures to widen this advantage through the protection of one's own information systems while partially destroying, disrupting, manipulating, or corrupting the information processing and gathering of the opponent. This full range of activities which may become an integrated area of military strategy and operations could be called information warfare. If in fact this development takes place, it will face us with very serious intellectual and analytic problems. For if there is one area in our ability to do analysis where we lack a well developed intellectual and analytic framework, it is in this area. Most of our modelling and simulation does a very poor job. Many models simply assume that C³I systems continue to function. At most analyses include the effects of possible partial disruption or disruption of command and control systems. So we may find ourselves in a situation where the part that we know the least about is becoming perhaps the most important, the most central, decisive area of conflict.

Since we may be just at the beginning of major changes in warfare, there may well be other areas of change that will emerge later. The two areas that we've talked about may themselves change or drop out as the central elements of the major change in the character of warfare. Another thing to say is that many other aspects of warfare may change and be impacted by the technologies that are available. That is, we have talked thus far almost solely about how the way we fight might change, but logistics and deployment practices may also change because of developments in information and communication technologies. The nature of the industrial base and its responsiveness and flexibility may be changed in important ways.

Some Implications

My impression is that a lot of people sign up to the notion that a military revolution is underway, but very few draw the significant consequences that should flow from that belief. As I have mentioned, I think you should see yourself as being at the beginning of a period in which really big changes will be taking place. That has a lot of strategic management implications. Some actions that could be taken now, if you truly believe that a revolution lies before you, are discussed below.

It goes almost without saying that one of the things you would want to do is to develop some longer term strategy for conducting yourself in this situation. We need to be clear about our long-term goals, clear about what we wish to achieve. In discussions and in another memo written some while ago, I put forward the possibility that we may want to think of two phases in the period that lies ahead; the first involves the world we are already living in, Chapter 11 of the Soviet Union, etc., and the focus on regional contingencies. The central military problems are power projection and peace making. Then, a second phase

which begins with the possible emergence of a major competitor or perhaps a coalition that may seriously challenge us. Delaying the onset of this phase and positioning ourselves to do well when this challenge arises would be the focus of attention now and during the first phase.

I believe that the most important thing for the next few years, given that we face no immediate large challenges, is to undertake a more active search for insights as to appropriate longer term changes in doctrine, concepts of operation, and organizational change. To some extent this is a matter of starting a process of search for, discovery of, and experimentation with, novel concepts of operation, organizational arrangements, etc.³ If one looks at the history of periods of military revolution, for example, the 20's and 30's, one sees that some of the key concepts arise quite early and then evolve as people explore them more thoroughly. The concepts have an impact on the second and third generations of equipment that embody the central technologies. Early on in development of naval aviation, the approach to longer range strike was through bombs dropped from airplanes at high altitudes flying straight and level. The Navy was the original supporter of the development of the Norden bomb sight. But against moving targets this type of bombing proved to be too difficult, and the idea of dive-bombing emerged. This then led to different aircraft designs and a variety of other adaptations. Also in the naval case, they began exploring fairly early what you could do if you could mount large scale strikes: that is, could get 200 airplanes in the air at once. This had implications for the design of the carriers, provision of crash barriers, the size of elevators, fuel lines up to the deck etc. So the sequence is to explore for concepts of operation which then feed back and refine the way in which the technology is used to develop appropriate weapon systems. In the 20's and 30's we did well at this for naval aviation, as did the Japanese. The UK, which had a big lead at the end of WWI, quickly fell behind. A lesson for us is that early leaders can easily lose out.

The second implication is that we ought to be looking for ways to increase the possibility of implementing the concepts of operation, new organizations, etc. This could be done through changes in educational programs and through changes in acquisition. There is a special problem in the acquisition system with its focus on a requirements-driven process. If

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you are in the midst of a period in which you don't know what the concepts of operation are going to be in the future, it's very difficult to formulate requirements with the level of certainty that the process now requires. You would like the acquisition system, or at least some part of it, to support the experimentation that is going to be required for effective innovation. Simulation may make experimentation with new equipment less needed than in the past, but will not eliminate that need.

If you look at history, you also see that in periods of this sort new career lines may be created to train officers with appropriate skills and expertise. This had to be done in the case of the aviators, but it is also the way in which the organization gradually accommodates the new weapon systems and develops the appropriate tactics and doctrines that go with their use. Information warfare is a possibility in this case, although it so permeates everything that it may not be appropriate to create a new line of specialists. But somehow one is going to have to have people who focus their minds on the appropriate techniques and doctrine to develop the intellectual attention to information warfare.

Specific Possible Actions

The ideal thing would be for the Secretary of Defense and Bill Perry, perhaps together with the Chairman, to put in place a special initiative in the area of the military revolution. This would be a way of focusing attention on, and increasing the amount of thinking about, ways in which warfare might change, new concepts of operation, and how to use available technologies. Some wargames and simulations can be organized by OSD, or conducted through contracts from OSD, but when you come down to it, the Services and the Joint Staff are the ones who have to make a revolution really happen. Most of the thinking about future warfare that is going on exists in the Services. The objective of the Secretary and the Deputy Secretary now could be to encourage the existing programs and to try to increase the level of effort. The Services have to be persuaded to put some of their very best people on the intellectual task of thinking about the future of warfare, how it will change, and the character of the new doctrines, concepts of operation, and organizational adaptations. This means changing the careers of some of these people so they can spend more time at war colleges, perhaps participating in wargaming and in research programs associated with the war colleges. They would have to get credit for this in their careers; it has to be a way to the top for them. The period we are in ought to lead to some refocusing away from the task of readiness and of training in current skills and operational doctrines to the intellectual task of finding the next and future operational concepts and organizational forms. This means accepting, perhaps, some increased near-term risks.

One might think of creating organizations like Rand of the 1950's. This would be a way of focusing high quality manpower on a full time, long-term basis on thinking about the implications of new technology in a wide range of future contingencies. It took Rand several years to make real progress, but by the end of the 50's, a lot of new insights emerged.

Probably, you would want to create new, small organizations, perhaps several of them. There, and at the war colleges, we might develop new analytic tools and find out how to use wargaming to explore for novel appropriate concepts of operation and the organizational arrangements for the use of hypothetical weapons 10 to 20 years from now. I mentioned earlier the area of information warfare which requires a lot of intellectual effort before we can make much analytic progress.

It might also be useful to create for the Secretary and Deputy Secretary a strategic studies group modeled after the CNO Strategic Study Group. This is a group of about 12 officers that serve for a year in a special group at the Naval War College. They are given a task by the CNO and report to him at the end of the year. Such a group reporting to the Secretary and Deputy Secretary could be a way of exploring some of the intellectual problems that lie ahead.⁴ Another possibility is to create a program of SecDef Fellows who would spend part of their time at Universities and at business organizations that are at the forefront of developing and thinking about the uses and implications of new technologies, especially in the information processing and communication technology areas. In particular, it would be useful if they could spend time focused not on the technologies themselves, but on the implications of these technologies for the way industrial organizations function or the way in which society will be changed by the rapidly developing technologies in these two areas. All of these would require funds to undertake these programs. It might be useful to set aside funds for support of a program that could be developed over the next few months and approved by the Secretary and Deputy Secretary. Some of these funds would be for studies, others for seed money to begin some of the potential programs, either those directly for the Secretary and Deputy Secretary, or as assistance to the Services or the Joint Chiefs for activities they want to undertake in response to the urging of the Secretary and Deputy Secretary. For example, I have allocated some money at the Air War College to help John Warden undertake a program there focused on the military revolution. There is a lot of leverage that can be had with fairly small amounts of money, if one finds people in the Services who want to explore innovative ideas.

In any case, I would repeat that the central issues now are intellectual, and we can afford to address these issues even within reduced budgets. What is needed is:

- Secretary of Defense/Deputy Secretary of Defense attention and leadership in putting together a special effort.
- Funding to support agreed-upon efforts.

The proposed new effort under John Deutch with Policy, Acquisition, and Joint Staff

⁴Another payoff is the creation over time of a network of people who have had the special experience of taking a top-level strategic management view of some set of important issues. This set of people and shared experience may make innovation and change easier than it otherwise might be.

participation may be able to develop a proposed set of actions for the Secretary and Deputy Secretary to take. Some efforts are already underway in the Services and in OSD. Additional activities like the SecDef Strategic Studies Group, if proposed and approved, will need a bureaucratic home and base of support as well as funds.

One last thing to consider is that if the next couple of decades are to be a period of innovation, the SecDef might want to pay special attention to the selection of the future Chairman and head of Services. One of the lessons of history is the major role played by

top-level support to more junior innovators and also the role of the Congress. Our situation is very different in many ways than it was in the 20's and 30's, but my guess is that top-level support of innovation will remain very important. But innovation may be more difficult than it was then. There may not be any new platforms (e.g., carriers) for innovators to rally round and commit themselves to; maybe space platforms, if space emerges as a major warfare area. The technologies (information, computational, communication) that seem central suffuse everything, the same way that small electric motors did several decades ago, changing everything, but creating no new major system like the automobile or the airplane. New innovation strategies may be required.



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The most compelling lesson that comes from looking at the 20's and 30's and at the first few years of World War II is that some military establishments do much better in developing the appropriate concepts of operation, making the organizational changes, and creating the doctrine and practices that fully exploit the available technologies. If no major wars occur along the way, each country has its own view of how best to make use of the available technology. Then war comes and it becomes clear that some countries' military have done a much better job of thinking through the appropriate concepts of operation and have made the necessary organizational changes. They have a dramatic advantage until the other military establishments can emulate them or make adjustments. This may take several years because of the difficulty of changing existing standard operating practices and the competencies of large organizations.

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As I said earlier, it's probable that we are near the beginning of the real revolution in military affairs. The Gulf War needs to be seen as something like Cambrai. A first trial of new technology and new ways of operating was undertaken. Because we are at the beginning, perhaps in 1922 in the analogy with the 20's and 30's, we cannot fully foresee how things are going to work out. This means to me that our first challenge is an intellectual one. We should not at this moment be rushing off to buy new equipment focused on our understanding as of this time.¹ We are already in the midst of adapting to the geopolitical revolution that has started with the Chapter 11 of the Soviet Union and our refocusing on regional threats. The possibility of a military revolution is superimposed on this already existing major source of uncertainty for our planning. While the technologies available may be useful, and some part of the revolution may take place as we adapt technology and our organizations to deal with the regional contingencies we now foresee, there are longer term questions and issues that should be addressed. What are our goals in the military revolution which may unfold over the next 20 years? What is our strategy for doing well? We have to think about potential emergence² of major threats in the future and how we could postpone their emergence. How are we going to deal with them as they emerge? How can we position ourselves to maintain our preeminent position? A large part of this preeminence will reside in superior ideas with respect to concepts of operation and organizational innovation. Indeed, being ahead in concepts of operation and in organizational arrangements may be far more enduring than any advantages in technology or weapon systems embodying them, and designing the right weapons systems may depend on having good ideas about concepts of operations. History shows the joint complex, interacting evolution of technology, systems, concepts of operations and organizations -- and new career lines for combat specialties associated with new weapons and concepts of operations.

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which begins with the possible emergence of a major competitor or perhaps a coalition that may seriously challenge us. Delaying the onset of this phase and positioning ourselves to do well when this challenge arises would be the focus of attention now and during the first phase.

I believe that the most important thing for the next few years, given that we face no immediate large challenges, is to undertake a more active search for insights as to appropriate longer term changes in doctrine, concepts of operation, and organizational change. To some extent this is a matter of starting a process of search for, discovery of, and experimentation with, novel concepts of operation, organizational arrangements, etc.³ If one looks at the history of periods of military revolution, for example, the 20's and 30's, one sees that some of the key concepts arise quite early and then evolve as people explore them more thoroughly. The concepts have an impact on the second and third generations of equipment that embody the central technologies. Early on in development of naval aviation, the approach to longer range strike was through bombs dropped from airplanes at high altitudes flying straight and level. The Navy was the original supporter of the development of the Norden bomb sight. But against moving targets this type of bombing proved to be too difficult, and the idea of dive-bombing emerged. This then led to different aircraft designs and a variety of other adaptations. Also in the naval case, they began exploring fairly early what you could do if you could mount large scale strikes; that is, could get 200 airplanes in the air at once. This had implications for the design of the carriers, provision of crash barriers, the size of elevators, fuel lines up to the deck etc. So the sequence is to explore for concepts of operation which then feed back and refine the way in which the technology is used to develop appropriate weapon systems. In the 20's and 30's we did well at this for naval aviation, as did the Japanese. The UK, which had a big lead at the end of WWI, quickly fell behind. A lesson for us is that early leaders can easily lose out.

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If you look at history, you also see that in periods of this sort new career lines may be created to train officers with appropriate skills and expertise. This had to be done in the case of the aviators, but it is also the way in which the organization gradually accommodates the new weapon systems and develops the appropriate tactics and doctrines that go with their use. Information warfare is a possibility in this case, although it so permeates everything that it may not be appropriate to create a new line of specialists. But somehow one is going to have to have people who focus their minds on the appropriate techniques and doctrine to develop the intellectual attention to information warfare.

Specific Possible Actions

The ideal thing would be for the Secretary of Defense and Bill Perry, perhaps together with the Chairman, to put in place a special initiative in the area of the military revolution. This would be a way of focusing attention on, and increasing the amount of thinking about, ways in which warfare might change, new concepts of operation, and how to use available technologies. Some wargames and simulations can be organized by OSD, or conducted through contracts from OSD, but when you come down to it, the Services and the Joint Staff are the ones who have to make a revolution really happen. Most of the thinking about future warfare that is going on exists in the Services. The objective of the Secretary and the Deputy Secretary now could be to encourage the existing programs and to try to increase the level of effort. The Services have to be persuaded to put some of their very best people on the intellectual task of thinking about the future of warfare, how it will change, and the character of the new doctrines, concepts of operation, and organizational adaptations. This means changing the careers of some of these people so they can spend more time at war colleges, perhaps participating in wargaming and in research programs associated with the war colleges. They would have to get credit for this in their careers; it has to be a way to the top for them. The period we are in ought to lead to some refocusing away from the task of readiness and of training in current skills and operational doctrines to the intellectual task of finding the next and future operational concepts and organizational forms. This means accepting, perhaps, some increased near-term risks.

One might think of creating organizations like Rand of the 1950's. This would be a way of focusing high quality manpower on a full time, long-term basis on thinking about the implications of new technology in a wide range of future contingencies. It took Rand several years to make real progress, but by the end of the 50's, a lot of new insights emerged.

Probably, you would want to create new, small organizations, perhaps several of them. There, and at the war colleges, we might develop new analytic tools and find out how to use wargaming to explore for novel appropriate concepts of operation and the organizational arrangements for the use of hypothetical weapons 10 to 20 years from now. I mentioned earlier the area of information warfare which requires a lot of intellectual effort before we can make much analytic progress.

It might also be useful to create for the Secretary and Deputy Secretary a strategic studies group modeled after the CNO Strategic Study Group. This is a group of about 12 officers that serve for a year in a special group at the Naval War College. They are given a task by the CNO and report to him at the end of the year. Such a group reporting to the Secretary and Deputy Secretary could be a way of exploring some of the intellectual problems that lie ahead.⁴ Another possibility is to create a program of SecDef Fellows who would spend part of their time at Universities and at business organizations that are at the forefront of developing and thinking about the uses and implications of new technologies, especially in the information processing and communication technology areas. In particular, it would be useful if they could spend time focused not on the technologies themselves, but on the implications of these technologies for the way industrial organizations function or the way in which society will be changed by the rapidly developing technologies in these two areas. All of these would require funds to undertake these programs. It might be useful to set aside funds for support of a program that could be developed over the next few months and approved by the Secretary and Deputy Secretary. Some of these funds would be for studies, others for seed money to begin some of the potential programs, either those directly for the Secretary and Deputy Secretary, or as assistance to the Services or the Joint Chiefs for activities they want to undertake in response to the urging of the Secretary and Deputy Secretary. For example, I have allocated some money at the Air War College to help John Warden undertake a program there focused on the military revolution. There is a lot of leverage that can be had with fairly small amounts of money, if one finds people in the Services who want to explore innovative ideas.

In any case, I would repeat that the central issues now are intellectual, and we can afford to address these issues even within reduced budgets. What is needed is:

- Secretary of Defense/Deputy Secretary of Defense attention and leadership in putting together a special effort.
- Funding to support agreed-upon efforts.

The proposed new effort under John Deutch with Policy, Acquisition, and Joint Staff

⁴Another payoff is the creation over time of a network of people who have had the special experience of taking a top-level strategic management view of some set of important issues. This set of people and shared experience may make innovation and change easier than it otherwise might be.

participation may be able to develop a proposed set of actions for the Secretary and Deputy Secretary to take. Some efforts are already underway in the Services and in OSD. Additional activities like the SecDef Strategic Studies Group, if proposed and approved, will need a bureaucratic home and base of support as well as funds.

One last thing to consider is that if the next couple of decades are to be a period of innovation, the SecDef might want to pay special attention to the selection of the future Chairman and head of Services. One of the lessons of history is the major role played by

top-level support to more junior innovators and also the role of the Congress. Our situation is very different in many ways than it was in the 20's and 30's, but my guess is that top-level support of innovation will remain very important. But innovation may be more difficult than it was then. There may not be any new platforms (e.g., carriers) for innovators to rally round and commit themselves to; maybe space platforms, if space emerges as a major warfare area. The technologies (information, computational, communication) that seem central suffuse everything, the same way that small electric motors did several decades ago, changing everything, but creating no new major system like the automobile or the airplane. New innovation strategies may be required.



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