"Trends in the Defense Industrial Base"

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Dr. Hensel: Thank you. Thank you very much. Well, I appreciate that wonderful introduction. Good morning to all of you. This is always a wonderful opportunity to be here at the Air and Space Technology Conference and Exposition. I really think it's just a fascinating gathering, because there are just so many different policymakers and leaders and scholars and practitioners. I always really enjoy attending the sessions and also just talking with people and with talking audiences, talking at the various dinners and lunches, so this is a really fun opportunity for me.

I wanted to focus my comments today on some of the recent trends in the defense industrial base. As all of you know, the defense sector has witnessed many changes over the past 20 years, including cycles of shrinkage and expansion in the defense budget.

We have seen globalization of the defense sector, as we've seen globalization of a lot of different sectors in the US economy. We've seen a lot of consolidation in our defense sector during the 1990s following the end of the Cold War when there was some excess capacity in the industry.

We've also seen the demand for certain types of weapon systems, with the emergence of a new type of threat in the post-9/11 world, which is the threat of terrorist groups that really tend to transcend the boundaries of nation-states and really serve as an enemy I think to most civilized countries.

There are now some new additional challenges faced by the defense sector, in the form of the global financial crisis and also in terms of the increased emphasis on controlling the cost growth in weapon systems and then finally the shift in defense priorities outlined by Secretary of Defense Gates in April of 2009.

So this presentation is going to explore some of the trends in those forces and also discuss some of their potential impact.

This chart here shows national defense consumption and investment outlays as a percentage of GDP in the first column and as a percentage of total government outlays in the second column.

And you can see that back in 1960, defense made up about ten percent of the GDP, dropping to eight and a half percent in 1970, dropping down to five percent in 1994, dropping down to 3.77 percent in 2000 and then climbing back up. We're at about four and a half percent of GDP now.

Some of this change in the percentage, some of the reason why we were at ten percent of GDP in 1960 and at four and a half percent now is due, of course, to the growth in GDP. I mean, our GDP in the U.S. has grown significantly over the past 40 years, and in fact even the makeup of GDP has changed as well.

The second column shows the national defense consumption and gross investment outlays as a percentage of total government outlays. You can see that back in 1960, defense outlays were 47 percent of federal outlays. And then they dropped down to 37.5 percent and then down into the 20s, and here in 2009 we're at about 25 percent of government outlays.

And again, some of this is due to the cycles of growth and shrinkage in defense spending, but a lot of it is actually due to the growth in the federal budget. The federal budget has grown significantly.

This chart here, which shows annual federal outlays and national defense outlays between 1990 and 2008, I think really captures it, because you can see that federal outlays have gone up quite steeply between 1990 and 2008. And while defense has gone up, it hasn't gone up at nearly the speed.

And of course, as many of you know, federal spending has significantly increased now with the desire to try to re-stimulate the economy. In fact, we're expecting budget deficits of about $9.1 trillion between 2010 and 2019. So there's going to be a real -- That graph in a couple of years is going to be going up much more sharply I think.

Now the current economic conditions, I think, impact the defense sector in several ways. The first way is through the budget. As I mentioned, there is going to be $9.1 trillion deficits forecast between 2010 and 2019 for the federal budget. It is expanding significantly to re-stimulate the economy. It's currently -- Our debt to GDP ratio in the U.S. is about 41 percent, and that's going to

be going up by the end of this year to about 61 percent and it may continue to climb.

I think that as concern grows over the potential size of budget deficits, there may be some pressure to try to control spending. And this in turn could lead to cutbacks in certain areas of the budget, possibly even on the defense end. If defense spending is in fact reduced in an effort to try to keep budgets down, there may be a reduction in demand for defense-related military products.

The impact of the economic crisis can also hit defense contractors on the commercial side. And the way that that would happen is if there are tight financing constraints on customers for the commercial aircraft, there may then be some more deferrals in order deliveries. There may be fewer aircraft orders, and then that in turn can hit the overall margins of defense contractors, which in turn could, depending upon their debt, over time impact their credit ratings and their borrowing capacity. So the economic crisis does have the potential to impact the defense sector in several ways.

Overall in the economy, the unemployment rate is about 9.7 percent, up from 9.4 percent the month before and it was 9.5 percent actually the month before that. And this is the highest unemployment rate that we have seen since 1983.

We have lost 6.7 million jobs in the U.S. since December of ’07 when this recession started. And we lost actually just 216,000 jobs last month, which ironically is actually less of a rate of job loss than we had back in January.

So we’re getting fewer job losses, but the unemployment rate in the economy overall is climbing significantly. I think that this is a recession that could lead to what’s known as a jobless recovery.

What I mean by that is that improvements in the labor market could actually lag improvements in GDP growth. We saw that in the 1991 recession and in the 2002 recession, where about 18 months after the recession ended there was only about a plus or minus one percentage point change in employment.

However, if you look at the 1982 recession, which did not have a jobless recovery, we saw about a six percent reduction in the unemployment rate 18 months after the recession had ended.

Some of this is, I think, due to -- Some of the reasons why jobless recoveries exist are due to improvements in worker productivity. When workers are more productive in the post recession period, as was the case in '91 and '02, there's less of an incentive for companies to hire new people because they're getting more work out of the existing ones. And that could be something that we're going to see.

In the aerospace and defense sector, they're expected to lay off 30,000 people in 2009, which is about four and a half percent of the work force. And probably these layoffs are going to be continuing through 2010.

I wouldn't think that the rate of job loss would exceed ten percent in the sector, and I don't think it's going to reach nearly the levels that we saw in the post Cold War period, where we saw about 40 percent cuts in jobs.

So I think that we could see some attenuation and shift in skill sets if there is a change in the reduction in demand for certain types of weapon systems. As unemployment climbs and people are laid off, there will obviously be attenuation in skill sets.

Also, I think another factor that could lead to this is the retirement of the baby boomers. As more workers retire and age, I think that key skill sets will be lost.

The number of workers that are eligible for retirement across 43 aerospace and defense companies has really been increasing. It was 5.7 percent last year, and it has more than doubled here in 2009, to 13 percent. And it's probably going to hit 18 percent in 2011 and 20 percent in 2013. So that's really something that I think that the sector is going to be facing as a potential challenge in the future.

Credit from banks continues to be very tight in the economy in general. Financial institutions do, of course, have funds but they're using a lot of these funds as a capital cushion to protect themselves against further loan losses.

The result of this is that in the second quarter of this year the number of loans made by the top 15 U.S. banks actually contracted by 2.8 percent. It is really not expected that loan portfolios are going to be growing much more until about the middle of 2010. So banks are very reluctant to lend.

As a side note, interestingly enough, the reserves have gone up a lot. Because when the federal government buys securities from the banks, the proceeds of those sales are credited as reserves in the banks. And so, when the banks actually, when they ultimately do begin lending, that's when people are concerned that inflation could ensue. That's why people are concerned about how the fed is going to withdraw liquidity from the system.

The way that the tight credit from banks can impact defense contractors in the upcoming months, as I said earlier, comes in the form of the tight financing faced by some of the customers of commercial aircraft, on the commercial side for defense contractors. Again, deferral or cancellation of order deliveries, which really, the trends from that have not been that significant yet, and I'll talk more about that. It could though, if they did accelerate, impact overall profit margins for defense contractors and also as less output and volume is going through the production facilities this may impact the ability of contractors to generate economies of scale and to lower costs.

Will we see reduced production over time if the crisis persists? Hopefully, the crisis won't persist. I think it's very likely that we're going to see an upturn towards the early part of next year, early to mid part of next year; the early to mid part of 2010. I think it will be a slow recovery though, because a lot of damage has been done.

But I think that, to take the example of Boeing and AirBus on their commercial fronts, they have been very cautious. Very cautious and very careful.

AirBus, in fact, reduced the number of A380s that it planned to produce this year from 18 down to 14. Boeing, in late June and July, planned to reduce production rates for next June for the 777 and also to delay planned ramp ups for the 747 and the 767.

Boeing has accommodated already some commercial jet delivery deferrals, about 60 in the first quarter, 70 in the second quarter. On balance, I see caution on the part of the commercial side of defense contractors, but as yet, hopefully that caution isn't going to turn into a reality if we recover soon enough from this.

Currently overall, I think there has been strong production, to take the example of AirBus and Boeing as an example. We've seen fewer new orders than last year, but actually the number of deliveries has been about the same.

AirBus booked 90 gross orders and had 22 cancellations in the first six months of 2009. It delivered 245 aircraft in the first half of last year, about 254 in the first half of this year.

Boeing booked 57 new orders in the second quarter, which was less than the 187 orders from the second quarter of last year. It delivered 125 planes, which is only one less than in the second quarter of 2008.

So far, the crisis really hasn't hit defense contractors on the commercial side that badly. It could have been a whole lot worse. Hopefully, we'll get out of this crisis fairly soon.

Overall in the economy, there has been some improvement in manufacturing activity. Inventories have now run down, so manufacturing has jumped up to restock those inventories. Also, there was a burst of manufacturing activity in auto production for the Cash for Clunkers program, which all of you know has now ended.

I think that in order to get a sustained increase in manufacturing activity, we're going to need to get some sustained growth in consumer spending. Of course that's linked back to the unemployment rate. If people are afraid that they're going to lose their jobs, they're not going to spend. If they don't buy things, then the manufacturing activity growth is going to be significantly limited.

We actually saw new orders for durable goods rise 4.9 percent in August; that's the highest level in two years. And it was higher than what economists expected at 3.0 percent.

Part of that was because there were a lot more orders for civil aircraft than were expected and that can be a somewhat volatile component of the manufacturing industry. It's a hard one to predict, and I wouldn't want to rely on that alone; I think we're going to see broader consumer spending across the economy so that those inventories that are restocked actually get sold and then replaced again.

On the consumer spending front, as I said, it has showed a bit of improvement; hopefully, this isn't just transitory. Month over month over the past three months there have been increases in consumer spending. There was actually an increase in consumer spending from June to July of 0.2 percent, although again, three-quarters of that was driven by consumer purchases of autos and the Cash for

Clunkers program. Hopefully the spending will continue, even though the program is gone.

Over time though, if the economy doesn't improve, I think reduced consumer spending can lead to lower air traffic, lower demand for commercial aircraft, and then that goes into lower earnings for defense contractors and depending upon their amount of debt, potentially lower credit ratings and higher borrowing costs. Hopefully that's a path that we won't have to traverse.

Another area where the defense sector is facing some challenges, I think, and opportunities for growth as well is in the shift in defense priorities. Secretary of Defense Gates in April of 2009 outlined new priorities which have a greater focus on fighting insurgent forces in places like Iraq and Afghanistan and a bit less of an emphasis on the need at this time to fight more conventional forces, more conventional foes.

That has led to a change in the demand, I think, for the types of military equipments that are needed. There is less need and demand for equipment that might be more helpful in conventional warfare, like the F-22, and there is much more of an increased demand for military equipment to combat insurgent forces in Iraq and Afghanistan, like unmanned aerial vehicles.

Of course, this also has impacts for the budgets because the F-22s were about $143 million apiece; that's a lot of money. I'd like $143 million. So the unmanned aerial vehicles, many of them, are much cheaper.

I think that this shift in demand not only has budgetary impacts, but it also has impacts for which regions of the country are benefitted. Because it depends on where the systems are made as to how many jobs are created in that particular area, which brings me to my next point.

We have been seeing a debate between Congress on the one hand and the Pentagon on the other over concerns about on the one hand economic growth and employment in congressional districts and on the other hand military concerns that are linked to strategic priorities and budgetary pressure. I think this type of debate is one that we're going to continue to see in the short-term, particularly as the economy's rate of improvement is a little on the slow side.

As I mentioned, this could very well be a jobless recovery. So I think unemployment rates are going to lag

improvements in GDP growth. So we may have certain states where unemployment does remain very high, even after the economy turns up, and higher in some states than in other states.

One example of this debate was in the debate over whether or not the F-35 Joint Strike Fighter needed a second jet engine made by GE and Rolls Royce. Some congressional representatives thought that that might be a good idea. Secretary of Defense Gates argued that the primary engine built by Pratt and Whitney was enough. He stated: "Where a dollar added to one program takes away from another program that we think is more important, we feel strongly about the fact that there is not a need for a second engine."

So definitely, he's focusing on budget constraints and what is the minimum amount that is needed, given the budget constraints.

There was also a debate over the Boeing C-17, and most recently there was a group of U.S. Senators who wanted funding for an additional 12 Boeing C-17s. Their justification was partially to keep the Boeing production line open and to maintain a strong aerospace industry.

We saw the conflict again over the conflict over executive jets, where the Pentagon had submitted a request for fewer executive jets and some congressional representatives wanted more executive jets. Jeff Morrel, who is a spokesperson for Secretary of Defense Gates noted, "It forces us to take money from things we do need to fund and redirect it for things we don't need. The bottom line is for everything that they appropriate for us above and beyond what we've asked for, it will at some point require us to find money from programs that we do need."

Yet on the other hand, you have Representative Young from Florida who knows that the Pentagon is not the fountain of all knowledge; they don't have all the knowledge and they don't have all the wisdom. Neither does the administration, and neither does Congress, and that's why we work together.

So I think we're going to continue to see debates like this, particularly heightened as Representatives and Senators have significant employment problems in their districts. Because some of these concerns are tied to issues like that.

But I think that this whole broader debate really highlights the issue that the CEO of Raytheon, Mr. Sugar, noted, which is that spending decisions really are a

balancing act between addressing dangerous national security threats and fiscal spending constraints. So I think that we'll see a little bit more of that type of debate.

Now with the shift in defense priorities, I think that some new areas of growth are emerging for the defense sector. And I think that these are areas where we can really expect to continue to grow, even if defense sales overall flatten. Those would be homeland security, cyber security, C4ISR products, and unmanned aerial vehicles.

President Obama has placed a greater emphasis on modernization of the force, usage of UAVs, greater dependence on space-based electronic warfare and communication systems, so there's definitely a move in that direction. I think that these are areas of growth.

The UAV market is estimated to be about 62 billion dollars over the next ten years. I think that, much as the Vietnam wore was sort of a helicopter war, I think that the wars in Iraq and Afghanistan have really showed the potential for unmanned aerial vehicles.

That's part of the reason why they've gone from, at the beginning of the war, about 4 percent of the Army's flying hours to about 40 percent right now. That's a pretty big jump.

I think that this sector provides opportunities for some of the smaller, younger, more innovative entrants to enter, and also opportunities for the larger more established defense contractors who have improved their knowledge base and gotten into the sector, to some degree partially through acquisitions.

Some examples, of course, of the younger firms are General Atomics, which I saw had a beautiful ad in the program for AFA. This makes the Predator and the Reaper planes.

We have AeroVironment, which makes the Ravens. It's also developing the Global Observer Platform. In fact, analysts really estimate 18-22 percent growth in revenues for AeroVironment over the next couple of years.

In other countries, we have the UK developer, Kinetic, that has been developing an ultra long-duration high-altitude system called the Zephyr. In Israel, there's a platform manufacturer called Elbit. So we're seeing smaller entrants in the U.S. and also all over the world starting to enter this market space.

Some examples of larger firms which enhance their capabilities through acquisitions: Northrop Grumman is one example, and that produces the Global Hawk. Some of its abilities in terms of entering the UAV market and developing these products were achieved through acquisitions.

Northrop acquired Ryan Aeronautics that had expertise in target drone production and design. They recently acquired Swift Engineering, which has expertise in Blended Wing UAVs. Boeing acquired the Insitu group in June, and that produces the smaller ScanEagle unmanned aerial vehicle.

Then we have some other big manufacturers as well that are starting to enter the space. In the UK, BAE is developing the Mantis Advanced Concept Demonstrator. L-3 is developing a long-endurance medium-altitude plane called the Mobius, which can be manned or unmanned. This is very much an evolving space, and I think it provides a lot of opportunities for a number of different types of firms.

The question here is, are mergers a solution to some of the problems the defense sector is facing? The possibility of reduced defense spending, does that lead to mergers? Will mergers help? We saw that this was certainly a reaction that happened at the end of the Cold War, during the 199s. Of course with the development of growth in some of these other sectors, C4ISR, unmanned aerial vehicles, there is more of a demand for R&D and for knowledge sharing. Mergers can certainly help with that. In general, mergers lead to the formation of more permanent relationships, and they also provide a lot of opportunities for cost cutting by reducing the size of the work force, by sometimes enabling a greater production volume to go through the same set of manufacturing facilities and to generate economies of scale and lower cost. You can reorganize the corporate hierarchy to internalize transactions costs that would have been bigger if one had been involved in an arms-length relationship. But there are also substantive costs of mergers; integration and absorption costs, communication difficulties. Mergers can have a very permanent impact on the market structure in terms of whether new entrants can enter, in terms of the market concentration ratios, and also in terms of market power. And they can be very hard to undo.

I think that acquisitions of smaller firms by larger firms can make a difference right now. In the UAV market, we certainly have seen that with Northrop's acquisitions of Ryan Aeronautics and Swift Engineering, and Boeing's acquisitions. Because there is an opportunity to share

skill sets and to pool and R&D efforts, but since these are smaller firms you're not going to have the high absorption integrations costs that you might see in mergers between very large defense contractors.

As I said, there was a substantive wave during the 1990s of mergers, sometimes between large defense contractors, such that actually 51 separate defense firms or units as of 1980 had been folded into the top four defense firms by 2001. And we saw that the top five defense contractors in '01 had the same share of prime contracts that the top ten defense firms in 1985 had received.

Last year I did a study where I actually took a look at the impact of the merger wave during the 1990s on the costs of weapon systems and did we see lower per unit costs in weapon systems where the manufacturers had merged. I examined cost data on about 304 systems between 1981 and 2006, and I found really that the evidence was mixed.

I found that in terms of per unit cost, about 20 percent of the firms experienced lower per unit costs after the merger; about 18 percent of them experienced increases in per unit costs. So on the one hand we saw more of a tendency towards lower per unit costs and cost efficiency than the other way around. But these percentages are awfully close, so I would say the evidence is mixed.

The other point is that only 18 plus 20 percent, i.e., 38 percent of systems experienced significantly higher or lower per unit costs following mergers, which suggests to me that 62 percent of the systems I looked at really didn't have an appreciable change in their cost structure.

So this would suggest to me that based upon, certainly looking at this set of data, the mergers from the '90s didn't necessarily yield all the benefits that were hoped. They yielded some, but integration costs, absorption costs; those may have been at issue.

Alliances, I think, can often be a good alternative to mergers. Part of this is because the parties involved in an alliance can share R&D, they can share knowledge. There are still opportunities to enter new markets. There are a number of benefits. They can also, of course, be easier to disassemble than mergers.

On the downside, however, with alliances, they may lack the depths of integration that are found in mergers. So you won't get the same types of efficiencies that one would get from greater integration.

And there is, of course, less of an incentive for the parties involved in the alliance to invest in what we term in academia as relationship-specific assets. Because the alliance could over time fall apart.

However, when one realizes that the defense manufacturing sector really is a global business, in that context alliances can actually be more helpful than mergers because mergers in which a foreign firm tries to, for example acquire a U.S. firm in the defense sector, oftentimes they're not well received due to high integration costs from a merger. Obviously, these are companies that are operating on two different continents.

Also for national security reasons, sometimes the mergers are blocked. There have been a number of instances where the foreign entrant withdraws its bid in anticipation that the acquisition will be blocked if it proceeds further.

We saw this back in the semiconductor industry in the '80s when Fujitsu, a Japanese firm, tried to acquire Fairchild Semiconductor, and there was a congressional outcry that the semiconductor industry was very important to U.S. national security and Fairchild was a particularly important player. We didn't want a Japanese firm involved in it. So Senator Metzenbaum of Ohio was very vocal, and Fujitsu ultimately withdrew its bid.

We saw this in the U.S. oil sector in 2005, another example, where the China National Overseas Oil Corporation attempted to acquire Unical. Again, people were very concerned. Do we want a Chinese firm acquiring a key player in our oil industry? So CNOOC withdrew its bid, and Unical was acquired by Chevron.

Interestingly enough actually, if you saw in the papers, I guess it would have been yesterday, there is some evidence that one of the Chinese firms is going to try to, and it would only be a small minority stake, not a merger, but one of the Chinese firms is looking at acquiring a minority stake in AES, which is a player in the electrical utility and power industry. So it will be interesting to see how now in this economy of tight financing constraints whether that is more likely to go through than before. I don't know. We'll have to see.

Alliances can create an improved market sector with better products. One way that this can happen is if an alliance occurs, takes place, and new products are developed. Some of the competitors might say, wow, those

are great products; maybe we should form an alliance with other competitors and also develop new products. That in turn can lead, from the perspective of an end user, to a much more vibrant and competitive marketplace.

One of the old examples of a successful alliance like this was the alliance of CFM International, formed in 1974 between General Electric and Snecma, which was then a French state-owned company. Basically, they tried to leverage their skills from the defense engine market into the civilian engine market. In fact, they did develop a number of engines; the CFM56 was one of them. As of 2007, these could be found in over 50 percent of single-aisle planes with a hundred seats or less, particularly in AirBus A320s and Boeing 737s.

During the early 1980s, Pratt & Whitney, which was a competitor of these firms, started losing market share. So it in turn formed the International Aero Engines alliance to develop a competing set of engines, and it did. The B-2500 is one of the examples.

In fact, by 1995, engines that were produced by these two alliances, the CFM International alliance and the International Aero Engines alliance actually controlled about a third of the aero engine sector.

This was an example, I think, where alliances beget alliances. You soon had a new product space, and that really added value for the end user.

I think that alliances can assist in developing interoperable equipment across allied forces, and lowering costs. Allied forces are facing a common global threat now, the terrorist threat that transcends the boundaries of nation states. And interoperable equipment is very helpful naturally in joint operations.

The F-35 JSF, I think, is just a great example of this. Secretary of Defense Gates, in purchasing more JSFs, I think has really emphasized the commitment of the U.S. to acquiring systems that are compatible with its allies and that are developed through global alliances. The F-35 involves nine different contractors across different countries, with Lockheed being the primary, and Northrop Grumman and UK firm BAE being among the primary subcontractors.

This is intended for to replace 13 different types of aircraft across 11 countries. I mean this is, sort of in a way, a revolutionary concept, I think. I think that it

could have a very substantive role in terms of lowering costs through common design, common sustainment infrastructure facilities, and economies of scale through greater production.

The Army, the Marines, I guess the Air Force, the Marines; the Navy's planes are all going to be based on a common design. They're going to have a common sustainment infrastructure worldwide.

The U.S. plans to buy 2,443 of these aircraft -- the last set of numbers that I saw. The UK, Turkey, and Italy are also plan to make purchases, so this will push the production run up to about 3,000; opportunity to generate economies of scale and lower costs as well as to have interoperable equipment.

Naturally, the international structure of the relationships between U.S. contractors and foreign contractors for the JSF led to some criticism, particularly in the earlier years. As of mid 2003, there was a concern that foreign contractors weren't having to share in the growing development costs of the program. There was a concern, of course, that too many U.S. jobs were going overseas. There was a concern on the part of the Europeans that dealt with some of the uncertainty in the return on their investment to the JSF, and there was also, of course, a concern about technology transfer.

The UK, in fact, threatened to exit the program unless the U.S. shared more information on stealth technologies. Of course this disagreement was subsequently resolved.

But I think that the case of the JSF really illustrates some of the benefits of alliances. Pooling R&D, pooling knowledge, trying to get a large production run, trying to have interoperable equipment between allied forces that has a common sustainment infrastructure and that has a common design, but it also --

Some of the risks of alliances also come into play in the form of are the partners bearing the share of the cost that they should? Are they getting an appropriate return on their investment? How is technology shared across boundaries? I think that the JSF has really broken new ground in this area and sort of troubleshot some of the problems that can arise, and it has laid the framework for more alliances like this in the future.

Another example of some of the costs and benefits; in a way it's a global supply chain. This is a slightly

different sort of idea. This is the Boeing 787. The commercial aircraft that's going to be 20 percent more fuel efficient than the others, and it's going to be designed using this new carbon fiber technology.

Boeing had a very different global supply chain strategy for this, where the suppliers were building large sections of the plane overseas and then these were going to be assembled in Washington State. There have been five delays that have resulted in the aircraft being two years behind schedule. Some of this has been due to problems with subcontractors, and it has led to higher development costs. It has led to higher penalties as well for lateness.

The widespread nature of the chain, the fact that it was a global supply chain made it hard to address problems sometimes. There were issues with part shortages, flawed materials, whether or not the appropriate fasteners were available, plane sections that didn't fit together.

The strike was also a huge problem. The machinist strike that lasted eight weeks and began in September of '08 did lead to more delays and higher costs. One of the main arguments at the machinist union had been that if more production had been in-house rather than completed by subcontractors, the 787 would have been completed earlier. So this is a situation where, in a way, this huge subcontracting global supply chain was problematic from the perspective of some union members. Of course, the strike ended up just pushing things out further.

In late June, Boeing announced that it needed greater reinforcement for the areas near the region where the wings and fuselage joined, and it requested its supplier, Alenia Aeronautica, to stop production on the fuselage.

So I think that with the 787, we're seeing some of the examples of a global supply chain. We're seeing innovation. This is a great new carbon fiber technology. Once it's perfected, we're going to have planes that are at least 20 percent more fuel efficient than the existing commercial jets.

We're seeing a recognition of globalization as well and how subcontractors from all over the over country can work together to provide a great product. I think that Boeing's Vice President of State and Local Government Relations said it very well when he said, "We were once a Puget Sound based company with customers all over the world, and Boeing today is a global company competing in a global marketplace."

And that's the case not just for Boeing but for a lot of the other large defense contractors and, frankly, a lot of companies all over America in different sectors. They were once local, they did want to have a global clientele, and now they're global companies with a global clientele.

But I think that the 787 also highlights some of the costs of this strategy and the way that you can have coordination issues and your supply chain can be spread very, very far apart so it's harder to address the problems.

I think that both the 787 and the JSF have really laid new ground for a lot of the benefits of these types of strategies; also the costs. And ways in which some of these costs can be addressed in the future going forward to lay the framework for more of these types of structures.

To conclude, I think the defense sector does continue to be a very sector in the economy. I think it's going to continue to be a key sector. I think that, hopefully, our economic crisis is not going to persist. Hopefully, we're going to see a slow upturn by early to mid 2010. But if does persist over time, it could lead to erosion in the profits of defense contractors.

Part of this might be due to the pressure on the federal budget as budget deficits start to balloon out and certain areas of the budget need to be cut back, like defense maybe. And maybe that could lead to a reduction in demand for military products.

I think if high unemployment and tight credit and weak consumer spending persist, the commercial side of the aircraft business for defense contractors could also be hit in the form of more cancellations, more order deferrals. Again, that has not really been a major issue yet. The order books still remain strong for a lot of the aircraft manufacturers. There may be fewer orders this year than in previous years, but still very strong order books and still deliveries that are very much similar to what they had last year.

I think that the shift in strategic focus towards combating insurgent forces rather than conventional forces is leading to new opportunities for growth in areas like the C4ISR area and the UAV market; $62 billion over the next ten years. That's a very big market.

And I think that, interestingly enough, this shift is going to benefit some of the smaller, newer entrants into the marketplace as well as some of the larger, more

established defense contractors.

I think that we're going to continue to see this conflict between Congress and the Pentagon over expanding or cutting back on weapon systems. We have this confluence of forces linked to budgetary pressures, linked to employment concerns in various congressional districts, linked to strategic military and cost priorities. As long as the jobless recovery persists, unemployment rates aren't coming down in certain states. I think that this type of debate could be heightened.

I think that mergers between smaller firms and larger firms will be very helpful, particularly as the defense sector expands into new area. Boeing's and Northrop's acquisition strategies are just examples of how acquiring a smaller entrant can be helpful in augmenting a preexisting knowledge set and producing new products.

I think that the benefits of mergers between large defense contractors may not be nearly as great. Certainly the evidence of how the mergers wave from the '90s worked out has been very mixed. Part of that may have been due to the high absorption and integrations costs as much as anything else.

I think that, particularly when you consider the fact that defense manufacturing is a global business, alliances add a lot of value relative to mergers. Not only are they more palatable from a national security perspective and from an absorption perspective, but also they do add some of the benefits of mergers; sharing R&D costs, developing new products, entering new markets, generating scale economies without the integration costs of mergers.

Nonetheless, as the development of the F-35 and the 787 showed, there can be problems. Absolutely. In terms of are the partners bearing the cost. Are they getting the return on their investment? How do you coordinate large global supply chains? How do you make sure that the parts fit together of all this? I think that the recent experiences have really helped to break a lot of new ground in that area.

I'm hopeful that the defense sector is going to continue to provide the best solutions at the lowest cost in the wake of these new challenges. We have globalization, we have the economic and financial crisis globally, we have the new shift in defense priorities, and we have hard budget constraints. I really do think that it's going to continue

to successfully continue its mission of preserving global security.

Thank you very much.

[Applause].

Question: [Inaudible] worked at Air Force Systems Command and they had an office in fact the entire [inaudible] chain, the entire [inaudible] involved [inaudible]. I worked for the Navy [inaudible]. Is there anything like that now in the track where the [inaudible] points and strategic problems [inaudible]?

Dr. Hensel: I think that, yeah, very, very much so. I certainly know that the Office of Naval Research, ONR, has been sponsoring a lot of projects like that. And I know that some of the offices, certainly within the Navy and also within the Air Force, are trying to develop systems like that, actually referencing back to some of the ones that you mentioned, like Copernicus.

The trouble with developing systems like that is always getting the right data, because you're getting it from so many different sources. And are you going to get it in a timely fashion? What's the quality that it's going to be? That sort of thing, but that is very much on the agenda from what I've heard. I think that those added a lot of value back then and could only be improved. I think that's a wonderful point. Absolutely.

Question: [Inaudible]. You talked a lot from the manufacturing side of the equation. Could you speak first to the broad sustainment side for the industrial base? And secondly, specifically to the independence versus OEMs?

Dr. Hensel: Well I definitely think that in terms of sustainment of the industrial base, one of the issues links back to the skill sets. We have to have the right skill sets in the industry to continue to keep innovation going.

I think that another issue has been in raw materials. Do we have access to the right raw materials? And there have been a lot of issues with China actually having a lot of the key raw materials that we need, certain of them, with long unpronounceable names. But that has been a problem as well. And those are very important for sustainment.

Regarding OEMs, I think you had a question about OEMs versus --

Question: [Inaudible]. What you talked about is the manufacturing --

Dr. Hensel: Absolutely.

Question: When this stuff is manufactured, it has to be sustained.

Dr. Hensel: It does.

Question: It's a piece of the industrial base which I didn't see covered. And in that, the independents have a large role, so I was wondering in your research and in your discussions if you could address those pieces.

Dr. Hensel: Well there certainly is, there have been studies out there that have shown that independence is very important. That's an area, really, where I think though much can be said on both sides. And the data on it is also very new. It's very new. It's just coming in.

The bulk of what I've seen, certainly in the academic side, has suggested that independence is very important in this. So I think that those are good points and very good questions that you're asking.

Question: Let me ask you about the energy in France. They recently joined NATO. Are they actively seeking alliances and partnerships? And where are they in the, if you will, the aircraft development and UAV development?

Dr. Hensel: I think that EADS is very actively seeking alliances. One area has been in the Indian marketplace. India was the tenth largest purchaser of military equipment in 2008. A number of defense contractors are in that space. EADS is one of them, and they've actually been partnering with domestic Indian firms to try to develop some of these.

EADS, I think, although it has expanded into the UAV market in the development stage, has not expanded to the degree that say Northrop Grumman has. And I think that that's an area that it probably -- I've heard tell it may focus on more in the future. I think it has been so focused on some of the delays in the A400M program and military transport planes and some of those other programs that it hasn't yet focused as much on the UAV market as it might have. But I have heard that they are developing some systems. And certainly they're partnering up with other firms in India, although that's not necessarily in the UAV sector; that's also just in the aircraft sector. I think that that's something to watch. Absolutely.

Thank you, General Schott.

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