

[H.A.S.C. No. 114-91]

**CARRIER AIR WING AND THE FUTURE
OF NAVAL AVIATION**

HEARING

BEFORE THE

SUBCOMMITTEE ON SEAPOWER AND
PROJECTION FORCES

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

SECOND SESSION

HEARING HELD
FEBRUARY 11, 2016



U.S. GOVERNMENT PUBLISHING OFFICE

98-958

WASHINGTON : 2016

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CARRIER AIR WING AND THE FUTURE OF NAVAL AVIATION

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON SEAPOWER AND PROJECTION FORCES,
Washington, DC, Thursday, February 11, 2016.

The subcommittee met, pursuant to call, at 3:32 p.m., in room 2212, Rayburn House Office Building, Hon. J. Randy Forbes (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. J. RANDY FORBES, A REPRESENTATIVE FROM VIRGINIA, CHAIRMAN, SUBCOMMITTEE ON SEAPOWER AND PROJECTION FORCES

Mr. FORBES. Today the subcommittee meets to discuss the carrier air wing and the future of naval aviation.

We have got a distinguished panel of guests, and they include Dr. Seth Cropsey, the Director of the Center for American Seapower, Hudson Institute; Dr. Michael C. Horowitz, the Associate Professor of Political Science, the University of Pennsylvania; and Professor Robert Rubel, Navy War College.

The distinguished witnesses that are here today have done so much to help in furthering this debate and discussion throughout the years and we welcome you and we are so glad to have you today.

The subject of our hearing today is the carrier air wing and the future of naval aviation. And I don't want for our discussion today to be focused on the past. We want it focused on the future. But we also have to look at where we have come in the past and some present realities.

Because of the shortness of time that we have and the fact that they are going to call votes perhaps at any time, we are going to dispense with our opening comments. I think Mr. Courtney has agreed to do the same. We will have those submitted for the record.

We are going to go right to your opening statements. I told you at the beginning that we could have votes in the interim. If so, we will have to excuse ourselves, take a recess, go cast those votes and then come back.

So, with that, if Mr. Courtney has no comments that he would like to make, then, Mr. Cropsey, since you are sitting on the side that you are sitting on, we assume that you are going to start us today. And we welcome you here and look forward to your opening remarks.

[The prepared statements of Mr. Forbes and Mr. Courtney can be found in the Appendix beginning on page 21.]

**STATEMENT OF DR. SETH CROPSEY, DIRECTOR, CENTER FOR
AMERICAN SEAPOWER, HUDSON INSTITUTE**

Dr. CROPSEY. Thank you, sir.

Mr. FORBES. By the way, all of your written testimony will be submitted for the record, without any objection.

Mr. Cropsey.

Dr. CROPSEY. Chairman Forbes, Ranking Member Courtney, and the distinguished representatives gathered here today, thank you for the honor of asking me to appear before this committee.

I have been asked to testify on the future of naval aviation and the carrier air wing specifically, with a focus on unmanned systems.

The testimony that I have offered for the record is divided into four parts. I will summarize them very briefly. I have looked at the evolution of the carrier air wing from 1980 until today. I discuss gaps in the modern air wing. I elaborated on the role that unmanned systems could have in the air wing. And I made broader recommendations about the structure of the air wing and the carrier platform.

I would like to emphasize that without a discussion of strategy, the comments offered here are speculative exercises, useful perhaps, but disconnected from the broader strategic ideas that ought to govern U.S. and allied security.

The U.S. has not faced such a diverse and dangerous group of threats since the end of the Cold War. At the high end, Chinese and Russian military capabilities can challenge American power globally as they have not in the past, or at least in the recent past for one of them.

Low-end threats like ISIS [Islamic State of Iraq and Syria] and similar insurgencies cannot destroy U.S. power, but can undermine regional stability or worse.

Hybrid adversaries, particularly Iran, employ a mix of conventional and insurgent assets to harass American forces and exploit critical vulnerabilities.

And I won't go into history here because I think I have handled it in the written remarks. But what we are looking at today is not unique, is not new. Great maritime powers have always experienced problems that overlapping threats present. Britain serves, I think, as the best example.

On the eve of World War I, First Sea Lord Jackie Fisher and First Lord Winston Churchill had to counter the powerful Kaiserliche Marine in the North Sea at the same time defending British shipping around the world against commerce raiders and submarines.

To remedy this strategic problem, Admiral Fisher's so-called "scheme," as it was termed at the time, marshaled heavy dreadnought battleships for major fleet engagements against the Germans in the North Sea, along with fast battlecruisers which were intended to destroy commerce raiders. Combined with smaller destroyers from other escorts, this mix of ships was designed to engage in major oceanic battles, at the same time protecting British shipping around the world.

Without such focused, strategic ideas, analysis and recommendations about weapons systems or conglomerations of them don't count as much.

Since its earliest days, naval aviation in the United States has always been defined by a diversity of platforms. The carrier platform, with the limitations it imposes on fuel usage and weight, has always required aircraft designers to create a diverse number of platforms.

Two factors have shaped the modern carrier air wing: aerial refueling and sustainable ISR [intelligence, surveillance, and reconnaissance] platforms. Aerial refueling extended the range and flight time of the carrier air wing, allowing it to remain on-station longer and patrol more airspace. This became critically important for long-range interceptors and fighter aircraft, since these platforms could now be designed with less of a mind to range since range-extending aircraft could be placed aboard the carrier.

Dedicated airborne early-warning platforms began to enter the fleet in the 1960s and that allowed the carrier air wing to monitor even more airspace.

Bringing us up to more recent history, the 1980s carrier air wing was the pinnacle of naval aviation diversity. Specialized strike, ISR, air-to-air and anti-submarine warfare aircraft gave the fleet the ability to respond to the Soviet threat on all levels. Unfortunately, budget cuts and a self-enforced ideology of one interpretation of jointness have forced a decline in diversity in the modern air wing.

Multi-role platforms, like the Hornet and Super Hornet, replaced mission-specific aircraft such as the A-6 and the F-14. The carrier also lost its organic tanking capability, forcing Navy to rely on Air Force tankers, to a certain extent, launched from potentially vulnerable ground targets.

This state of affairs is untenable considering the anti-access threats the U.S. faces today. China, Russia, and Iran have created an overlapping access-denial network supplemented by insurgent groups in critical regions.

Unmanned systems can greatly improve the carrier air wing's efficacy by filling critical gaps in tanking, in ISR, and strike capability.

In the immediate future, U-class [unmanned] programs could be focused on creating a viable carrier-based tanker considering the advantages that an unmanned platform has over a manned tanking platform. The Navy could also benefit from longer loiter time of current unmanned systems and use them to amplify ISR and strike/sea control capabilities.

Finally, the Navy would benefit from, I believe, a broad effort to re-diversify the air wing. It would benefit from developing a new manned airframe for air-to-air combat, along with creating a low-end platform to perform cheaper strikes against long-term insurgency groups, for example.

The Navy might also consider increasing the size of the carrier air wing to its nominative, its intended strength of 80 or more aircraft, rather than under-equipping each deployed carrier strike group.

Finally, the Navy would benefit, I believe, from considering the creation of other platforms to perform consistent strikes against insurgencies. Small carriers might be added, not in place of, but in addition to large-deck carriers as part of this approach, along with low-cost strike aircraft.

Naval aviation is the cornerstone of the U.S. Navy and, by extension, the back power of American seapower globally. The Navy is taking steps to integrate unmanned systems into the air wing. Focusing on these will improve diversity and the overall efficacy of manned and unmanned platforms.

Nevertheless, as I said at the beginning, without a proper strategy, no procurement, operational doctrine or development project can really preserve the American-led international order.

Thank you for your patience.

[The prepared statement of Dr. Cropsey can be found in the Appendix on page 25.]

Mr. FORBES. Dr. Cropsey, thank you.

Dr. Horowitz.

STATEMENT OF DR. MICHAEL C. HOROWITZ, ASSOCIATE PROFESSOR OF POLITICAL SCIENCE, UNIVERSITY OF PENNSYLVANIA

Dr. HOROWITZ. Thank you, Chairman Forbes, Ranking Member Courtney, other members of the subcommittee and staff and guests here today for the invitation to testify before you. It is a real honor to be here to speak about the vital importance of the carrier air wing and the challenges it faces.

America's global reach relies in no small part on naval aviation and the carrier air wing. Yet because of long procurement timelines and moves by potential adversaries, the decisions made in the next several years, in just the next few years, will be critical. The United States cannot rest on its laurels in the carrier domain.

In what follows, I will very briefly describe the rising threat to the carrier and then three areas where I think this committee can work with the Navy to try to move the carrier forward to sustain it as a critical part of the Navy into the middle part of the 21st century.

We all know that America's aircraft carriers are increasingly vulnerable. From China's development of an anti-ship ballistic missile to the proliferation of anti-ship cruise missiles, like the SSN-22, the risk to U.S. aircraft carriers is arguably as large as it has ever been since our carriers were actually out there fighting in the Second World War.

Add to this advances in air-to-air missiles by China, including the PL-15, and the carrier air wing itself is increasingly at risk. And the history of military innovations demonstrates that established powers using established technologies must continually innovate to keep up.

The dawn of the carrier age itself is an example of this. The British, who had dominated naval warfare before with the battleship, viewed the aircraft carrier as a spotter, something to help find adversary ships. This demonstrates the kind of failure of imagination that is crucial for the United States Navy to avoid. By taking seriously these threats to the carrier itself, and the carrier air wing,

Congress and the Navy can work together to preserve the role of carrier aviation in U.S. power projection capabilities to assure that what happened to the British will not happen to the United States Navy.

And here are three areas where I think the United States Navy could invest and I hope this subcommittee will promote to help ensure that the carrier air wing remains a strong and vital part of U.S. military power.

The first is increasing America's investment and the Navy's investment in munitions. One way to ensure the continued strength of carrier aviation is extending its range. Range in this space can mean two things, the range of the airplanes that launch from the carriers——

Mr. FORBES. Dr. Horowitz, I am sorry to interrupt you, could you just make sure your microphone is on. And maybe if it is not, get a little closer.

Dr. HOROWITZ. Sorry.

Mr. FORBES. That is okay, thank you.

Dr. HOROWITZ. One way to ensure the continued strength of carrier aviation is extending its range. Range in this case could mean two things: increasing the range of the airplanes launching from the carrier or increasing the range of the munitions that those planes carry.

But for a variety of bureaucratic and budgetary reasons, it is often easy to under-invest in munitions, not buying enough and not investing enough in research and development for the next generation.

There is good news in this area. The Navy's development of the Long-Range Anti-Ship Missile, something this committee has supported, will critically extend the range of the weapons launched from current carrier aircraft. But advanced munitions are expensive. One estimate suggests that the Long-Range Anti-Ship Missile [L-RASM] may cost \$2 million per missile.

That is money well spent, but Congress and the Navy should think about ways to reduce the unit cost of advanced munitions. One way to reduce costs is through larger buys that generate economies of scale, but another is to consider next-generation systems that might employ more off-the-shelf commercial technology to take advantage of growth in robotics and related fields.

The Navy could consider harnessing developments in swarming technology, to give just one example, to develop lower-cost munitions where the target is destroyed not by a single munition that escapes detection, but through overwhelming adversary defenses through mass.

The second area I think this committee should push the Navy to invest in more is unmanned or uninhabited systems. The move by the Navy to convert the U-class system into a tanker might be a good-news story. It will be a good-news story if that tanker allows the Navy to experiment with unmanned systems on a carrier, paving the way for a more advanced, armed platform in the future. This would be a really good-news story.

It won't be a good-news story if rather than being a bridge to the future of combat aircraft the purchase of an unmanned tanker rep-

resents a shift away from thinking about uninhabited systems for carrier-based, deep-strike missions.

If the Navy lacks the bureaucratic appetite to invest heavily in next-generation systems, it could increase the structural risks to carrier aviation over the long term. Due to their ability to loiter, the fact that they are not limited by human endurance, and that they can operate in more dangerous missions where American pilots might be at risk, there are several advantages to having unmanned platforms in deep-strike missions.

There is good evidence that suggests that senior leadership of the Pentagon gets it, from the Third Offset Strategy that Deputy Secretary Work has advocated to Secretary Carter's preview calling for the potential of microdrones and swarms, there is a lot to like. But this will require close monitoring, especially with a new administration entering next year.

Finally, given these changes in the threat environment, it is worth at least thinking about whether investing in a small number of large aircraft carriers should remain the optimal path for the United States Navy over the next generation.

The old aphorism about not putting all of your eggs in one basket is potentially appropriate here. It may make sense to diversify risk. One path forward might involve investing in some number of smaller aircraft carriers.

Though the air wing would be smaller in number than the current *Ford*-class aircraft carriers the Navy is building, it might be possible to extend the capabilities of such platforms by leveraging uninhabited systems or leveraging the potential for what is called manned/unmanned teaming or quarterbacking where one advanced U.S. Navy aircraft would work together quarterbacking several remotely piloted airplanes. It is a way to leverage the investment that the United States has already made and use the aircraft that the United States Navy has developed over the last generation.

This will be very difficult for the Navy. The Navy is the best in the world because of its carriers and because of the carrier air wing. But as the Navy's original investments in naval aviation and the carrier in the interwar period show, there is no innovation incubator like the United States Navy when it puts its mind to it.

And that is something that I hope that this subcommittee will continue pushing the Navy on to ensure that the carrier air wing remains a vital part of the 21st century Navy.

Thank you.

[The prepared statement of Dr. Horowitz can be found in the Appendix on page 41.]

Mr. FORBES. Thank you, Dr. Horowitz.

And Professor Rubel, we are going to have to wait until we get back. Fortunately, Speaker Ryan now has made sure that we are there within the 15-minute mark, so we don't want to take a chance of anyone missing votes.

So, with that, we will recess until the conclusion of votes and then we will begin again.

Thank you.

[Recess.]

Mr. FORBES. Gentlemen, thank you for your patience during those votes. And when we left, I think we had Professor Rubel up

next. So, Professor, thank you for being with us and we look forward to your opening thoughts.

**STATEMENT OF ROBERT C. RUBEL, PROFESSOR EMERITUS,
U.S. NAVAL WAR COLLEGE**

Mr. RUBEL. Thank you, Congressman.

Mr. Chairman and distinguished members of the Seapower and Projection Force Subcommittee of the House Armed Services Committee, it is a distinct honor and privilege to be called to testify as a witness on the future of naval aviation, just as it was to be a practicing naval aviator for the first 20 years of my 48-year Navy career, 30 of which were Active Duty.

You have read my written testimony that lays out my concerns about the readiness of naval aviation to deal with the challenges that are emerging.

In my view, the Navy cannot continue to deploy and operate as it has since the end of World War II. A combination of rising naval competitors and reduced budgets force a fundamental rethinking of both force structure or, as Admiral Richardson, the current CNO [Chief of Naval Operations] puts it, fleet design, and operational doctrine. This will be a difficult process for a Navy that has been accustomed to unchallenged supremacy for the past 25 years.

Among other things, I advocate relieving the carrier force from routine presence duty so that the Navy can develop doctrine and training for a concentrated carrier force that can provide adequate warfighting capabilities in the face of new threats.

The need to shift from a dispersed, constabulary posture to a warfighting posture was described by our foremost naval theoretician Alfred Thayer Mahan in 1911 as he observed the naval arms races occurring in Europe. A concentrated fleet was, at that time, needed to support the Monroe Doctrine, the central U.S. strategic policy of the day. Concentration was needed for two purposes: deterrence and response.

Today, we observe a certain rhyming of history, rising naval powers forcing the U.S. Navy to consider military concentration vice constabulary dispersion. However, in today's world, the constabulary function is still critical to the execution of U.S. strategy.

The Navy must deploy where needed to cultivate the global maritime partnerships to bolster maritime security, to reassure allies and friends, and generally defend the global system of commerce and security.

Whereas up to now this presence function could be performed by most any kind of unit, today the need is for units that possess credible war-at-sea capabilities in order to deter and disrupt regional aggression and constitute a viable crisis response force. The embryonic concept of distributed lethality holds promise for creating this kind of force.

If the Navy is able to constitute such a force and keep the carriers substantially in reserves, new approaches to the design of air wings become possible. I outline some illustrative ideas in my full testimony statement.

I believe the Nation needs to invest more in its Navy than currently. But even if funds become available, fleet design should change along the general lines I advocate. Doing so will reduce

strategic risks by allowing the Navy to harmonize tactical and operational risks with the stakes involved in any particular crisis by avoiding placing the national command authority in an all-or-nothing situation.

I believe in the continuing strategic utility of aircraft carriers, but they must be used differently than in the past because geopolitical conditions have changed. I urge the Congress to support Admiral Richardson as he undertakes the difficult job of putting the Navy's rudder over and steering a course for change.

Thank you, sirs.

[The prepared statement of Mr. Rubel can be found in the Appendix on page 58.]

Mr. FORBES. Thank you, Professor.

I am going to defer my questions until the end.

So, I would like to recognize Mr. Courtney now for any questions that he might have.

Mr. COURTNEY. Thank you, Mr. Chairman.

And thank you to all the witnesses for, you know, really great, thoughtful, stimulating testimony. And again, as we are about to embark on the budget process, the timing is perfect. And again, you know, your written comments obviously are going to be made part of the record and circulated to all the members.

Again, there is a lot to sort of ask questions about. I guess one I wanted to start with, Captain Rubel, you know, trying to visualize your concluding remarks about sort of moving away from a constabulary role to a more concentrated use of the carriers and then distributed lethality to sort of fill the constabulary function.

You know, there has been a lot of heartburn over the last couple of years or so about carrier gaps, you know, in terms of not being out there in different parts of the world where, you know, people have kind of grown accustomed to their presence. I guess, you know, that is—I wonder if you could just sort of elaborate a little bit more in terms of how you visualize the distributed lethality that would sort of reassure our allies and, obviously, you know, protect our national interests.

Mr. RUBEL. It is a challenge. The carrier is sometimes referred to as an iconic ship type. That is, it is not only its size and advanced capabilities, but also its reputation from World War II on give it a status in the eyes of not only American citizens, but citizens around the world, so that when one of those things shows up, it means something.

The intangibles involved in that must be overcome as we work to substitute other types of forces for the carriers. I see the distributed lethality force as consisting of cruisers, destroyers, and other types of ships. Whether the LCS [littoral combat ships] will work out as part of that or not, I don't know. But our amphibious forces, those are big ships. If we pack them with lots of missiles and advertise the fact and use exercises, live-fire demos, et cetera, and work the public relations part of it in tandem with the development of these new types of forces, I think we can get there.

It seems to me we don't have much of a choice. I don't see us going beyond 11 carriers. Maybe we can, but if we can't there aren't enough carriers to maintain presence like we are used to, providing presence around the world, so something has to give.

Right now it is creating these unplanned gaps, which is a strategically risky way of doing business.

The United States has a well-founded grand strategy, I believe, of maintaining a law-based world order and a free market, liberal trading economy globally. That kind of system requires security, it requires comprehensive security, and the Navy has to be out there with something. If we don't have enough carriers to do it, we have to do it with something else.

We might as well develop something that allows us to take the pressure off the carrier force and constitute a force, a warfighting force that will truly deter China, Russia, or whoever.

Mr. COURTNEY. Thank you.

Dr. Horowitz, again, you talked about the U-class sort of steps, you know, the stepped-up approach that it appears that, you know, the Navy is pursuing, starting with the tanker function, but you obviously were pretty adamant that, you know, we can't just sort of stop there and that we have got to really, you know, enhance that technology to take it to a higher level.

In terms of a timeline, you know, how do you sort of see that, you know, stepped-up use of unmanned aircraft as far as, you know, trying to achieve the goals that you laid out?

Dr. HOROWITZ. Thanks for your question. This area, the intersection of robotics and military technology, is one where the technology is advancing quickly. And one of the biggest challenges, I think, for the United States military as a whole in this category, to back up a little bit, is how long our procurement timelines, you know, are.

I mean, like, you know, we could have a whole different discussion about the acquisition system, but I think if you want to identify a risk point in the strategy that has been identified in the budget, from my perspective, it would be that it takes so long to actually acquire and deploy this tanker and then so long to use it and feel comfortable with it, so that it is, you know, 25 years later and we still really haven't made progress.

In some ways, the early discussions about what the next-gen [generation] naval fighter look like might be illustrative for understanding the direction that the Navy wants to move in.

You know, Secretary Mabus made the comment last year, I believe, that the F-35 was likely to be the last manned naval fighter. And the rubber will meet the road when the Navy starts thinking about their plans for what the next-generation fighter looks like. That, I think, will be a really key decision point in ensuring that the Navy remains on the right track.

Mr. COURTNEY. Thank you, Mr. Chairman.

Mr. FORBES. Mr. Conaway is recognized for 5 minutes.

Mr. CONAWAY. Well, thank you.

And I apologize for missing your testimonies.

Dr. Cropsey, here I am. I am on record as saying we need a 12th carrier. Can you talk to us about how many carriers we actually need? Is that pie in the sky? I know that may be a little bit aspirational, but can you talk to us about, from your perspective, what that would do for today's Navy or 5 years from now maybe when we actually got that 12th carrier in the water?

Dr. CROPSEY. Thanks for the question.

Mr. FORBES. Dr. Cropsey, do you have the mike on?

Dr. CROPSEY. Yes, I do, sir.

Mr. FORBES. Okay, that is all right. Sometimes you have to keep it up—

Dr. CROPSEY. I need to talk louder. His point about carriers meaning something is right, I agree with that. He is absolutely right. They mean ISR, they mean strike, they mean sea control, they mean anti-submarine warfare.

I also think that it is correct that one carrier in each of the areas of contention, as we have today, is insufficient now and will become more insufficient in the future and does not include the Mediterranean.

So, it seems to me that we limit ourselves and we limit our capabilities and ultimately we limit our security by looking at this in terms of what can we afford. The question is, what do we have the will to do and what must be done?

Before John Maynard Keynes, the idea of government spending going into debt was anathema to the rulers of Britain, the aristocracy, to the House of Commons. And when they looked at the cost of the Second Boer War, they realized that the sinking fund, which was meant to pay off limited debt, was not going to be sufficient and that they were really in the red in a way that horrified them. And they made changes in their Navy that started them on the path toward where they are today with 19 surface ships.

I am afraid that if we think of the number of carriers in those terms, we will find ourselves in the same position in the future, which is why I think that we need something like 16 carriers, a number of ships that would allow them to operate together, and that would also require being able to integrate carrier operations, and a number of ships that would allow us to once again be present in force in the Mediterranean. Consider what is happening as we have left, look at what China and Russia are doing, and you know that.

Mr. CONAWAY. Let me ask this question. I am currently reading a book about the First World War in the start and it is talking about the way the armies of the Germans and the Austro-Hungarians and Russians continued to train cavalry troops. They would finish up all of their exercises with a mass cavalry charge, sabers drawn, flags flapping, wonderful, grandiose kind of things. Are we at risk of clinging to a carrier concept much like the other outdated weapon systems have, you know, gone that direction? Are we at a point or at risk at all of something like that going on where we just look really foolish trying to cling to a weapon system like that?

Dr. CROPSEY. I think we are always at risk of something like what you are saying. That is a reasonable question. I think that it would be that the argument against carriers and the specific argument against carriers in the future would be greatly strengthened by showing that there is an alternative that can perform those functions that well.

And when I see that, then I will be convinced more than I am now that the risk you talk about is a real one.

Mr. CONAWAY. Thank you, Mr. Chairman. Yield back.

Mr. FORBES. Mr. Johnson is recognized for 5 minutes.

Mr. JOHNSON. Thank you, Mr. Chairman.

Dr. Horowitz, while fifth-generation capabilities are critical in missions involving high-end threats in an anti-access area-denial environment, they are just as important in a low-threat environment, like Afghanistan today. The F-35C has capabilities that exceed the current air wing aircraft, such as the ability to carry over 30 percent more ordnance and having around 50 percent more on-station time in a close-air-support mission.

In addition to the fifth-generation capabilities of stealth, sensor fusion, combat identification and network connectivity, do you see these weapons' long range and on-station time capabilities important in protecting our men and women on the ground?

Dr. HOROWITZ. Thank you for your question. I think that the roll-out of an effective F-35 throughout the fleet is vital for American naval power over the next generation. We can have, and a professor like me might be willing to engage in, an academic debate about an alternative. But where we are now, it is crucial that the F-35 is made to work and deploys. Because I think you are absolutely right that in Afghanistan, in many of these different scenarios around the world, some of which are not the highest-end combat situations, the capabilities that the F-35 will bring to the table are important.

And I would say that is also a reason why I think I have emphasized the necessity of investing in next-generation munitions, because the platform, in some ways, is only as good as what it is firing at the end of the day. You know, the airframe is a means to an end. The means to the end in some cases might be surveillance, and in some cases it might be strike.

And one way, to the extent that the F-35 has some limitations, to try to help it be better in some ways, is to give it better munitions to work with.

Mr. JOHNSON. Mr. Rubel, do you have anything to add?

Mr. RUBEL. The F-35 will bring key capabilities to the fleet, there is no doubt. I mean, it is the only game in town right now and it needs to work.

We should not ignore the capabilities of the F-35B. The Marine Corps model will revolutionize the capabilities of the 10 big-deck amphibious ships we have, essentially, if we choose to do so, turning them into light aircraft carriers. There is really no comparison between the F-35B and the AV-8 Harrier.

And so it creates a lot more possibilities for both the Navy and the Marine Corps having that airplane aboard those vessels.

Mr. JOHNSON. Thank you.

Dr. Cropsey.

Dr. CROPSEY. Congressman, did I understand correctly that your question applied also to low-end missions?

Mr. JOHNSON. Yes.

Dr. CROPSEY. Yes. Well, sir, I don't think that if the danger that you face on a camping trip is a grizzly bear that you should bring a 105 mm howitzer along with you. You can protect yourself with less. And the F-35, I do not disagree with my colleagues here about its effectiveness. I have had some questions about its radar cross-section and some questions about its usefulness as an air-to-air platform.

But I don't have a lot of questions about its applicability to, for example, ISIS. It doesn't seem to me as though that makes sense. If the target is an ISIS convoy, do we need a platform as advanced and as sophisticated as the F-35? I don't think so.

Mr. JOHNSON. And what would be the alternative?

Dr. CROPSEY. Well, for example, the old OV-10, the observation plane which can land on aircraft carriers, can carry ordnance, it is a good design, low speed. Why are we using such an expensive and powerful platform against such a relatively small target?

Mr. JOHNSON. What do you say, Dr. Horowitz?

Dr. HOROWITZ. My concern is that I am not sure we have a choice, given the current procurement plans of the Navy. And I think the F-35 is, as I think my colleague said, perhaps, you know, the only game in town for those kinds of missions.

I agree that it would be better if there was a lower-cost option that we could use to deliver strikes in cases where the full range of capabilities of the F-35 are not needed. But given current procurement plans, the F-35 will be necessary.

Mr. JOHNSON. Thank you.

And I yield back, Mr. Chairman.

Mr. FORBES. Thank you, Mr. Johnson.

Dr. Cropsey, the Navy seeks to decommission the 10th carrier air wing in the President's budget for this year. But the fiscal year 2012 NDAA [National Defense Authorization Act] directs the Secretary of the Navy to ensure that the Navy maintains a minimum of 10 carrier air wings and for each such carrier air wing a dedicated and fully staffed headquarters.

How do you see the decommissioning of the 10th wing? Would that be running counter to the law? And do you think it is a good idea to decommission one of our carrier air wings?

Dr. CROPSEY. I think you are, Mr. Chairman, in a better position to answer the question about whether it runs counter to the law.

On the question of the advisability of the idea, I think it is another of the salami slicing that the Navy has been forced to and has chosen to do over the past 10 to 15 years. And the way I look at it is that the more slices you take away from the salami, the less salami you have left.

So, this strikes me as an ill-advised idea and one that will not improve the carrier air wings as a whole or naval aviation's capability. It is very simple. We keep on reducing like this and we keep on talking as though the constraints that we are looking at right now are absolute ceilings, we are going to end up as the British did. That is a certainty.

Mr. FORBES. Dr. Horowitz, you mentioned earlier that you believed we should be looking at a smaller-type aircraft carrier. The Navy has testified before to us that they have examined that and over and over again come back with the conclusion that we should not, that we should stay with the size that we have.

There is some discussion, and I know Professor Rubel has even talked about, that we may be moving away from what we have seen of late for our carriers, which is to provide strike capacity to land targets, and they may actually be involved in warfare at sea, which would require us to have more planes coming together.

What advantage do you think the smaller aircraft carrier would have, given the fact that you would still need the same platforms to defend the small carrier as you would a large carrier and it may necessitate having to have more small carriers to get that kind of mass of planes together?

Dr. HOROWITZ. That is a great question. And I think that the potential value of small carriers lies, in part, in the way that it will help the Navy diversify risk. In a threat environment where the large carriers are not at risk of being essentially in naval combat, that it makes a lot of sense to have a small number of large carriers that act as mobile airfields for land-based strike more than anything else.

But if losing ships becomes something that is possible in war once again, as it seems like it potentially is, given the changes in the threat environment, then from a strategy perspective, setting aside sort of cost efficiency and budget for a moment, a diversity through increasing the carrier fleet through some small carriers makes sense.

I think the Navy is not wrong that it would certainly be expensive to do.

Mr. FORBES. Professor Rubel, looking at all the roles unmanned carrier aircraft could fulfill, do you see the need for a single or multiple types of unmanned aircraft to perform the ISR, buddy tanker, and long-range strike missions? And how would you prioritize those missions?

Mr. RUBEL. As I outlined in my testimony, I do foresee the need for a range of different types of unmanned aircraft, ranging from a high-aspect ratio, in other words a long, straight, narrow wing that is optimized for high endurance and high altitude, to act as a relay, line-of-sight relay platform for the battle force network in case our satellites get taken out, and other ISR and miscellaneous duties; a low-aspect ratio, in other words a swept-wing, strike-fighter-like version that can be used for strike and especially air-to-air work; and then maybe a third type that would be the tanker, be the ASW, anti-submarine warfare, platform, do any number of other support duties around the carrier.

So, just as we had a family of aircraft aboard the old carriers, I mean, when I started flying we had fighters, two types of attack aircraft, ASW aircraft plus helos [helicopters] plus the airborne early-warning airplane, we had a real variety of specialized aircraft, we should consider specializing our unmanned aircraft in a similar manner.

Mr. FORBES. And Dr. Cropsey, given the fact that we are seeing the capabilities and capacities of China to produce and deploy anti-access weapons, including the DF-21, but obviously not limited to that one system, is it critical for our air wings to possess long-range, penetrating strike capabilities to maintain a credible deterrent? Or is that something that we should not necessarily be focused upon?

Dr. CROPSEY. I think we should definitely be focused on that. The likelihood is that China's DF-21 capabilities, once demonstrated, will find their ways into other parts of the world as well. So, this is not the only place where long-range penetration is going to be an issue.

We might be able to solve that simply by tanking. I am not so sure of that. But I am much more certain that we will see this problem elsewhere. It will multiply. And as all of us have said here, this is where things are going and this is how things are changing. Nobody is going to let us amass a force next to their nation the way we did in Desert Storm. That was yesterday.

Mr. FORBES. Gentlemen, we told you at the outset, too, that we wanted to give each of you a few minutes if you needed it to put anything else on the record that we perhaps haven't covered, that might be outside of the testimony that you offered. I would like to offer you that opportunity now.

And Professor Rubel, maybe we will start with you. Anything else you have in summary for this afternoon?

Mr. RUBEL. The United States, one way or another, has to find a way to achieve strategic efficiency. In other words, our goals to maintain a law-based, liberal-trading, international order stays the same. But we are increasingly challenged by rising threats and deep national debt, so we are getting squeezed from two sides.

To do this, we need to get more strategically efficient in all our operations. From the Navy's point of view, like I have outlined, we relieve the carriers of their station-keeping duties, substitute a distributed lethality force, I think the Navy can maintain its support for the national strategy with that kind of a three-tiered force, which I outline in my testimony, at a cost maybe not the same as now, the Navy's going to need augmentation of its budget, but at least an affordable cost for the United States.

So, we simply have to think about the architecture of our fleet differently than we have been. Thank you.

Mr. FORBES. Thank you.

Dr. Horowitz.

Dr. HOROWITZ. Thanks. And thank you again for the opportunity to testify before this subcommittee.

I think that the United States Navy is facing something right now that it has proven historically to be incredibly hard, even for the best meaning militaries in the world to do, and that is to reinvent itself on the fly while you are the best in the world. And that is extremely challenging. And one of the areas where that will likely have to occur over the next generation is with the carrier air wing.

I think that it is very fortunate that both through the advocacy of this subcommittee and the current leadership of the Pentagon that there is positive momentum for investing in next-generation systems, particularly, but not limited to, the unmanned space that I think will be necessary for deep-strike capabilities in the next generation.

But I think there is a real challenge, given the fiscal environment, in the next administration that will come up, and it will be crucial for this subcommittee to ensure that that administration understands this challenge as well.

Mr. FORBES. Thank you, Doctor.

Dr. Cropsey.

Dr. CROPSEY. I would also like to thank you again for the honor and opportunity to speak here.

We have gone over the major points here about the carrier air wing, I think, to people's satisfaction. It needs to be more robust than it is. There need to be more planes on its decks. Restoring the diversity of the air wing is critical to the platform's capabilities to its future, extending the air wing's range, using drones as tankers, and then the follow-on steps that my colleagues have talked about, providing cheaper missiles, building them, integrated carrier operations, perhaps adding smaller carriers to the larger carriers of which I have said we need more, distributing lethality, increasing the naval budget.

But I think that one of the most important things that this subcommittee has done and can do in the future is to tell people, tell your constituents, tell the country what this means, what are the stakes here.

I don't like to use this term because I hope that it is not true, but I fear that we as a nation are becoming sea blind and that what was known very well by Army generals and merchants and naval, obviously, people in the Navy at the beginning of the republic has been lost and is just not understood anymore and our reliance on strong seapower forces, our reliance on increasing globalized seaborne trade, that these are all subjects that are a little bit over the horizon for most people.

And I think that you play an extremely important role, not only by your advocacy of seapower, but in your ability to articulate its importance to the public.

Mr. FORBES. Well, gentlemen, thank you all so much for being with us. Thank you for your testimony and helping us to create this record.

We look forward to talking with you in the future as these questions arise. But we really appreciate you spending your time today.

And Mr. Courtney, if you have nothing else, then we are adjourned.

[Whereupon, at 5:35 p.m., the subcommittee was adjourned.]

A P P E N D I X

FEBRUARY 11, 2016

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

FEBRUARY 11, 2016

**Opening Remarks of the Honorable J. Randy Forbes,
Chairman of the Seapower and Projection Forces Subcommittee, for the hearing on
The Carrier Air Wing and the Future of Naval Aviation
February 11, 2016**

Today the subcommittee meets to discuss the Carrier Air Wing and the Future of Naval Aviation. Our distinguished panel of guests includes:

- **Dr. Seth Cropsey**, Director of the Center for American Sea Power, Hudson Institute;
- **Dr. Michael C. Horowitz**, Associate Professor of political Science, University of Pennsylvania; and
- **Professor Robert Rubel**, Naval War College.

Distinguished witnesses, thank you for coming.

The subject of our hearing today is the carrier air wing and the future of naval aviation. While I do want our discussion today to be focused on the future, that discussion must recognize past and present realities.

Just two days ago, the President delivered a budget request with major implications for carrier aviation. Among other things, the President's budget seeks to acquire additional F-35s and Super Hornets over the next five years, to shift the focus of unmanned carrier aircraft development to aerial refueling, and to inactivate one of our ten carrier air wings.

These decisions cause me to have two major concerns:

- First, I am concerned about the strike fighter shortfall, the health of carrier aviation at present, and the impact that inactivating another carrier air wing could have;
- Second, I am concerned about capability gaps in the future carrier air wing, and whether or not we are fully exploiting in the incredible potential of unmanned aircraft.

I am hopeful that our expert witnesses can provide insights on both of those issues, and also how they might be linked, since efforts to mitigate near-term challenges will have long-term repercussions and implications.

As members of this subcommittee and our witnesses are well aware, the ability to dispatch and employ an aircraft carrier and its air wing has provided the United States with an unmatched capability that can singularly change the course of history. While I want this hearing to be forward-looking, I believe that there are many examples in our recent history that could help frame our discussions and address my concerns.

For example, during World War II, Lieutenant Colonel Jimmy Doolittle's Tokyo Raid on 18 April 1942 continues to stand out, and is instructive for today's hearing.

Following the surprise attack on Pearl Harbor, President Roosevelt wanted the Navy to retaliate as soon as possible to lift America spirits and to destroy the Japanese sense of invulnerability. The objective was to find a way to penetrate an anti-access environment with an aircraft that had sufficient range and payload needed to accomplish the mission.

At the time, the Navy couldn't meet the mission requirements, which called for a carrier-launched aircraft that could cruise 2400nm and deliver a payload of 2,000lbs. To meet this requirement, the Navy turned to the Army Air Corps and its B-25 bombers. These new aircraft were specially modified with additional internal fuel tanks needed to almost double their range. Given the distances involved, the raiders had to fly unescorted and rely on not being detected to make it through the anti-access environment.

As to our hearing today, it is clear that challenges to be confronted in the far reaches of the Pacific and beyond have not changed much since WWII—the tyranny of distance, the need to protect the fleet, the need to deliver a payload in an anti-access environment undetected—all remain.

Having reviewed the threats to the carrier and the Navy's program of record, I am convinced that the Navy recognizes the threats to the carrier and its air wing and is taking some appropriate steps to mitigate them. At the same time, I remain concerned that the current Carrier Air Wing is optimized for sortie generation for short range strike missions in permissive to slightly contested environments. I continue to believe that a significant weakness in the current carrier air wing is its inability to provide the long range strike capabilities that will be needed to hit distant targets in anti-access environments.

Earlier this week, the Department of Defense announced its plans to develop an unmanned Carrier Based Air Refueling System or "CBARS" as a way to mitigate shortfalls in organic aerial refueling and ISR. I look forward to learning more about the CBARS aircraft and how the Navy intends to employ it. But with regard to UCLASS, I remain convinced that a carrier based, deep penetrating, long range strike capability is an essential element of any future carrier air wing.

Finally, I would like to highlight the enduring importance of electronic warfare and recognize the Navy's foresight in keeping the electronic attack mission alive after the Air Force all but abandoned it following the first Gulf War. The carrier-based EA-18G "Growler" and its electronic warfare systems provide capabilities invaluable to both the Navy and the Joint Force in contested environments and in future high-end fights.

It is my firm belief that Navy should show the same wisdom in developing an unmanned penetrating long-range strike capability as it did by retaining electronic attack capabilities.

Once again, I want to thank our witness for participating in our hearing this afternoon and I look forward to hearing your views on this important topic.

With that, I turn to my good friend and colleague, the ranking member of the subcommittee, Joe Courtney.

**Opening Remarks for Congressman Joe Courtney
Ranking Member
Seapower and Projection Forces Subcommittee
Carrier Air Wing and the Future of Naval Aviation
February 11, 2016**

Mr. Chairman, thank you for calling today's hearing on the Navy's carrier air wing and the future of Naval Aviation. I also want to thank our panel for agreeing to be here today to share their thoughts on the topic.

The aircraft carrier is the preeminent source of America's power projection capability. Over the years, this subcommittee has routinely held hearings on the relevance and future of the aircraft carrier, but as we all know, the carrier is nothing without the air wing it employs. The anti-access area denial (A2/AD) environment has led some to question whether the carrier can operate in those contested areas or if the aircraft will have the range needed to be effective. As new missiles and technologies continue to be developed by potential adversaries that threaten access, it is imperative that the United States keep pace and field systems that will allow the carrier and its air wing to project power and deter aggression anywhere in the world.

Over the years, we have seen the carrier air wing evolve from one with a large mix of aircraft to one composed of multi-mission aircraft capable of performing a variety of missions. Looking ahead, it is clear that the air wing will remain a key part of our nation's security and ability to project power well into the future – but only if we make the right investments in its composition, capabilities and reach.

The 2017 budget request submitted to Congress this week makes a number of proposals relevant to our discussion today. For instance, the budget makes investments in air-launched munitions like the Long Range Anti-Ship Missile, as well as expanding the capabilities of the SM-6 and the Tomahawk – all worthy advances in the offensive capabilities of our fleet and our carrier air wing.

The budget also requests support for purchases of the F-35 and FA-18 strike fighters, both critical components of our air wing. While I am concerned that the 2017 rate proposed for the F-35C variant for the Navy may be below optimal levels for efficient production and for meeting our looming fight generation strike fighter needs, I am pleased that the Navy has accelerated purchases of this critical aircraft within the five year future years defense plan. The advanced capabilities of the F-35 will make a significant contribution to the future of the air wing.

Additionally, the budget also moves us forward on a new stage in the evolution in the carrier air wing with the possible introduction of an unmanned aircraft. This subcommittee has been very active in ensuring that the new aircraft's requirements have

been fully vetted and are balanced with all of the other capabilities across the entire Department of Defense. The Navy is proposing new plan for an unmanned carrier aircraft with an initial tanking mission, and potential for future growth into new mission areas in the future. I look forward to examining the details of this new proposal, and I am very interested in hearing any comments the witnesses would like to share on how they believe unmanned aircraft should best be incorporated into the air wing.

Just as the aircraft carrier cannot be thought of singularly without the air wing, the capabilities of the air wing should not be discussed without taking into account the entire strike group. The cruisers and destroyers that make up the carrier strike group bring a significant amount of combat power that directly contributes to the effectiveness of the air wing. Arguably, the best example of this is the Naval Integrated Fire Control (NIFCA) concept, where the air wing's E-2D links the rest of the combat aircraft with the cruisers and destroyers. This concept dramatically increases the range and effectiveness of the overall strike group.

The combat reach of the aircraft carrier is often questioned due to the threat of certain missiles. However, the capabilities brought by the surface assets within the strike group are what enable these threats to be countered. It is possible that with the development of new offensive weapons, the reach and effectiveness of the carrier air wing could be further enhanced. I look forward to hearing from the witnesses on what new technologies they believe could be incorporated into the overall strike group that could potentially expand the reach of the carrier air wing.

I want to thank the Chairman for holding this hearing today and to the witnesses for appearing here today. I look forward to their comments.

Dr. Cropsey Testimony**February 11, 2016****Subcommittee on Seapower and Projection Forces****Introduction:**

Chairman Forbes, Ranking Member Courtney, and other distinguished members of the committee. Thank you for the honor of appearing before this committee. I have been asked to address the future of naval aviation and the carrier air wing, with a specific focus on unmanned systems.

This testimony will include four sections. First, I will discuss the evolution of the carrier air wing, from the 1980s until the present, with a specific focus on diversity and range. Second, I will analyze the gaps in the current carrier air wing, with an eye towards the new anti-access threats that the US' contemporary adversaries and potential adversaries pose. Third, I will explain the potential role of unmanned systems in the air wing. Finally, I will present my recommendations to this committee, on the topics of unmanned systems and the air wing as a whole.

Before I begin, I would like to emphasize that none of the points I raise matter without serious consideration of strategy. Since the end of the Cold War, all American attempts at strategy-making have been regionally focused. Low-intensity threats dominated U.S. thinking, with protracted insurgencies becoming the norm, rather than major conflict with states. To emphasize: the last two ground wars the U.S. has fought have been in the same country against the same military. Saddam's surplus Soviet forces and massive conscript army were first overwhelmed by a technologically advanced allied coalition, and then destroyed by a much smaller, primarily American, invasion force just a decade later.

Following this ground invasion, the United States did not face a major regional or global threat. Long-term, protracted insurgencies in Afghanistan and Iraq took their toll, but fighting those enemies did not require a global strategy. Modern American threats are no longer regional. China's interests are globalizing. It presents a direct strategic challenge to the American-led international order, and has confronted US power throughout the Asia-Pacific. Russia exploits the cracks in the European alliance system, and the inability of the US and its allies to adapt to changing situations to seize territory, and has inserted itself into the current Middle Eastern maelstrom as the US has departed. The Islamic Republic of Iran has embarrassed the US on multiple occasions, capturing its sailors, flaunting its sanctions, and attacking its allies under the pretext of righteousness. Finally, a lack of American resolve has allowed Islamist groups to turn the tide against the West. Islamic State now holds territory in the Middle East and along the Southern Mediterranean, allowing it to exploit Europe's soft underbelly in its most vulnerable condition since the height of the Cold War.

These threats, ranging from China at the highest end of the spectrum, to ISIS at the low end, overlap regionally and strategically. Iran and ISIS operate in the same countries, and are engaged in military conflict. Russia has thrown its weight behind Iran and its Syrian proxy, Bashar al-Assad. Moscow has committed a substantial expeditionary force to the conflict in the Levant. Its actions in Eastern Europe intersect with the refugee crisis, fertile ground for ISIS and other terrorist groups to infiltrate the EU. Finally, China and Russia both have interests in

Central Asia and the Pacific, which coincide with Iranian rulers' ambition to monopolize the world's petroleum supply.

The overlap between these threats necessitates a global strategy that is designed to counter the full spectrum of potential enemies. Such an understanding must dictate not only our tactics and operational procedures, but also our weapons systems.

Great maritime powers have always experienced the problems that overlapping threats present. Britain serves as the best example. The Royal Navy in 1807 had to prevent Napoleon's forces from striking across the Channel and making landfall in England, while simultaneously combating the slave trade off the coast of Africa. On the eve of World War One, First Sea Lord Jackie Fisher and First Lord Winston Churchill had to counter the powerful *Kaiserlich Marine* in the North Sea, while defending British shipping around the world against commerce raiders and submarines. Churchill reprised his role at the outbreak of World War Two, countering the dual threat of the German submarine fleet, and Japan's powerful Navy in the Pacific.

In each of the three examples, the Royal Navy diversified the tools at its disposal to respond to both high and low end threats. In the early 19th century, the British constructed powerful first and second-rate ships of the line to preserve their dominance over the French. Neither their strategy nor their shipbuilding stopped here. In addition, the Royal Navy built smaller frigates, and later Baltimore Clippers, to hunt down pirates off the African Coast.

Admiral Fisher's vaunted "scheme" marshalled heavy dreadnought battleships for major fleet engagements against the Germans in the North Sea, along with fast Battlecruisers, which were intended to destroy commerce raiders, despite their different usage during Jutland. Combined with smaller destroyers and other escorts, this mix of ships was designed to engage in major oceanic battles, and protect British shipping internationally. During the Second World War, Churchill created destroyer and light aircraft carrier picket squadrons to confront U-Boats and German commerce raiders, while maintaining the British battleship fleet to counter the *Kriegsmarine* if needed. In each of these cases, the Royal Navy employed high and low end platforms, quite often in the same theater of operations and sometimes against the same enemy, to achieve a diverse set of strategic goals. The multiplicity of current threats to the United States, ranging from the sophisticated and powerful PRC to ISIS' crude tactics, indicates the need for a similar approach today.

Threats have ceased to be regional: they now span continents, hemispheres and traditional US combatant command areas of responsibility. These pose systemic challenges to the American-led liberal international order. Without an understanding of how to deal with these actors, their intentions, and their capabilities, our discussion today on systems and platforms exists only in a closed loop. Without a coherent strategy, discussion of fleet design is an exercise in speculation.

Evolution of the Carrier Air Wing (1980-2016):

Since its earliest days, naval aviation has always been defined by a diversity of platforms. The carrier platform, with the limitations it imposes on fuel usage and weight, has always forced aircraft designers to create a diverse number of platforms. Even in the earliest days of the Second World War, the carrier air wing was comprised of air superiority fighters like the F4F

Wildcat, scout bombers like the SBD Dauntless, and Torpedo Bombers like the TBD Devastator. This delineated structure continued throughout World War II, with platforms specific to certain missions conducting strike, reconnaissance, or air combat as needed.

Two factors have shaped the modern carrier air wing – aerial refueling, and sustainable ISR platforms. Aerial refueling extended the range and flight time of the carrier air wing, allowing it to remain on station longer, and patrol more airspace. This became critically important for long-range interceptors and fighter aircraft, since these platforms could now transcend earlier limitations on range. Truly dedicated air-borne early warning platforms began to enter the fleet in the 1960s, allowing the carrier air wing to monitor even more airspace.

By the 1980s, the modern carrier air wing emerged. Long-range interceptors, multi-role fighters, strike aircraft, ground attack aircraft, electronic warfare platforms, maritime patrol aircraft, aerial refueling platforms, and air-borne early warning platforms ensured the efficacy of the air wing in a variety of situations. The long-range F-14 Tomcat doubled as an air superiority fighter and long-range interceptor, allowing the carrier air wing to intercept threats at range and destroy enemy fighters in dogfights. The multirole F/A-18 Hornet carried a heavy payload, and despite its shorter range, could serve well as a dogfighter if needed, improving fleet air superiority and strike capabilities. The A-6 Intruder platform's heavy payload and effective range provided the carrier with an all-weather strike aircraft. The platform also doubled as an Electronic Warfare airframe, when reconfigured as the EA-6B.

Moving to more low-level platforms, the A-7 Corsair II, derived from the F-8 Crusader fighter aircraft, gave the carrier subsonic attack capability to be used in ship-to-shore actions. Maritime patrol aircraft included the carrier-based S-3 Viking, and the long-range, land-based P-3 Orion, allowing the Navy to defend the carrier against undersea threats and interdict shipping when needed. Variants of the A-6 and the S-3 were used as carrier-based aerial refueling platforms, increasing range and loiter time for all aircraft in the air wing. Finally, the E-2 Hawkeye ensured that the air wing could monitor the skies at all times, allowing for a much more effective sortie rate. The carrier air wing could then conduct its four critical missions: ISR, Strike, Sea Control, and ASW. It could fulfill these missions at long range, against a variety of high end and low-end threats.

This air wing was designed with a specific purpose: countering the threat that the USSR posed to the US' European allies. *The Maritime Strategy* of the 1980s called for the Navy to take pressure off the European Central Front by applying it to the Soviet Union's flanks – the Mediterranean, the northern seas, and the Pacific. The air wing was designed with this goal. The F-14 and F/A-18 could achieve air superiority against limited long-range Russian air cover, while intercepting long-range strike aircraft. The A-6 and A-7 would then exploit this air superiority by striking inland at ground targets. The S-3, when coupled with the surface combatants in a carrier strike group, would help destroy the Soviet submarine fleet. Finally, aerial refueling platforms multiplied the range and endurance of the entire air wing, ensuring long-term patrols and deep strikes into enemy airspace remained possible.

This air wing structure ensured the ability of the carrier platform to respond to multiple gradations of threats. The same flattop had the tools to fight high-end Soviet fighters and

intercept bombers, attack hardened ground installations, and provide consistent air support against low-level threats at a low cost. The diversity of the air wing therefore increased combat power, and made the carrier, and by extension the fleet, more efficient.

Decline in Diversity:

Since the end of the Cold War, the US Navy's carrier air wing has declined in diversity, with multirole platforms replacing mission-specific aircraft. The F-14, A-6, S-3, and A-7 were phased out, with the F/A-18 Hornet and Super Hornet taking over their various missions. Despite the versatility of the platform, the F/A-18 cannot match the range of the platforms it replaced, nor does it provide the same sort of air-to-air capability that the F-14 did. The F-35 attempts to offer the Navy a measure of the A-6's and A-7's strike abilities, but the expensive platform comes with major operational questions. Most important, the Navy currently lacks organic range-extending airframes. It relies on land-based KC-10, KC-130, and KC-135 refueling aircraft. Such an arrangement is viable in peacetime, or when low-level, regional threats are the US' primary concern. However, in combat, such operational assumptions are dubious.

Deficiencies in the Modern Air Wing:

A small number of platforms have replaced the previously diverse carrier air wing. In fact, the current air wing can be narrowed to three platforms: F/A-18 variants, E-2 Hawkeyes, and the newly introduced F-35. These platforms are currently deficient in performing the four major roles of ISR, Strike, Sea Control, and ASW. In addition to these gaps in tactical abilities, there is a major strategic gap in the carrier air wing's ability to defeat Anti-Access/Area Denial (A2AD) systems being employed by such potential adversaries as China, Iran, and Russia.

Current carrier borne ISR missions are carried out by the E-2 Hawkeye. The E-2 carries a large radar system that is used to monitor and coordinate all air and surface surveillance and targeting operations. The Hawkeye has adequate radars to complete its mission, with an 800 nautical mile range. However, its endurance time of six hours limits the time it can remain on station. As the typical carrier air wing only contains one squadron of E-2's, for a total of five birds each, the carrier's ISR capabilities are limited.

The current carrier air wing uses two multipurpose platforms to conduct strike missions – the F/A-18 and the F-35. Although the F-35 is not yet in service, and is not slated to be in large numbers until late 2018, its projected role in the air wing warrants its inclusion in this discussion. The F/A-18's C, E, F, and G variants (the final of which is the carrier's Electronic Warfare platform) can carry a heavy armament, and can perform multiple missions quite effectively. The smaller F/A-18C carries nearly 14,000 pounds of ordinance, whereas its larger Super Hornet cousin can carry nearly 18,000 pounds of weapons. However, the combat radius of both platforms does not exceed 600 nautical miles at most, and in reality is closer to 350-400.

The F/A-18 is not effective for striking over large distances, despite its serviceability when striking shore targets in Afghanistan or Iraq. To overcome this range restriction, the Navy has used two methods. First, "buddy tanking" involves outfitting an F-18 with multiple drop tanks rather than weapons, and using it as an impromptu range-extension platform. This system requires a high percentage of the air wing to be removed from combat during long-range strike

missions. Air Force tankers can be used to increase the range of Navy strike fighters. This is a viable option only if the Air Force has secure bases within range, which is unlikely in the majority of modern combat environments. The EA-18G electronic warfare platform suffers from the same range and endurance difficulties as the F-18 fighter variant.

The F-35 will serve theoretically as a high-tech, stealthy strike platform, complementing the low-tech F/A-18. Its integrated-stealth, fifth-generation technology, internal weapons bays, and informational capabilities should be a major asset to the modern air wing. However, the platform has major liabilities. Its radar profile is still quite large, its internal weapons bays do not contain enough ordinance for a significant strike, and it has multiple potential informational vulnerabilities. Nevertheless, the greatest problem for this high-cost platform is its range. The F-35 is limited to just over 600 nautical miles, giving it only a slight edge over the F-18 it is intended to replace. This small difference does not enable it to conduct deep strike operations any more effectively than an F-18.

The shorter range of the F-18 and F-35 has also made sea control more difficult to achieve. Without a long-range interceptor like the F-14 (which was also armed with specialized, long-range air-to-air missiles to increase its combat radius), the current carrier air wing is much less capable of defeating incoming threats and establishing sea control. Aside from the range limitations on both potential sea control platforms, both the F/A-18 and F-35 are questionable dogfighters. The F/A-18 can challenge any major air-to-air platform, aside from Su-35 variants, making it decently survivable. However, the F-35 has poor aerodynamics, meaning it cannot serve as an effective dogfighter if needed. Fully integrating such an airframe into the air wing in the next decade would decrease the ability of the Navy to control the seas, in addition to the other drawbacks inherent in the F-35 platform.

More broadly, organic stealth capability on the carrier platform may be a very far reach. Stealth aircraft like the F-22 aircraft must be cleaned and serviced every few sorties. Small bits of debris and poor weather conditions on land erode the airframe's stealth. Operational conditions are even worse onboard an aircraft carrier. Salt spray constantly abrades the airframe. The cramped conditions of the hangar deck point to multiple scrapes and bumps. Additionally, the carrier cannot have a built in stealth service facility, as this would take up too much space. Thus, the F-35 is an even less effective aspect of the air wing – it is simply an under-armed, aerodynamically poor attack aircraft with a high radar profile.

The Navy's antisubmarine warfare (ASW) capabilities have declined since the retirement of the S-3 Viking. The Viking's 600+ nautical mile range gave American fleets a potent tool to combat Soviet submarines in the 1980s, protecting the critical flat top from undersea threats. With its retirement, the SH-60 helicopter took over its ASW duties. The resulting range decrease of 200 or more nautical miles (to a maximum 400 nautical mile range) makes the carrier, and by extension the fleet, much more vulnerable to attack from subsurface assets. In addition, aerial refueling is not possible for most helicopters. So the fleet would be just as vulnerable to submarines notwithstanding range-extending platforms.

Although the individual components of the modern air wing are effective, taken as a whole, the carrier air wing is deficient. It is hampered by its short range and small loiter time. Its

multipurpose airframes cannot perform air superiority missions to the level of the most advanced Russian and Chinese fighters. In addition, its major platforms like the F-35 have significant vulnerabilities. A final problem exacerbates all the listed weaknesses in the carrier air wing: a lack of aircraft. The services as a whole have been forced to tie up expensive platforms to cut costs. Because the maintenance costs for the Navy are much higher than for any other service, the Navy must bear a portion of any budget cuts by tying up platforms. This has resulted in the placement of 11 missile-defense *Ticonderoga*-class cruisers into the reserve fleet, along with other major surface combatants. Naval aviation has also experienced the problems that budget cuts impose on the service. For at least the last eight years, the Navy has fielded undersized carrier air wings, numbering at 60 aircraft, or at most 75% of the supercarrier's designed capacity. This smaller number of planes specifically causes one of the problems noted above—the undersized air wing does not field enough E-2 Hawkeye airborne early warning platforms to adequately patrol the airspace around the carrier.

The final problem the carrier air wing encounters today is cost. The carrier platform is expensive, with the newest *Ford*-class coming in at \$2.4 billion over budget. However, the costs of the supercarrier are justifiable, as the alternative of a land-based network requires a high expenditure of diplomatic capital and financial resources, and small carriers would have difficulty providing needed combat power to the fleet with sufficient cost savings. Nevertheless, the platforms on the carrier are not efficiently employed in current missions. The 1980s era air wing used the A-6 and the A-7 to strike land targets, with the A-7 performing the majority of close air support missions. Using this cheaper platform for lower-cost missions allowed the more advanced A-6 to be maximized in different combat environments. Today, the F/A-18 performs all interdiction, intercept, and air superiority roles in the air wing. Although it serves well in all three missions, the platform is extremely cost inefficient for strike against organizations like ISIS. Using the F-35 for such strikes will be even more economically inefficient. A large-bore howitzer is unnecessary to protect against a marauding grizzly bear.

Modern Threats:

Unlike during the post-Cold War period, the United States must confront several major state actors on the international stage. The three foremost state threats today are China, Russia, and Iran. Each adversary has its own characteristics and difficulties. Unfortunately, all three rivals have the technology to challenge the U.S. access to its territory, preventing a first Gulf War-style massed invasion.

Since the early 2000s, China has embarked on a major military modernization program. From beginning its first strategic submarine patrols to experimenting with carrier aviation, to recently announcing the construction of its first domestically built aircraft carrier, the Chinese military has become a modern instrument that can conceivably challenge American power. It has numerous effective air-to-air platforms, a large submarine fleet, and an effective air defense system. U.S. bases are increasingly vulnerable to Chinese attack. More important, China's DF-21 hypersonic missile threatens to cripple the carrier by speeding through its defensive escort screen and destroying or disabling the platform itself. Both the carrier and its air wing are vulnerable, in addition to the land bases that would typically house Air Force refueling platforms. China has harassed American naval forces in contested areas, such as the South and

East China Seas, and has shown a willingness to confront American allies, namely Japan, in various conflict points.

Russia's resurgent military has focused mainly on improving its ground and air capabilities. On the specific topic of access denial, the highly potent Russian S-300 and S-400 air defense systems increase the ability of the Russian military to prevent American aircraft from striking ground targets. The resurgent Russian surface and submarine fleet push the U.S. Navy even further away from shore, complicating any sort of effective power projection. Russia has demonstrated its desire to shackle the U.S. in certain critical regions through its actions in Eastern Europe and the Middle East. Russian-backed separatists have destabilized Ukraine, and thrown the EU and NATO into disarray. Meanwhile, the Russian military props up the Assad regime and destroys the Syrian opposition, while claiming the moral high ground by fabricating strikes against ISIS. The S-300 missile system now deployed in Syria has forced the U.S. to enter into deconfliction procedures with the Russians on the ground, demonstrating the degree to which small actions can create larger diplomatic and military effects in critical areas.

Iran's burgeoning anti-access network has expanded since the nuclear deal this past July. The Islamic Republic has already taken advantage of the new trade deals it has cultivated to purchase aircraft technology. Iran is receiving the S-300 missile system from Russia, and has developed close ties with the Chinese. Its strategic position along the Strait of Hormuz increases its ability to manipulate the world's energy supply, making the country an even greater threat. The Islamic Republic aims to deny the U.S. access by both destabilizing the countries around it, like Syria and Iraq, and simultaneously increasing its own armed forces to defend its southern coast. This layered anti-access network will be difficult for the U.S. to break through, if the need arises. An Iranian naval presence in the Red Sea, purchased with recently unfrozen funds or future oil revenues, would add to Iran's regional weight giving it influence in the approaches to the Suez.

These three threats intermingle with various non-state and proxy groups in the Middle East and Europe. Russia directly controls separatist rebels in Eastern Ukraine, and has propped up the so-called Donetsk People's Republic for nearly two years. Hezbollah (Iran's proxy in Lebanon) gives the Islamic Republic a foothold on the Mediterranean coastline. Unaffiliated groups like ISIS, Jabhat al-Nusra, and al-Qaeda pose a threat to the United States and its allies. They undermine regional stability, and have the potential to strike the American homeland.

All of these threats exist in overlapping regions. ISIS, al-Qaeda, Jabhat al-Nusra, and Iran all compete for power in the Middle East. Russian intervention in Syria has added another ingredient to this bubbling cauldron. China and Iran both have interests in the Indian Ocean and Pacific, and have a close relationship on energy issues. Finally, Russia's intervention in Syria, its Eastern European mischief, and its presence in the Northern Pacific ensure that its military force spans multiple regions. The U.S. must confront multiple high and low intensity threats in the same region. The current carrier air wing is not designed to confront these challenges. Its short strike range and loiter time, small size, and inefficient cost put American commanders at a disadvantage in any encounter with their Russian, Chinese, and Iranian adversaries.

Role of Unmanned Systems:

Unmanned systems can play a critical role in remedying the difficulties previously identified. The benefits of unmanned aircraft can be restricted to ISR, strike, and refueling.

Using an unmanned platform for ISR missions could allow new, more advanced sensors to be integrated into the fleet. Additionally, without the physical pilot in the aircraft, the airframe could be made more compact, stealthier, or more spacious for fuel or sensors. A proper unmanned ISR system would integrate the most modern sensor technology into a high-endurance platform that could remain on station for a day or more. The Predator and Reaper drones embody this concept on a smaller scale, with the Reaper's 1,000 nautical mile range, 14-hour endurance time, and several thousand pounds of potential ordinance proving invaluable to American forces throughout the Middle East. A more sophisticated ISR platform could fulfill the reconnaissance role of the E-2.

Unmanned platforms are also suited to strike missions. First, the platform can be constructed with more inherent stealth characteristics – namely a lower radar profile and internal weapons bays. Without a pilot, the structure of the airframe can be modified as needed. Second, deep strike missions into contested territory are risky. Placing an unmanned system in harm's way instead of a manned aircraft could make higher risk missions viable. If the UAV is destroyed, the mission can be moved to another manned or unmanned aircraft. Third, the increased loiter time that UAV's offer allows for improved sea control operations. The ability to remain on-station for over 12 hours would allow the carrier to control a larger amount of airspace with fewer sorties, instead relying on long-term presence flights from unmanned sea control surface warfare aircraft.

Finally, refueling is a natural fit for unmanned platforms. The design benefits inherent in a UAV allow for greater fuel storage. Once again, removing the pilot greatly increases the storage space of the airframe. Thus, a UAV designed for air-to-air refueling could both remain in flight for several hours, and service multiple aircraft. This would eliminate the need for buddy or Air Force tanking by once again providing the carrier air wing with an organic tanking capability.

The current unmanned system for the Navy, the UCLASS vehicle, the X-47B, is likely to play an increasing role in naval aviation. Similar in shape to the USAF B-2 Spirit bomber, the UCLASS is designed to have a low radar profile. The platform could be used for strike, ISR, refueling, or some combination of the three.

Recommendations – Unmanned Systems:

In the near future, unmanned systems should initially be used as tanking and range extending aircraft. At its current developmental stage, the UAV naturally fits as a tanking platform. Added tanking ability is the most direct path to extending the air wing's range. The extra space in the UCLASS platform could be taken up by more fuel. Refraining from using UCLASS variants as strike platforms in the near future ensures that Navy is not putting unproven technology into a contested combat environment. Instead, it would be maximizing the tools currently at its disposal, giving the service breathing room to continue experimenting with the development of different types of unmanned systems.

Although tanking should be a priority for the first widely-deployed unmanned system, strike/sea control and ISR should be considered as the technology matures. The Sea Avenger UCAV is a candidate for an extended loiter time strike aircraft. A different approach might consider placing smaller UAV platforms on destroyers and cruisers, to give them a greater degree of organic ISR capability. A Reaper-style drone—or even a smaller one—launched from an *Arleigh-Burke* would significantly increase the ISR coverage of the carrier group, and take some of the strain off the already hard-pressed carrier air wing.

Further into the future, I hope that Navy will consider creating a full-fledged ISR and strike unmanned platform. The advantages of using an unmanned system in a contested environment cannot be overstated. The potential decrease in human cost is coupled with the ability of an unmanned system to perform maneuvers that a human pilot cannot, such as tight turns and high-speed vertical strikes.

Recommendations and Issues – The Carrier Air Wing:

This testimony has argued that the current carrier air wing is challenged to perform all its necessary missions. Integrating unmanned systems into the air wing, particularly as tankers and ISR platforms, would begin to address these challenges. Other issues remain.

First, there is the question of the diversity of platforms in the air wing. Using the F/A-18 platform for a strike fighter, interceptor, air superiority fighter, and electronic warfare platform may save costs. Nevertheless, the F/A-18 platform cannot perform all the missions it is assigned with equal efficacy. Developing dedicated airframes for different roles within the air wing would ensure the more effective allocation of aircraft, and improve each aircraft's performance in its specific mission set. Greater certainty about the nation's strategic objectives and the role of seapower in achieving them ought to precede any decision about which combat roles require a dedicated aircraft.

Second, and again according to a clear strategic rationale Navy would benefit from considering the development of a manned air superiority fighter to replace the F/A-18 in its fleet air defense and air superiority role. The supermaneuverable Su-35 and its variants can outfly every aircraft in the American military apart from the F-22 Raptor. In addition, the F-18 cannot intercept incoming enemy aircraft at range, making the carrier less effective, and more vulnerable. A dedicated air superiority platform that can double as a long-range interceptor would fill this critical gap in the carrier air wing.

Third, these strategic questions should include revisiting the concept of a dedicated ASW aircraft. The S-3 did not lose its role as an ASW platform because of its inefficacy – rather, the Soviet submarine threat declined, allowing the aircraft to be transitioned to other duties. The resurgent Russian and Chinese navies both field advanced and numerous submarine fleets. Their numbers will grow. Russian and Chinese submarines have tailed American carrier groups in the Asia-Pacific. The US' allies have renewed their focus on ASW aircraft. Japan has purchased a number of P-8A Poseidon aircraft to patrol the disputed East China Sea, and South Korea recently received several S-3's to increase its ASW capabilities. Should we not be considering the same improvements? Increasing the number of P-8A's throughout the Navy's land-based air stations will help remedy this undersea vulnerability. But if land-based ASW was insufficient

during the Cold War, what makes it sufficient today? The USSR was an economic nonentity compared to China.

Fourth, what exactly is the role of the F-35C in the air wing? Despite its various vulnerabilities and costs, the F-35 does provide important strike and stealth capabilities to the carrier air wing. However, the platform is not designed to conduct air-to-air missions. Although long-range missiles could remedy some of this aerial vulnerability, is the F-35C reliable in a real dogfight? Historical experience has shown that assumptions of purely beyond-visual-range combat conducted by missiles are unwarranted. This raises important questions about the F-35C's potential role in the air wing, as well as whether some of its role could be taken up by either the F/A-18 or a newly developed air superiority fighter.

Fifth, do we need a low-end, low-cost platform for air support and strike missions against targets like ISIS? Using high-end platforms like the F/A-18 and the future F-35B and C to attack insurgency groups is very expensive. Each F/A-18 sortie can cost several million dollars, after accounting for flight costs, the price of munitions, and air force tankers. This cost dwarfs ISIS' expenditures on each convoy and group of fighters. During the Vietnam War, the Navy used the A-1 Skyraider propeller-driven aircraft to attack North Vietnamese ground targets. The aircraft's long loiter time and low cost made it a highly effective tool to attack lightly armored, low-cost guerillas in Indochina. The A-1's other contemporary counterinsurgency aircraft, the OV-10 Bronco, could launch from a carrier without a catapult. The A-7 served a similar role in the later stages of the war. Both platforms were survivable, and relatively cheap compared to the higher end A-6 and F-4. There is value in versatility, making the F/A-18 an important aircraft for the air wing. Nevertheless, when high and low-end threats persist in the same region, it is necessary for the carrier air wing to have a tool for persistent strikes against insurgent targets, along with high-end platforms that can confront greater threats.

Sixth, the Navy should increase the size of the carrier air wing to full strength. Budget restrictions have forced the Navy to downsize the carrier air wing, decreasing its efficacy. ISR capabilities have suffered, due to the smaller number of E-2C's present on the flattop. Strike and air-to-air missions have also been affected, as a lower number of aircraft increases airframe fatigue. Regardless of other developments, the carrier air wing ought to be increased to its full strength.

Seventh, the Navy would benefit from reconsidering how it uses stealth aircraft. As previously stated, the carrier is a poor environment for inherently stealthy platforms. Nevertheless, the carrier could need stealth platforms for strikes against entrenched enemy targets. If these platforms are needed, the Navy could transport them onto the carrier, and use them for one or two sorties to maximize their stealth capabilities. After striking the identified targets, these assets should be returned to a shore base for cleaning and refit. Better to rent a car when you travel than buy one.

Recommendations – The Carrier Platform:

The carrier's survivability in contested environments has been questioned for many decades. Historical experience has proven that the carrier is a defensible platform when operating within its system – the carrier strike group. The supercarrier is the most effective platform for

achieving localized air superiority and sea control, and then projecting power against enemy targets. A carrier under 60,000 tons will not have a large enough air wing to be a viable fleet capital ship, and will lack the hull area needed for three armored decks. Nothing can match the ability of the carrier to provide on-target force in a wide array of situations. Building smaller carriers for high end engagements is impractical.

If the Navy is to explore the small carrier option, it can take one of two routes. First, it could use these platforms to strike against low-end targets, for example in the Middle East and North Africa. Such a model is similar to the approach of employing low-cost platforms on the supercarrier to free up more expensive airframes for operations against high value targets. As threats like ISIS proliferate across the Greater Middle East, in tandem with rising high-end adversaries in the region like Iran and Russia, the U.S. may have to choose to place one or two available carriers in the Persian Gulf/Arabian Sea, or along the North African coastline. Small carriers could allow the Navy to maximize its assets, by freeing up supercarriers for patrols in more critical areas, while smaller platforms conduct strikes against insurgency groups.

Three methods exist for the low-intensity carrier idea. First, the Navy could build a smaller platform from the keel up. This affords it the greatest degree of design flexibility, since a 20,000-40,000 ton carrier can be built with a full catapult and trap launching and landing system, diversifying the potential air wing, and increasing the strike range of aircraft on board. Second, the Navy could convert older LHD/LHA's into smaller carrier platforms. The three remaining *Tarawa*-class LHD's and the *Wasp*-class are all candidates for conversion. Such a conversion would mirror the SCB-27 and SCB-125 rebuilds on the *Essex*-class aircraft carriers after World War II, and would include the installation of an angled deck, catapult, and trap, along with the strengthening of the flight deck to withstand CATOBAR operations. Third, the Navy could repurpose its existing *Wasp* and *America*-class LHD's/LHA's for strikes against lower priority targets. It could field an aircraft like the OV-10, which had the capability to take off without a catapult from an LHD.

Second, the Navy could build 60,000 ton conventionally powered carriers to supplement the supercarrier fleet. These ships could be contracted to multiple shipyards, decreasing the cost of construction. The 60-strong air wing of these mid-sized carriers would make them capable against high and low-end targets. Four to six of these ships, much like the aforementioned low-intensity attack carriers, would free up American supercarriers, and ensure the efficient allocation of assets. They should in no way be understood as substitutions for the congressionally-mandated requirement for 11 large-deck carriers.

Recommendations – Miscellaneous:

There are several other smaller issues with the carrier air wing whose solution would help ensure its short and long term efficacy. First, the Navy, and U.S. military as a whole, would benefit by developing cheaper munitions for use against lower-priority and lower-tech targets. Sustained campaigns against insurgent groups like ISIS are likely in the foreseeable future. Operation Inherent Resolve has demonstrated the strain that long-term bombing campaigns can put on the American supply chain. The U.S. is currently running low on guided munitions, the critical tool for American airpower when it attacks ground targets. Developing lower-cost munitions for use against groups like ISIS is therefore critical, considering the long-term nature of insurgency

challenges. These cheaper munitions could be paired with the low-cost ground attack aircraft previously suggested, to create a specific tool for fighting insurgent groups in the Middle East and Africa.

Conclusion:

The carrier air wing is the U.S. Navy's most critical tool for achieving its objectives. From ISR and Strike to Sea Control and Air Superiority, there is no replacement for the efficacy of the carrier air wing carried onboard a large-deck flattop. Unmanned systems will be a part of the future of naval aviation, with a more limited tanking role in the immediate future that expands to ISR and Strike as technology develops. Aside from unmanned platforms, Navy would benefit from reevaluating the full composition of the air wing, and reemphasizing diversity and mission specificity, to ensure the greatest possible level of combat ability.

Despite the importance of these recommendations, I cannot stress the importance of strategy. If we do not understand our adversaries and our goals, what we build and buy is irrelevant. A proper strategy is more critical than any specific procurement or development can ever be.

HUDSON INSTITUTE

Seth Cropsey began his career in government as assistant to Secretary of Defense Caspar Weinberger. In 1984 he was appointed Deputy Undersecretary of the Navy where he advised the Secretary on strategy, special operations, defense organization, and naval education. In the George H. W. Bush administration he served as Principal Deputy Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict.

After leaving the Defense Department in 1991 Cropsey led the Asia Studies Center where his work focused on U.S.-Japan security and diplomacy as well as emerging commercial and security relations between the U.S. and China.

In 1994 he returned to the government as first department chairman and distinguished professor at the George W. Marshall European Center for Security Studies in Garmisch-Partenkirchen, Germany. He administered the department of national security planning, developed curriculum, lectured, and led seminars. After returning to the U.S. Cropsey joined the American Enterprise Institute where he wrote and published a monograph on defense export controls.

In 2002 he was confirmed by the Senate as director of international broadcasting where he helped increase resources, broadcasting, and focus on audiences in key Middle Eastern states.

In 2005 Cropsey returned to writing, analyzing, and lecturing on U.S. strategy. He is currently a Senior Fellow at Hudson Institute and serves as Senior Advisor for maritime strategy at the Center for Naval Analyses. He completed a book on the decline of American seapower in January 2012, scheduled for publication in early 2013.

Cropsey served as a naval officer from 1985 to 2004 and served with Special Boat Squadron TWO in Little Creek. He has lectured at Oxford, the Ecole Militaire, the NATO School at Oberammergau, various national security forums in Albania, Hungary and Romania, Taiwan's National Defense University, and U.S. colleges and universities. His articles have been published in such journals and newspapers as the *Foreign Affairs*, *World Affairs*, *The American Interest*, *The Wall Street Journal*, *The Washington Post*, *Harper's*, *Commentary*, and *The Weekly Standard*.

He is a graduate of St. Johns College in Santa Fe and received his M.A. from Boston College. He holds a Ph.D. in philosophy from the University of Cluj in Romania. Cropsey, his wife, and 12-year old son live in Bethesda, MD.

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Ensuring the Future of Naval Power Projection: The Role of Carrier Aviation

**Michael C. Horowitz, Associate Professor of Political Science and Associate Director of
Perry World House, University of Pennsylvania**

**Testimony for the House Armed Services Subcommittee on Seapower and Power Projection
Forces**

Prepared for delivery on February 11, 2016

Thank you Chairman Forbes, Ranking Member Courtney, other members of the subcommittee, and staff, for the invitation to testify before you today. It is an honor to speak about the vital importance of the carrier air wing, the challenges it faces, and ways to sustain carrier-based airpower into the middle part of the 21st century. The opinions expressed in this statement are mine alone and should not be interpreted as representing the University of Pennsylvania or any other organization with which I am affiliated.

America's global reach relies in no small part on naval aviation and the carrier air wing. The ability of the United States to use the aircraft carrier as a mobile airfield is a necessary component of projecting power over great distances, helping give the United States military global reach. Ensuring that carrier aviation is an integral part of the future of US military power, however, will require forethought. Due to growing missile threats to the carrier and other challenges from an anti-access/area denial (A2/AD) environment, as well as the long procurement timelines to build new systems, the decisions made over the next several years will be critical in determining the future trajectory of carrier aviation. In what follows, I briefly describe the rising threat to the carrier, along with three ways the United States Navy can help sustain the carrier air wing's role in global power projection: focusing on munitions, investing in uninhabited systems, and diversifying risk.

Growing Threats to the Carrier Air Wing

As is well known, America's aircraft carriers are increasingly vulnerable. The spread of anti-ship cruise missiles such as the SS-N-22 Sunburn, along with the development of China's anti-ship ballistic missile, the DF-21D, places US aircraft carriers at greater risk of being sunk than at any point since arguably the end of the Second World War. China's YJ-18 supersonic anti-ship cruise missile further illustrates the way long-range, fast threats to the carrier are growing. Moreover, China's air-to-air missiles such as the PL-15 could also place the carrier air wing itself at risk even after it launches from the carrier.

The threat to the carrier is not only a matter of China's growing capabilities. Iran also possesses the SS-N-22, and others around the world have been modernizing their cruise missile arsenals over the last decade.¹ Add swarming drone boats, sea mines, and submarines to the mix, and the carrier faces an array of threats. Even given the substantial investment and expertise that the US Navy has in protecting the carrier, these threats are likely to grow.

¹ Dennis M. Gormley, *Missile Contagion: Cruise Missile Proliferation and the Threat to International Security* (Santa Barbara, CA: Praeger, 2008).

A more vulnerable aircraft carrier could push it (and the associated strike group) further and further away from the shores of potential adversaries, placing naval power projection at risk and also reducing the ability of the carrier, through its mere presence, to reassure allies. The United States should not take the future of the carrier, and the ability of carrier aviation to serve as the basis of global power projection, for granted.

The history of military innovation demonstrates that established powers, using established technologies, must continually innovate to keep up with new challenges. The example of the British, who struggled to view the aircraft carrier as more than a spotter for the battleship, demonstrates the kind of failure of imagination that it is crucial for the United States Navy to avoid. By taking seriously these threats to the carrier itself, and the carrier air wing, Congress and the Navy can work together to preserve the role of carrier aviation in US power projection capabilities.

Invest In Munitions

One way to ensure the continued strength of carrier aviation, in the face of growing threats to the carrier, is extending its range. Range in this case could mean two things: increasing the range of the airplanes launching from the carrier, or increasing the range of the munitions that those planes carry. For a variety of bureaucratic and budgetary reasons, however, it is often easy to under-invest in the development of munitions and the purchase of munitions in sufficient quantity. The recent announcement that the US Navy is developing an anti-ship version of the SM-6 is great news for naval power projection.² Combined with prior reports of a new anti-ship Tomahawk,³ these systems should dramatically expand the range of the Navy's surface-to-surface anti-ship missile capabilities.

These recent developments in surface-to-surface missiles are not a substitute, however, for innovation in air-launched munitions. In the air, the development and deployment of the Long Range Anti-Ship Missile (LRASM), a long-range, low-visibility, munition, is significant for giving US carrier-based aviation the ability to rapidly strike adversary ships at long range. Along with the Joint Air-to-Surface Standoff Missile-Extended Range (JASSM-ER), LRASM represents the type of range-extending investment in munitions that will give the carrier air wing new striking power. Extending the range of the weapons launched from carrier aircraft allows the carrier itself to stand off further from the fight, decreasing its vulnerability.

It is vital that budgetary constraints do not lead to the reduction in funding for the generation of munitions currently coming online, along with research and development in next-generation weapons. That being said, the current generation of advanced munitions are expensive. For example, one estimate suggests LRASM may cost \$2 million dollars per missile.⁴ This is money well spent, but unless the fiscal environment changes, and even if it does, Congress and the Navy should think about ways to reduce the unit cost of advanced munitions.

One way to reduce costs is through larger buys that produce economies of scale, but another way is to consider next generation systems that might employ more off-the-shelf commercial technology to

² Bryan McGrath, "The U.S. Navy's Surface Force Just Got a Lot Deadlier," *War On The Rocks*, February 4 2016, <http://warontherocks.com/2016/2002/the-u-s-navys-surface-force-just-got-a-lot-deadlier/>.

³ Sam LaGrone, "Bob Work Calls Navy's Anti-Surface Tomahawk Test 'Game Changing'," *USNI News*, February 10 2015, <http://news.usni.org/2015/2002/2010/west-bob-work-calls-navys-anti-surface-tomahawk-test-game-changing>.

⁴ David Axe, "Look out, China! America Is Getting New Ship-Killing Missiles," *The Week - From War Is Boring*, August 28 2015, <http://theweek.com/articles/573963/look-china-america-getting-new-shipkilling-missiles>.

take advantage of developments in robotics and related fields. The Navy could consider harnessing developments in swarming technology,⁵ to give just one example, to develop lower cost munitions where the target is destroyed not by a single munition that escapes detection, but through overwhelming adversary defenses through mass. Another advantage of such an approach is that it reduces the risk of mission failure in the case that an adversary does find a way to defeat one advanced munition in particular. Investing in munitions as one way to extend the effective range of the carrier air wing is also consistent, broadly, with Secretary Carter's emphasis on arsenal planes as a future element of US military power.⁶

Focus On Next-Generation Uninhabited Systems

If reports are accurate, the Navy will now be converting its Unmanned Carrier Launched Airborne Surveillance and Strike (UCLASS) program into an aerial refueling tanker. The logic behind what some news sources say will be called the Carrier Based Aerial Refueling System (CBARS) is to extend the range of the F-35.⁷ Details about this program and what it means for the Navy's overall approach to uninhabited systems remain unclear, however.

One of the most significant challenges when adopting new technologies is developing the organizational capacity to utilize those technologies effectively.⁸ To the extent that the new CBARS program gives the Navy a testbed for incorporating uninhabited systems on the carrier, this could serve as a gateway towards next-generation, armed systems. By using more proven technologies at a relatively low cost, CBARS could operationally pave the way for more advanced uninhabited systems. This would be a good news story.

After all, an armed, uninhabited aircraft able to operate in contested airspace could offer advantages for the Navy, presuming the relevant technologies continue maturing. Uninhabited aircraft could operate for longer, have other advantages from not being limited by human endurance, and potentially execute more dangerous missions since US forces would not be at risk. Another way to incorporate uninhabited aircraft might be through retooling existing systems, such as 4th generation aircraft, to serve as uninhabited "arsenal planes" coordinated by 5th generation aircraft.

Alternatively, there is always the risk that, rather than being a bridge to the next generation, CBARS represents a shift away from thinking about using uninhabited systems for carrier-based deep strike missions. If that is the case, and the Navy lacks the internal appetite to invest heavily in next-generation systems, it could increase the risk to carrier aviation over the medium term, due to the range-based threats to the carrier I previously described.

To be clear, uninhabited systems are not without their risks. The technology is not yet mature, as debates about the UCLASS system and the technological range of the possible demonstrate. At

⁵ Paul Scharre, "Robotics on the Battlefield Part II: The Coming Swarm," *Center for a New American Security*, October 2014, http://www.cnas.org/sites/default/files/publications-pdf/CNAS_TheComingSwarm_Scharre.pdf.

⁶ Ash Carter, "Remarks Previewing the FY 2017 Defense Budget as Delivered by Secretary of Defense Ash Carter, Washington DC, February 2, 2016," *Secretary of Defense Speech at the Economic Club of Washington*, February 2 2016, <http://www.defense.gov/News/Speeches/Speech-View/Article/648466/remarks-prev%648420iewing-the-fy-642017-defense-budget>.

⁷ Dave Majumdar, "The U.S. Navy's Bold Plan to Unite F-35s with Refueling Drones," *The National Interest (Online)*, February 5 2016, <http://nationalinterest.org/blog/the-buzz/the-us-navys-bold-plan-unite-f-35s-refueling-drones-15125>.

⁸ Michael C. Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton, NJ: Princeton University Press, 2010).

present, a human in the cockpit offers situational awareness for operations in contested airspace that we do not know if uninhabited systems could match. Uninhabited systems will also always face the risk of hacking, jamming, and other network access issues – making the Navy even dependent on its data links. The information yielded from experiments with the X47-B, however, show that there is great potential if uninhabited capabilities are made a priority investment area.

Fortunately, there is evidence suggesting the senior leadership of the Pentagon fundamentally recognizes the importance of uninhabited systems. Deputy Secretary Work consistently emphasizes the importance of military robotics in the 3rd Offset,⁹ and Secretary Carter's preview of the FY17 budget called out the potential of micro-drones and swarms.¹⁰ Moreover, Secretary of the Navy Ray Mabus said in 2015 that the F-35 "should be, and almost certainly will be, the last manned strike fighter aircraft the Department of the Navy will ever buy or fly."¹¹ As the shape of the upcoming F/A XX 6th generation fighter comes more into view, the Navy must take the potential of uninhabited systems seriously as platforms potentially capable of deep strike missions in contested airspace.

Consider Ways to Distribute Risk

For the last generation, the United States Navy has emphasized building small numbers of extremely capable carriers, the Ford Class, that can launch larger numbers of sorties than their predecessor, the Nimitz class.¹² A small number of large carriers seemed optimal in a world where the threats to the carrier were minimal, in a relative sense, meaning the Navy could be confident in its ability to deploy carriers to hot spots around the globe.

Given the changes in the threat environment, it is worth at least thinking about whether this should remain the optimal path for the United States Navy over the next generation. The old aphorism about not putting all of your eggs in one basket is potentially appropriate here; it may make sense to diversify risk. The Navy needs to avoid the problem of self-deterrence, where fear of the risk to the carrier means the Navy – and thus the United States military – is unwilling or unable to deploy to potential hot spots and either prevent a conflict from starting or decisively intervene.

One path forward to diversify risk, for example, might involve investing in some number of smaller aircraft carriers. Though the air wing of each carrier would be smaller in numbers than the Ford Class, it might be possible to extend the capabilities of such platforms by leveraging uninhabited systems. More generally, to meet the naval power projection challenges of the middle part of the 21st century, the US Navy needs to be ready for a world where other countries have the ability to place the aircraft carrier at risk. Whether or not the Navy considers pursuing smaller carriers, creative thinking on how to diversify risk should be part of how the Navy contemplates the future of the carrier air wing. This will be no small task. The United States Navy is the best in the world in no

⁹ Robert O. Work, "As Delivered by Deputy Secretary of Defense Bob Work, Jw Marriott, Washington, D.C., December 14, 2015," *Deputy Secretary of Defense Speech at CNAS Defense Forum*, December 14 2015, <http://www.defense.gov/News/Speeches/Speech-View/Article/634214/cnas-defense-forum>.

¹⁰ Carter, "Remarks Previewing the FY 2017 Defense Budget as Delivered by Secretary of Defense Ash Carter, Washington DC, February 2, 2016."

¹¹ Ray Mabus, "SECNAV's Prepared Remarks at Sea-Air-Space 2015," April 15 2015, <http://navylive.dodlive.mil/2015/2004/2015/secnavs-prepared-remarks-at-sea-air-space-2015/>.

¹² Jerry Hendrix, "Retreat from Range: The Rise and Fall of Carrier Aviation," *Center for a New American Security*, October 2015, <http://www.cnas.org/sites/default/files/publications-pdf/CNASReport-CarrierAirWing-151016.pdf>.

small part due to its carriers and the carrier air wing. But as the Navy's original investment in naval aviation and the aircraft carrier in the Interwar Period shows, the United States Navy can serve as one of the greatest innovation incubators in the world.

Implications

As referenced above, these issues are far from the only issues relevant for the future of carrier aviation. This testimony does not discuss, for example, the oft-debated issues surrounding the development of the F-35. Needless to say, the effective and timely deployment of the F-35 is necessary for the maintenance of the carrier air wing in the short-term and medium-term. The newly described CBARS program could extend the range of the F-35, giving it greater ability to conduct longer patrols and then deploy into adversary airspace. The F-35 is not a substitute, however, for any of the issues raised above.

In short, by investing in next-generation munitions, working to realize the promise of uninhabited aircraft, and thinking imaginatively about new ways to distribute risk, the carrier air wing will remain one of the most important elements of US military power projection into the middle part of the 21st century.

Thank you for your time, and I look forward to your questions.

Michael C. Horowitz

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University of Pennsylvania, Philadelphia, PA Associate Professor of Political Science	July 2011-Present
University of Pennsylvania, Philadelphia, PA Assistant Professor of Political Science	July 2007-June 2011
Harvard University, Cambridge, MA PhD, Department of Government, Graduate School of Arts and Sciences	September 2001-June 2007
Emory University, Atlanta, GA B.A., Phi Beta Kappa and summa cum laude in Political Science.	August 1996-May 2000

BOOKS

- *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton, NJ: Princeton University Press, 2010).
 - Received Edgar S. Furniss Book Award from the Mershon Center for International Security Studies
 - Received Best Book Award from the International Security Studies Section of the International Studies Association
 - Finalist for International Studies Association Best Book Award
 - Received 2011 Lasswell Prize from the Society of Policy Scientists
- *Why Leaders Fight* (with Allan Stam and Cali M. Ellis) (New York: Cambridge University Press, 2015).

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- “Public opinion and the politics of the killer robots debate”. *Research & Politics*. Forthcoming.
- “Domestic Signaling of Commitment Credibility: Military Recruitment and Alliance Formation.” (with Paul Poast and Allan Stam). *Journal of Conflict Resolution*. Forthcoming.
- “Improving Probabilistic Predictions by Identifying and Cultivating ‘Superforecasters’.” (with Barbara Mellers, Eric Stone, Philip Tetlock, et al.). *Perspectives on Psychological Science*. Forthcoming.
- “Introducing the LEAD Dataset.” (with Cali M. Ellis and Allan Stam). *International Interactions*. 41:4, pp. 718-741
- “The Rise and Spread of Suicide Bombing” *Annual Review of Political Science*, 18, pp. 69-84.
- “A Revised Look at Interstate Wars, 1816-2007” (with Dan Reiter and Allan Stam). *Journal of Conflict Resolution*. Forthcoming.

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-
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 - “When Leaders Matter: Rebel Experience and Nuclear Proliferation” (with Matt Fuhrmann). *Journal of Politics*, 77:1 (January 2015), pp. 72-87.
 - “How Prior Military Experience Influences The Future Militarized Behavior of Leaders” (With Allan Stam). *International Organization*, 68:3 (June 2014), pp. 527-559.
 - “Poor Man’s Atomic Bomb? Explaining the Relationship Between Weapons of Mass Destruction” (With Neil Narang). *Journal of Conflict Resolution*, 58:3 (April 2014), pp. 509-535.
 - Republished in *Nonproliferation Policy and Nuclear Posture: Causes and Consequences for the Spread of Nuclear Weapons*, edited by Neil Narang, Erik Gartzke, and Matt Kroenig (New York: Routledge, Forthcoming).
 - “Allying to Kill: Terrorist Intergroup Cooperation and the Consequences for Lethality” (with Phil Potter). *Journal of Conflict Resolution*, 58:2 (March 2014), pp. 199-225.
 - “What Determines Military Victory? Testing the Modern System” (With Ryan Grauer). *Security Studies*, 21:1 (2012), pp. 83-111.
 - “When Backing Down is the Right Decision: Partisanship, New Information, and Audience Costs” (With Matt Levendusky). *Journal of Politics*, 74:2 (2012), pp. 323-338.
 - Received Best Paper Award from the *Journal of Politics* for articles published in 2012.
 - “Domestic Institutions and Wartime Casualties” (with Erin Simpson and Allan Stam). *International Studies Quarterly*, 55:4 (2011), pp. 909-936.
 - “Drafting Support for War: Conscript and Mass Support for Warfare” (With Matt Levendusky). *Journal of Politics*, 73:2 (2011), pp. 524-534.
 - “Non-State Actors and the Diffusion of Innovations: The Case of Suicide Terrorism”. *International Organization*, 64:1 (Winter 2010), pp. 33-64.
 - Republished in *Political Violence*, edited by Erica Chenoweth (New York: Sage, 2014).
 - “Long Time Going: Religion and the Duration of Crusading”. *International Security*, 34:2 (Fall 2009), pp. 162-193.
 - “The Spread of Nuclear Weapons and International Conflict: Does Experience Matter”. *Journal of Conflict Resolution*, 53:2 (April 2009), pp. 234-257.
 - Republished in *Causes and Consequences of Nuclear Proliferation*, edited by Robert Rauchhaus, Matt Kroenig, and Erik Gartzke (New York: Routledge, 2011).
 - “Age, Regime Type, and Violence” (with Rose McDermott and Allan Stam). *Journal of Conflict Resolution*, 49:5 (October 2005), pp. 661-685.
 - “Evolution or Revolution?” (with Stephen P. Rosen). *Journal of Strategic Studies* 28:3 (June 2005), pp. 437-448.
 - “When Does Aerial Bombing Work? Quantitative Empirical Tests, 1917-1999” (with Dan Reiter). *Journal of Conflict Resolution* 45:2 (April 2001), pp. 147-173.

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Michael C. Horowitz

- “Information Age Economics And The Future Of The East Asian Security Environment,” *The Political Economy of National Security in East Asia*, eds. Avery Goldstein and Edward Mansfield (Stanford, CA: Stanford University Press, 2012), pp. 211-235.
- “Civilian Nuclear Power, Nuclear Weapons Programs, and Militarized Disputes,” *The Nuclear Renaissance*, eds. Matthew Fuhrmann and Adam Stulberg. (Stanford, CA: Stanford University Press, 2013), pp. 288-312.

PEER-REVIEWED JOURNAL ARTICLES OR CHAPTERS UNDER REVIEW OR CLOSE TO REVIEW

- “The Consequences of Drone Proliferation: Separating Fact From Fiction” (with Sarah E. Kreps and Mathew Fuhrmann)
- “An Introduction to Autonomy in Weapon Systems” (with Paul Scharre)
- “Droning On: The Proliferation of Unmanned Aerial Vehicles and Military Innovation.” (with Matthew Fuhrmann)
- “Tactical Diversity in Militant Violence” (with Evan Perkoski and Philip Potter)
- “Sizing Up the Adversary: Leader Attributes, Credibility, and Reciprocation in International Conflict” (with Philip Potter and Allan Stam)

BOOK MANUSCRIPTS IN PROGRESS

- Religious Motivations and the Politics of Warfare. Supported by grant from the Smith Richardson Foundation. Draft manuscript completed.

GRANTS

- MacArthur Foundation (with the Center for a New American Security, Autonomous weapons)
- Intelligence Advanced Research Projects Activity (Forecasting)
- Minerva Initiative/Department of Defense (Terrorist group behavior)
- National Science Foundation (Leaders and international politics)
- Smith Richardson Foundation (Religion and war)

OTHER PUBLICATIONS

- “Ban or No Ban, Hard Questions Remain on Autonomous Weapons.” (with Paul Scharre) *IEEE Spectrum*, August 20, 2015: <http://spectrum.ieee.org/automaton/robotics/military-robots/ban-or-no-ban-hard-questions-remain-on-autonomous-weapons>
- “What is Policy Relevance” *War on the Rocks*, June 17, 2015: <http://warontherocks.com/2015/06/what-is-policy-relevance/>
- “Should ‘Killer Robots’ be Banned?” (with Paul Scharre) *The National Interest Online*, June 26, 2015: <http://nationalinterest.org/feature/should-killer-robots-be-banned-13196>

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-
- “The Morality of Robotic War” (with Paul Scharre) *The New York Times*, May 26, 2015: <http://www.nytimes.com/2015/05/27/opinion/the-morality-of-robotic-war.html>
 - “Keeping Killer Robots on a Tight Leash.” (with Paul Scharre). *Defense One*, April 14, 2015: <http://www.defenseone.com/ideas/2015/04/keeping-killer-robots-tight-leash/110164/>
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 - “Meaningful Human Control in Weapon Systems: A Primer” (with Paul Scharre). *CN4S Working Paper*, March 2015: http://www.cnas.org/sites/default/files/publications-pdf/Ethical_Autonomy_Working_Paper_031315.pdf
 - “Does anyone make accurate geopolitical predictions?” (with Barbara Mellers). *Washington Post: Monkey Cage*, January 29, 2015: <http://www.washingtonpost.com/blogs/monkey-cage/wp/2015/01/29/does-anyone-make-accurate-geopolitical-predictions/>
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 - “Beyond UCLASS: Preparing the Navy for Next Generation Warfare.” (with Sam Brannen) *War On The Rocks*, July 22, 2014: <http://warontherocks.com/2014/07/beyond-uclass-preparing-the-navy-for-next-generation-warfare/>
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 - “Droning On.” (with Sam Brannen) *Foreign Affairs* July/August (2014)
 - “The Crisis-Prevention Directorate” (with Dafna H. Rand). *The National Interest Online*, May 21, 2014: <http://nationalinterest.org/feature/the-crisis-prevention-directorate-10500>
 - “The Looming Robotics Gap.” *Foreign Policy*, Issue 206 (2014).
 - “Coming Next in Military Tech.” *Bulletin of the Atomic Scientist* 70:1 (January 2014), pp. 54-62.
 - “Should ‘Systems Thinkers’ Accept the Limits on Political Forecasting or Push the Limits.” (with Phil Tetlock and Richard Herrmann) *Critical Review* 24:3 (2012), pp. 375-391.
 - “Trending Upward: How the intelligence community can better see into the future.” (with Phil Tetlock). *ForeignPolicy.com*, September 6, 2012: http://www.foreignpolicy.com/articles/2012/09/06/trending_upward
 - “How Defense Austerity Will Test U.S. Strategy in Asia” *NBR Analysis* (August 2012)
 - “Information Age Weaponry and the Future Shape of Security in East Asia” *Global Asia* (Summer 2011).
 - “Maintaining American Military Power In An Age Of Uncertainty” *Small Wars Journal* (February 2, 1011).
 - “A Common Future: NATO and the Protection of the Commons” Chicago Council on World

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Affairs, Transatlantic Paper Series #3 (2010).

- “Correspondence: Long Time Going”. *International Security* 35:1 (Summer 2010), pp. 201-208.
- “Correspondence: The Limits to Partition” (with Alex Weisiger). *International Security* 33:4 (Spring 2009), pp. 203-210.
- “The Future of War and American Military Strategy” (with Dan Shalmon). *Orbis* 53:2 (Spring 2009), pp. 300-318.
- “Who’s Behind That Curtain? Unveiling Potential Leverage over Pyongyang”. *The Washington Quarterly* 28:1 (Winter 2005), pp. 21-44.
- “Don’t Take Canberra for Granted: The Future of the U.S.-Australian Alliance”. *Orbis* 48:3 (Summer 2004), pp. 465-478.
- *Homeland Defense: A Strategic Approach* (with Joseph J. Collins). CSIS Press: Washington, D.C. (2001).
- *Defending America in the 21st Century: New Challenges, New Organizations, and New Policies* (with Frank Cilluffo, Joseph J. Collins, Arnaud de Borchgrave, and Daniel Gouré). CSIS Homeland Defense Project. December 2000.

DATASETS

- Interstate War Data (IWD). With Dan Reiter and Allan Stam
- Leader Experience and Attitude Descriptions (LEAD). With Allan Stam and Cali M. Ellis
- Military Recruitment Around the World, 1815-2000
- United States Uses of Forces, 1789-2012
- Global biological and chemical weapons proliferation, 1914-2000
- Unmanned Aerial Vehicle proliferation. With Matthew Fuhrmann. In Progress.

PROFESSIONAL SERVICE

- Associate editor, *International Studies Quarterly* (2014-Present)
- Hosted Peace Science Society Annual Meeting (2014)
- Member of the board of the Conflict Processes Section of APSA and the International Security Studies Section of ISA
- Waltz Dissertation Prize Chair (2015) and committee member (2014, 2012)
- Member of the editorial board of the *Journal of Conflict Resolution*
- Book review editor for *Orbis*
- Member of the American Political Science Association, International Studies Association, Peace Science Society, and Institute for International Strategic Studies
- Reviewer for the *American Political Science Review*, *American Journal of Political Science*, *Journal of Politics*, *International Organization*, *International Security*, *International Studies Quarterly*, the *Journal of Conflict Resolution*, and many other journals.

DRAFT ARTICLES/CONFERENCE PRESENTATIONS/OTHER

- “The proliferation of robotics and the promise of autonomous systems: consequences for military effectiveness.” Presented at Military Effectiveness Conference sponsored by Kessler Foundation, June 2015.
- “Learning and Foreign Policy Decision-Making: Evidence from a Geopolitical Forecasting Tournament.”
- “Foreign Policy Bias and Geopolitical Accuracy”
- “Assessing Judgmental Accuracy in World Politics: The Limits of Objectivity” (with Phil Tetlock et al.)
- “Religion and the Costs of War”
- “The Evolution of Terrorist Tactics: The Case of Hijacking” (with Evan Perkoski and Philip Potter)
- “Some Things Never Change: Insurgency and Counterinsurgency in the Roman Empire” (with Emerson Brooking)
- “Modeling The Diffusion of Military Technologies” (with Christopher Brown)
- “Leader Backgrounds, Risk, and International conflict”. Paper presented at the annual meeting of the American Political Science Association, September 2014.
- “Droning On: The proliferation of UAVs.” With Matt Fuhrmann. Paper presented at the annual meeting of the American Political Science Association, September 2014, and the annual meeting of the International Studies Association, February 2015.
- Learning and Foreign Policy: Evidence from Crowd-Sourced Geopolitical Forecasts.” Paper presented at the annual meeting of the International Studies Association, February 2015.
- “Terrorist Tactical Diversity.” With Evan Perkoski and Phil Potter. Paper presented at the annual meeting of the the Peace Science Society, October 2014.
- “Leader Backgrounds, Risk, and International conflict.” With Allan Stam. Paper presented at the annual meeting of the International Studies Association, San Francisco, April 2013.
- “The Life-Cycle of Terrorist Innovation: The Case of Hijacking.” With Phil Potter. Paper presented at the annual meeting of the International Studies Association, San Diego, March 2012.
- “The Family Backgrounds of Leaders and Militarized Disputes.” With Allan Stam. Paper presented at the annual meeting of the Peace Science Society, Los Angeles, October 2011.
- “How Prior Military Experience Influences Future Militarized Behavior.” With Allan Stam. Paper presented at the annual meeting of the American Political Science Association, Seattle, September 2011.
- “Partisanship and the Use of Force: Do Party Reputations Matter” (with Matt Levensky)
- “Does Where You Stand Depend On If You Served: Military Service and International Conflict.” With Allan Stam. Paper presented at the annual meeting of the Midwest Political Science Association, Chicago, IL, April 2010.
- “Terrorist Strategy and the Links Between Terrorist Movements: Quantitative Tests” (With Phil Potter). Paper presented at the annual meeting of the International Studies Association, New

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Orleans, LA, February 2010

- “Arms Control Treaties and US foreign policy”. Paper presented at the annual meeting of the American Political Science Association, Toronto, Canada, September 2009.
- “Does Religion Matter? The Impact of Religious Belief on Warfare”. Unpublished Manuscript.
- “Looking Back to Move Forward: China’s Response to the Soviet Threat and its Implications for Understanding Chinese Strategy, 1966-1975”. Unpublished Manuscript.
- *Research Report on the Use of Identity Concepts in Comparative Politics* (with Peter Bruland). Completed for the Harvard Identity Project. April 2003.
- *Research Report on the Use of Identity Concepts in International Relations*. Completed for the Harvard Identity Project. July 2002.

AWARDS/HONORS

- Best Paper Award from the *Journal of Politics* (2012)
- Named as Term Member at the Council on Foreign Relations (2014)
- Received 2010 Henry Teune Award given by Pi Sigma Alpha students at the University of Pennsylvania for undergraduate teaching.
- Postdoctoral Fellow at the Belfer Center for Science and International Affairs at the John F. Kennedy School of Government, Harvard University (2006-2007).
- Awarded Dissertation Research Funds from the Weatherhead Center for International Affairs, Harvard University (November 2005).
- Invited to participate in the 6th Annual “New Faces” conference sponsored by the Triangle Institute for Security Studies, Duke University (September 2005).
- Predoctoral Fellow at the Belfer Center for Science and International Affairs at the John F. Kennedy School of Government, Harvard University (2005-2006).
- Sidney R. Knafel Dissertation Completion Fellow at the Weatherhead Center for International Affairs, Harvard University (2005-2006).
- Predoctoral Fellow at the John M. Olin Institute for Strategic Studies, Harvard University (2004-2005).
- Graduate Student Associate at the Weatherhead Center for International Affairs, Harvard University (2003-2004).
- Awarded two Early Dissertation research grants from the Weatherhead Center for International Affairs, Harvard University (April 2003 and November 2003).
- Awarded two Summer Study research grants from the Department of Government, Harvard University (May 2002 and May 2003).
- Awarded Distinguished Teaching Certificate for Excellence for work in Historical Studies A-12, Introduction to Conflict and Cooperation, Spring 2003.
- First place at the National Debate Tournament, the National Championship of College Debate (2000).

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PROFESSIONAL EXPERIENCE

- | | |
|--|---------------------|
| Council on Foreign Relations
International Affairs Fellow | 2013 |
| <ul style="list-style-type: none"> ▪ Advisor to the Deputy Assistant Secretary of Defense for Force Development in the Office of the Undersecretary of Defense for Policy, U.S. Department of Defense. ▪ Part of small team in OSD-Policy responsible for reviewing issues related to the future of UAVs and the implications for the U.S., including transfer policy and international norms. Helped lead DoD participation in interagency review process designed to produce US government approach on UAVs. ▪ Overall responsibilities included work on strategy and force structure related to the Quadrennial Defense Review, as well as examining the effects of sequestration on the defense budget and the Rebalance to the Asia-Pacific. | |
| Center for Strategic and International Studies
Senior Associate | 2014-Present |
| Center For a New American Security
Adjunct Senior Fellow | 2014-Present |
| Foreign Policy Research Institute
Senior Fellow | 2008-Present |
| International Centre for the Study of Radicalisation and Political Violence
Associate Fellow | 2008-2012 |
| Center For A New American Security
Non-Resident Fellow | 2007-2009 |
| Long Term Strategy Project
Analyst | 2004-2007 |
| <ul style="list-style-type: none"> ▪ Research and analysis on international security topics for the Office of Net Assessment in the Department of Defense. Projects included studies on the nature of religious warfare and the future of American grand strategy. | |
| Science Applications International Corporation
Researcher | 2003-2004 |
| <ul style="list-style-type: none"> ▪ Conducted research projects directly under the supervision of the Director of the Office of Net | |

Michael C. Horowitz

Assessment. Completed project on the geography of Chinese troop movements and threat perceptions. Assessed potential scenarios for Chinese use of directed energy weapons and wrote conference paper on directed energy weapons and United States strategy.

Center for Strategic and International Studies
Research Assistant, International Security Program

2000-2001

- Research and analysis on topics ranging from Homeland Defense to nuclear modernization to Cross-Strait (China-Taiwan) relations, among others.

**DISCLOSURE FORM FOR WITNESSES
COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES**

INSTRUCTION TO WITNESSES: Rule 11, clause 2(g)(5), of the Rules of the U.S. House of Representatives for the 114th Congress requires nongovernmental witnesses appearing before House committees to include in their written statements a curriculum vitae and a disclosure of the amount and source of any federal contracts or grants (including subcontracts and subgrants), or contracts or payments originating with a foreign government, received during the current and two previous calendar years either by the witness or by an entity represented by the witness and related to the subject matter of the hearing. This form is intended to assist witnesses appearing before the House Committee on Armed Services in complying with the House rule. Please note that a copy of these statements, with appropriate redactions to protect the witness's personal privacy (including home address and phone number) will be made publicly available in electronic form not later than one day after the witness's appearance before the committee. Witnesses may list additional grants, contracts, or payments on additional sheets, if necessary.

Witness name: Michael Horowitz

Capacity in which appearing: (check one)

☒ Individual

☐ Representative

If appearing in a representative capacity, name of the company, association or other entity being represented: _____

Federal Contract or Grant Information: If you or the entity you represent before the Committee on Armed Services has contracts (including subcontracts) or grants (including subgrants) with the federal government, please provide the following information:

2015

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00014-12-1-0966	Office of Naval Research	12772.00	Territorial Alliances: Causes, Dynamics, and Consequences
(Subaward No. 3002402484)	(Minerva Research Grant)		

2014

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00014-12-1-0966	Office of Naval Research	44764.66667	Terrorist Alliances: Causes, Dynamics, and Consequences
(Subaward No. 3002402464)	(Minerva Research Grant)		

2013

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00014-12-1-0966	Office of Naval Research	61241.08	Terrorist Alliances: Causes, Dynamics, and Consequences
(Subaward No. 3002402464)	(Minerva Research Grant)		

Foreign Government Contract or Payment Information: If you or the entity you represent before the Committee on Armed Services has contracts or payments originating from a foreign government, please provide the following information:

2015

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

2014

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

2013

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment

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**STATEMENT OF
CAPTAIN ROBERT C. RUBEL, USN (RET)
PROFESSOR EMERITUS, U.S. NAVAL WAR COLLEGE
BEFORE THE SEAPOWER AND PROJECTION FORCES
SUBCOMMITTEE
HEARING ON CARRIER AIR WING AND THE FUTURE OF NAVAL
AVIATION
11 FEBRUARY 2016**

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RELEASED BY THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON SEAPOWER AND PROJECTION FORCES

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The views expressed are my own and do not reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. This paper does not contain any information above “unclassified” and all sources are in the public domain.

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Mr. Chairman and distinguished members of the Seapower and Projection Forces Subcommittee of the House Armed Services Committee. It is a distinct honor and privilege to be called to testify as a witness on the future of naval aviation just as it was to be a practicing naval aviator for the first twenty years of my 48 year Navy career, 30 of which were active duty. Throughout that career, including 20 as a professor at the Naval War College, I devoted considerable time reflecting on my experiences and thinking and writing about various naval strategic and operational issues, naval aviation being a frequent subject. My overriding concern has been to help naval aviation be ready for what’s next. In my view, it is not.

My outlook on the nexus of naval aviation and maritime strategy was formed early; in fact during my first assignment after graduation from flight training. Reporting to Attack Squadron 66 in late October of 1973 while it was deployed aboard USS Independence. Independence was then operating in the Eastern Mediterranean during the US/Soviet crisis associated with the Yom Kippur War. I quickly discerned that the Navy had neither the weapons nor the doctrine to effectively counter the anti-ship missile-armed Soviet Fifth Eskadra.¹ The best we could do at the time was to “birdog” Soviet ships – orbit overhead of their formations waiting for smoke to appear on deck indicating a missile launch. We started working on anti-ship tactics after that cruise, but we were limited by only having freefall bombs. In my view at the time, even with optimally executed tactics, we would likely lose 2-4 aircraft per single ship attack. The air wing could be effectively put out of commission attacking a six ship formation. It took four years to get Harpoon to the fleet, which gave us at least a fighting chance against well-armed surface combatants.

More broadly, I was concerned about the vulnerability of the aircraft carrier in the relatively constrained waters of the Eastern Mediterranean. During the ’73 crisis air wing strike planners discussed having Independence run west through the Straits of Sicily to get untargeted and perhaps unlocated, such that if hostilities broke out, we would be able to fight an “approach battle” in which we at least

control could some of the geometry as we rolled back Soviet forces. Of course, had we done that, the Soviets could have gone before the UN General Assembly and called for a resolution for naval forces to remain in place, or perhaps issue a demarche to the US to keep its ships west of the Straits. This would have effectively isolated Israel. Even as a junior officer I saw the strategic weakness in relying on aircraft carriers to serve as crisis chess pieces in constrained waters in the face of a well-armed adversary.

The 1973 situation illustrates a danger I subsequently observed coming into play in various war games I conducted over the years. Frequently, neither military officers nor civilian leaders are able to perceive the incipient strategic effects of tactical actions; they “can’t see it coming.” When carriers are dispatched to demonstrate national will and deter aggression during crises, the President is going “all in” in terms of the strategic investment being made in the crisis.² This sets up a potential dilemma as seen in 1973; leaving the carrier in a tactically vulnerable situation risks the loss of not only a scarce and valuable strategic asset, but also would ruin the fearsome reputation of the ship. But maneuvering to reduce tactical risk would also produce strategic harm; reducing deterrence by raising doubts about national will, or perhaps actually catalyzing hostilities by convincing the adversary that such moves are a prelude to a preemptive attack.³

This situation has not changed, although the Navy has been slow and reluctant to recognize the problem. In my various capacities at the Naval War College I worked to convince the Navy of the problem and devise solutions. Among other actions, I wrote articles, established advanced research groups, designed and directed wargames and led the research effort that produced the logic upon which the 2007 A Cooperative Strategy for 21st Century Seapower was based. Some of this work bore fruit, most directly in the relationships developed between the forward fleets and the NWC advanced research groups. Based on these relationships, forward fleet staffs have developed better sets of tactics for the use of the carriers. However, these are basically bandages for a bigger problem; the inappropriate use of carriers as presence platforms.

Today, although I am retired, I remain committed to convincing the Navy to recognize and address the problem of proper aircraft carrier use. This has become even more compelling in the current budget environment. Having been reduced to 11 aircraft carriers, only ten active and currently only five of those available for service, the Navy finds itself unable to provide forces for the forward Combatant

Commanders as it has in the past. A recent Hudson Institute paper asserted that in order to fulfill all strategic demands, 16 carriers would be needed. The paper also wisely added that such a number was likely unaffordable.⁴ The combination of evolving anti-carrier forces and fiscal constraints means that the Navy cannot continue to do business as it has since the end of World War II.

Recently there has occurred within naval circles a dialogue, if not controversy, over the aircraft carrier. Some have called for the retiring of carriers due to their presumed vulnerability. Others, including the leadership of naval aviation have stoutly defended them. In my view, the issue is not whether or not to have aircraft carriers, but rather how to use them. Once the Navy adopts a more strategically sensible way to employ them, in peace as well as war, the number actually needed will become clearer. I want to emphasize at this point that the doctrine for aircraft carrier use and the design of the air wings that populate their decks are interdependent, although in theory, doctrine should dictate design.

My view on aircraft carriers and their air wings is based on the judgment that because of the dual problems of vulnerability and limited numbers, aircraft carriers should not be used for routine day-to-day forward presence and close-in crisis maneuver. An array of missile-armed surface combatants and submarines, along with various joint forces should constitute what I will call the Deterrence, Disruption and Crisis (DDC) Forces based on the concept of “distributed lethality” currently being developed by the Surface Force, Pacific Fleet.⁵ Each forward fleet would have such forces at their constant disposal. The carriers would be preserved for surge, cruising and experimentation. Relieved of station keeping, a whole new approach to designing and using embarked naval aviation would become possible.

Although the USN used multi-carrier task forces during World War II, after the war the normal posture was to operate them singly, perhaps bringing two or three together during crisis or war. This being the case, individual air wings were forced to multi-task, performing both sea control and power projection functions as well as others such as fleet defense. Multi-tasking has always been a dangerous business in carrier warfare. The classic example is the Battle of Midway in which Admiral Nagumo suffered the loss of his four carriers by getting caught trying to rearm his aircraft for ship attack right after conducting attacks against Midway Island. This has been ascribed to hesitation by Nagumo, however, a penetrating analysis by Jonathan Parshall and Anthony Tully reveals a more profound error by Admiral Yamamoto; putting an insufficient force in a position in which it might

have to multi-task. Had the *Kido Butai* been filled out with six instead of four carriers, there would have been sufficient aircraft to conduct multi-tasking at the air fleet level.⁶ This analysis is relevant to current considerations of aircraft carrier use doctrine and air wing design.

I hasten to acknowledge that in Desert Storm the Navy had six carriers participating, between those in the Red Sea and those in the Persian Gulf. However, that was a benign environment from a force protection perspective, and the carriers simply functioned as airfields at sea, feeding sorties into the Air Force managed Air Tasking Order. Facing an opposed environment at sea is an entirely different proposition. The Navy now acknowledges it will be facing, potentially, such an environment in East Asia, the Persian Gulf and even the Eastern Mediterranean. What it has not fully come to terms with is how to use the carriers effectively in these situations.

If the carriers are relieved of station keeping (always acknowledging they may be frequently needed for actual strike operations such as against ISIS), the possibility of creating a multi-carrier task force arises. Having over 200 US Navy aircraft available in a single force significantly changes the equation for potential adversaries. However, establishing such a force is not a function of simply aggregating current air wings. The Navy must develop an understanding of what naval combat would look like if the forward (DDC) force was an array of surface and subsurface combatants operating in the closer littoral and the combat was intensely missile-centric. In my view, a useful way to proceed is to have a set of customized air wings, each of which has a particular strength. In such a “naval air fleet” there might be four kinds of wings:

- **Level of effort wings.** These would be primarily composed of F-18s. They would conduct the kind of high sortie rate ground support and interdiction operations that we have carried out in Afghanistan and Iraq. Essentially these mirror the current type of air wing. However, the Navy should also develop a low cost “Counter-insurgency” aircraft so that strike fighter airframe life is not wasted on less demanding missions.
- **Battlespace Superiority Wings.** These would be composed mostly of F-35Cs and several types of unmanned aircraft (UCAS) along with the necessary support aircraft. Their function would be to roll back enemy anti-access/area denial forces as well as conduct sea control.

- **Littoral Support Wings.** These wings would support the DDC forces by providing a number of services, including high altitude, long endurance line of sight communications relay to reconstitute the battle force network. The wing might also perform reconnaissance and targeting, electronic warfare, operational deception and other functions. They would consist of high aspect ratio UCAS, some F-35s and other types of aircraft not yet designed.
- **Sea Base Wings.** In the event of crisis or war, one or more carriers ought to be configured with especially robust maintenance and repair facilities and carry replacement aircraft that would be readily available to make up combat losses in other wings.

These are notional ideas, meant mostly to indicate the possibilities if aircraft carriers were freed up from having to conduct individual station keeping. A multi-carrier task force with several types of wings would be designed from the outset to conduct multi-tasking effectively.

Another benefit of removing the carriers from presence duty is their availability for fleet experimentation – which would be needed to work out multi-carrier and specialized air wing doctrine. I witnessed the failure of the Navy’s Fleet Battle Experiment Program in the late 1990s and early 2000s. Among the key problems was the need to superimpose the experiments on forces that were in training for deployment. This led to any number of shortcuts and compromises, including the need to pack multiple component experiments into one exercise and the inability to reset and try again, that ultimately led to the demise of the program. The legendary success of the fleet battle experiments in the 1920s and 1930s was predicated on having the battle fleet available for exclusive focus on the exercises. Despite all the lip service that has been paid to innovation and concept development over the past twenty years, the Navy has not been able to free up significant forces for experimentation duty. Removing the carriers from station keeping would significantly boost experimentation. In order to achieve a naval version of “the third offset,”⁷ extensive hands on work involving human/machine collaboration is a must. A force of ready but unengaged carriers offers a laboratory of unequalled value.

In this new type of naval air force structure, a small carrier might have a role. We currently have ten (9 active, 1 under construction) of these in the form of the large deck amphibious ships. The F-35B as well as the V-22 will transform the capabilities of these ships such that they could function effectively as force

multipliers for the CVNs. Of course, strenuous objections from the Marine Corps can be expected to any initiative to use them in this way. However, under the air fleet concept, it is not hard to envision the overriding utility of such use.

Let me say at this juncture that I am convinced of the value of a large, nuclear powered aircraft carrier. What is not generally appreciated by most folks is that a carrier is “fought” on its flight deck and hangar deck. The ability to move aircraft around flexibly as well as the ability to generate maximum sorties with four catapults is at the heart of a carrier’s capability. It does not just happen. The design of the flight deck, including the elevator configuration is critical. As the size of a carrier deck is reduced, aircraft carrying capacity and critically, ability to move aircraft around and thereby generate sorties is reduced. The overall capability of a carrier design as it becomes smaller does not degrade in a linear manner. A carrier half the size of a Nimitz Class would have less than half the sortie generation capability, but would likely cost over half as much. The Ford Class, despite its breathtaking construction costs, represents an efficient approach to having strategically relevant air power at sea. My comments above on the potential utility of small carriers is predicated on the fact that the LHAs and LHDs already exist. This logic mirrors that which led to the construction of light carriers on existing cruiser hulls in 1943. Availability trumped capability.

Those interested in aircraft design will have perceived in this testimony so far that I call for the development of at least two different types of UCAS; a low aspect ratio “strike fighter” similar to the X-47B that has been demonstrated, and a high aspect ratio craft, similar in appearance if not size to the MQ-4C Triton. The potential for a swarm of unmanned fighters, coordinating at machine speed and armed with lethal air-to-air missiles promises to be a game changer in the dense air combat arena of the far littoral. Land air bases supporting the MQ-4C are likely to be threatened by conventional ballistic missiles, so the Navy will need an embarked analogue, both for sea control and for high altitude communications relay.

There are several common sense principles that ought to govern the employment of unmanned aircraft, and in fact the overall design of future air wings:

- **Aircraft should not be tasked to do what missiles can do.** There are many factors that govern whether a missile is the right weapon for a particular mission, some of which are based on the limits of current technology. However, the USN has a track record of using Tomahawk in

place of manned aircraft for deep strikes, and in the future more advanced variants plus conventional ballistic missiles and even rail guns will take over more of that mission portfolio. This makes it questionable whether the Navy ought to invest in a deep strike bomber.

- **Manned aircraft should not be tasked to do what unmanned aircraft can do.** The X-47B has already demonstrated the capability to take off and land on a carrier. An unmanned combat aircraft (UCAS) is essentially a robot and robots are best employed in doing jobs that are either too risky, too difficult or too boring and repetitive for humans. As artificial intelligence matures, there will be a widening area in the naval aviation mission portfolio between those best handled by missiles and those that must be handled by manned aircraft. These missions will tend to be long endurance and able to be handled by machine intelligence in partnership with remote humans. Communications relay, reconnaissance and sea control (surface and subsurface) suggest themselves. However, the potential swarming capabilities of UCAS opens up a whole new arena of air superiority operations since coordination at machine speed among multiple fighters seems likely to overpower human-occupied fighter formations.
- **A single air wing should not be asked to multi-task in the face of significant opposition.** Because of a lack of opposition and other reasons, the USN is accustomed to operating air wings singly. Navy air wings are accustomed to practicing sea control, fleet defense and power projection operations simultaneously at times. Of course, in a low/no threat environment, these tasks can be performed by just a few aircraft. The Navy does possess a command and control mechanism for handling simultaneous functions (Composite Warfare Commander or CWC) but lacks doctrine and practice in coordinating multiple CVNs in highly contested operations. Although the F-18 is a strike fighter that, depending on its loadout on a particular launch, is capable of mission switches in the air, the decision matrix when faced with simultaneous mission/threat situations is difficult at best. Some have contended that the Hornet, by being a jack of all trades is a master of none. Despite the Hornet's (and soon the Lightning's) superior capabilities, there is some validity to the charge, especially when it comes to aircrew training. However, if air wings are allowed to specialize, and if the Navy commits to developing a true multicarrier force doctrine, both Hornet and Lightning II crews could get better at particular missions.

- ▶ **High end aircraft should not be used for low end missions.** As previously mentioned, when high end fighters are used for counter-insurgency type missions, their high end capabilities are not being used. This would not be a problem if the fighter's service life was not being used up and if the Navy had lots of fighters (including attack jets) as it did in Vietnam. But neither is the case, and especially in view of the cost of modern fighters, the Navy can no longer afford the inefficiencies involved in using high end fighters for low end missions. A naval cousin to the Air Force A-10 would be a logical solution.
- ▶ **Only use up high end jet service life for absolutely essential purposes.** This seems to be redundant with the previous principle, but it has a different focus. A fighter jet, in principle, ought to be used only for its designed combat missions and the training required for aircrew. However, on a daily basis, air wing F-18s are employed for service functions around the strike group, including tanking, surface search, training of radar operators and combat information center crews, and other non-tactical tasks. The retirement of the S-3 Viking placed all those missions into the laps of strike fighter squadrons. Each sortie assigned for these purposes uses up a bit of the service life of the Hornet. Using up airframe life on a \$7 million A-7 for "housekeeping" missions was cost effective; on a \$300+ million F-35C it is not. An inventory of all the service missions should produce a set of mission requirements in addition to some other key function like anti-submarine warfare that could be handled by a dedicated aircraft.

These principles imply a future set of air wings that will feature a variety of unmanned aircraft. This, in turn, raises the question of what future manned aircraft should be developed.

A recent Center for New American Security paper by Dr. Jerry Hendrix⁸ chronicles the progressive reduction in average unrefueled combat radius of the carrier air wings. Hendrix regards this as a key factor in the vulnerability of the carriers, forcing them to move closer to enemy access denial systems in order to perform their missions. I disagree with this diagnosis. Unrefueled strike range was a key factor in attack aircraft design up through the 1970s. This was a function of the nuclear strike mission of the carriers. Once that requirement was removed, unrefueled combat range became less critical because conventional strike is more a function of level of effort – repeated sorties – than pure range. If a few

conventional bombs at extreme range could prove decisive, then cruise missiles ought to be used, as indeed they routinely have been. Moreover, the development of anti-ship ballistic missiles with progressively greater range makes any attempt to insulate the carriers from such attack by building longer range strike aircraft an exercise in futility and a waste of money. Instead, if additional range is an issue, a new, dedicated organic tanker ought to be developed to add range to the air wing.

One of the reasons for the so-called strike fighter gap, the current paucity of airframes on carrier flight decks, is the rapid expenditure of F-18 airframe life due to the wars in Afghanistan and Iraq and delays in the fielding of the F-35C. Per the principles above, many, if not most of the missions in those wars could have been handled by a cheaper, less capable aircraft, thus preserving F-18 airframe life. The F-35C will also have a finite airframe life, and its cost makes preserving airframe life even more critical than that of the F-18. Carrier aircraft must perform all manner of missions on a day-to-day basis, most of which do not require the capabilities of the F-18 and F-35. However, the F-18 costs almost an order of magnitude less than the F-35, so it is my view that the F-18 production line should remain open, and the Navy should develop a cheaper, lower capability light attack aircraft for the kinds of missions F-18s are performing today over Iraq.

Returning to the 1973 crisis, the Navy found itself in a precarious situation because it had spent the previous 27 years focusing on land attack, both nuclear and conventional. This caused it to not recognize the emergence of the Soviet Navy's new sea denial capability. There has been an analogous development since the fall of the Soviet Union. Since Desert Storm the Navy has again focused exclusively on land attack – for many valid reasons, but the emergence of an increasingly powerful Chinese Navy and signs of a revitalizing Russian Navy provide reason for it to rediscover and refurbish its war at sea capabilities. However, the pride and comfort associated with being effectively unchallenged at sea dies hard, and it has been difficult to gain traction for the idea that the Navy, especially its aircraft carriers, might be vulnerable. I am heartened by CNO Admiral Richardson's recent paper entitled *A Design for Maintaining Maritime Superiority*. In it, he calls for the development of alternative fleet designs, which opens the door to new thinking on the role of aircraft carriers.

The development of a DDC force and the relief of the carriers from routine presence duty may provide an opportunity for monetary savings needed to develop new weapons and aircraft. Beyond savings in operational costs, the Navy may be

able to reduce the total carrier force by deferring or cancelling the refueling of several Nimitz Class carriers. For now, it seems inadvisable to terminate construction of Ford Class carriers as doing so could result in the loss of national capability to build more in the future.

I hope that this brief testimony has imparted to you the vision of a new, more strategically efficient and robust naval aviation establishment. My intent is not to present a specific blueprint, but to illustrate a different way of thinking about carrier-based aviation and indicate the possibilities. I believe it is possible to field a significantly more strategically efficient force within feasible budget levels, one that improves warfighting and deterrence, reduces strategic risk and one that best leverages “third offset” technologies.

¹ See Lyle Goldstein and Yuri Zhukov, “Tale of Two Fleets, A: A Russian Perspective on the 1973 Naval Standoff in the Mediterranean,” *Naval War College Review*, Spring 2004, p 27-63. (<http://www.usnwc.edu/Publications/Naval-War-College-Review/2004---Spring.aspx>)

² For a more in-depth discussion of this issue see Robert C. Rubel, “Deconstructing Nimitz’s Principle of Calculated Risk,” *Naval War College Review*, Winter 2015, pp 31-46. www.usnwc.edu/getattachment/e0c936f8-6add-4653-8163-627244ed890f/Deconstructing-Nimitz-s-Principle-of-Calculated-Ri.aspx

³ Robert C. Rubel, “Cede No Water: Naval Strategy, the Littorals and Flotillas,” *Proceedings Magazine*, September 2013, Vol139/9/1327, (Annapolis, MD: US Naval Institute Press), p 42. <http://www.usni.org/magazines/proceedings/2013-09/cede-no-water-strategy-littorals-and-flotillas>

⁴ Seth Cropsey, Bryan McGrath and Timothy Walton, *Sharpening the Spear; The Carrier, The Joint Force and High End Conflict*, October 2015, (Washington, DC: The Hudson Institute) p. 39. <http://www.hudson.org/research/11731-sharpening-the-spear-the-carrier-the-joint-force-and-high-end-conflict>

⁵ Vice Admiral Thomas Rowden, Rear Admiral Peter Gumataotao and Rear Admiral Peter Fanta, “Distributed Lethality,” *Proceedings Magazine*, January 2015, Vol 141/1/1343, (Annapolis, MD: US Naval Institute Press), pp. 18-23. <http://www.usni.org/magazines/proceedings/2015-01/distributed-lethality>

⁶ Jonathan Parshall and Anthony Tully, *Shattered Sword The Untold Story of the Battle of Midway*, (Washington, DC: Potomac Books, 2005), pp. 405-406.

⁷ Robert Work, quoted by Cheryl Pellerin, “Work: Human-Machine Teaming Represents Defense Technology Future,” Department of Defense, DoD News, Defense Media Activity, November 8, 2015. <http://www.defense.gov/News-Article-View/Article/628154/work-human-machine-teaming-represents-defense-technology-future>

⁸ Dr. Jerry Hendrix, *Retreat from Range: The Rise and Fall of Carrier Aviation*, October 2015, (Washington, DC: Center for New American Security). <http://www.cnas.org/sites/default/files/publications-pdf/CNASReport-CarrierAirWing-151016.pdf>

Captain Robert C. "Barney" Rubel USN, Ret
Professor Emeritus, US Naval War College

Captain Rubel, is retired and living in Monticello, Illinois. From May, 2006 to August 2014 he was Dean of the Center for Naval Warfare Studies at the US Naval War College. Prior to assuming this position, he was Chairman of the Wargaming Department. A thirty-year Navy veteran, he received his commission through the Naval Reserve Officer Training Corps at the University of Illinois. He subsequently became a light attack naval aviator, flying the A-7 Corsair II and later the F/A-18 Hornet. He commanded Strike Fighter Squadron 131 and also served as the Inspector General at U.S. Southern Command.

In his twenty years of flying, Captain Rubel amassed over 3000 hours of flight time and 880 carrier landings, 300 of which were at night. As a junior officer he was involved in the standoff between the US Sixth Fleet and Soviet Fleet during the 1973 Arab-Israeli War and the 1974 Cyprus Crisis. He became a nuclear and conventional weapons instructor and a landing signal officer. He served in both capacities as an instructor in Attack Squadron 174, the East Coast A-7 replacement training squadron, then under the command of now Senator John McCain. As a member of the Carrier Air Wing 7 staff he spent eight months in the Indian Ocean as a strike leader during the 1980 Iranian Hostage Crisis. In 1985 he was aboard USS Nimitz in the Mediterranean during the TWA Flight 847 crisis in 1985. As commanding officer of Strike Fighter Squadron 131, he deployed aboard USS Eisenhower to the Red Sea in 1990 right after Iraq invaded Kuwait.

Captain Rubel's shore assignments were principally involved with professional military education. He is a graduate of the Spanish Naval War College in Madrid and the U.S. Naval War College in Newport, RI. He completed three separate faculty tours at the U.S. Naval War College as a joint military operations instructor and ultimately as the Deputy Dean of the Center for Naval Warfare Studies. During these tours he served as the William F. Halsey Chair of Air Strike Warfare and later the Colin Powell Chair of Joint Warfare. He gained extensive experience with service and joint education policy through his participation as an accreditation team member on the Chairman of the Joint Chiefs of Staff Process for the Accreditation of Joint Education (PAJE) Team. He also served as the special assistant for joint education to the Dean of Academics. After retiring from active duty, he became director of the Research and Analysis Division within the Naval War College's Wargaming Department, and in 2004 became Chairman of the Department. In this position he transformed the department from a military staff to a civilian faculty culture. He also founded the Halsey and Gravely student advanced research groups. In addition, he was a visiting lecturer at a number of international professional military education institutions, including the German Armed Forces Staff College, the Mexican Naval War College, the British Joint Services Staff College and the Colombian Senior War College.

In 2006 he was appointed interim Dean of the Center for Naval Warfare Studies. Within a month the Chief of Naval Operations, Admiral Mullen, ordered the College to help the Navy Staff create a new maritime strategy. Professor Rubel designed and directed an eight month

effort that provided the logic and concepts that produced and underpinned the 2007 US national maritime strategy “A Cooperative Strategy for 21st Century Seapower.” Subsequently given permanent appointment as Dean, Professor Rubel increased student advanced research and developed new lines of inquiry including strategic cyberspace, unmanned systems, naval logistics and command via challenged networks. He also redirected the vector of the International Law Department from teaching maritime law to research on cutting edge law of war issues. He has published over thirty articles and book chapters on a number of subjects related to naval operational warfighting and strategy.

Captain Rubel continues to serve as a member of the CNO Advisory Board and is active in local American Legion activities.

Captain Rubel has an undergraduate degree in liberal arts from the University of Illinois and a master’s degree in national security and strategic studies from the US Naval War College. He is married to the former Donna Meece of Monticello, Illinois. They have two sons and five grandchildren.

RESUME

Education	<u>Master of Arts, National Security & Strategic Studies</u>	Nov 1986
	U.S. Naval War College, Newport, RI	
	<u>Diploma and Cross of Naval Merit First Class</u>	Oct 1982
	Thesis: “Considerations Involving the Use of Anti-Ship Missiles”	
	Spanish Naval War College, Madrid, Spain	
	<u>Bachelor of Science Liberal Arts Psychology</u>	Feb 1971
	University of Illinois, Champaign-Urbana, Illinois	
Experience:	Retired/Professor Emeritus, U.S. Naval War College	
	<i>August 2014 to present</i>	
	Independent consultant, speaker and writer	
	Volunteer	
	Member, Chief of Naval Operations Advisory Board: Navy Staff, Washington, DC.	
	<i>February 2013 to present</i>	
	Advise the Chief of Naval Operations on strategy and innovation.	
	Dean, Center for Naval Warfare Studies: U.S. Naval War College, Newport, RI	
	<i>May, 2006 to July 2014</i>	
	Directed a 150 person research and analysis organization composed of seven departments. Faculty and staff ranged from Navy enlisted and officers of all services through captain/colonel, noted civilian academics, former ambassadors and various technical personnel. Directed the nine-	

month gaming and analysis effort that produced the 2007 national maritime strategy. Established several key advanced student research groups that currently produce key warfighting analyses for the fleet. Through calculated risk hires of key leadership of my departments, elevated the reputation of the College and changed the strategic direction of research. Conducted direct research and education related engagement with international naval leadership.

Chairman, Wargaming Department: U.S. Naval War College, Newport, RI

April, 2004 to May, 2006

Directed an 85-person department in the conduct of more than 80 research and education wargames and projects for the Navy and a range of Department of Defense and US Government customers. Drove innovation efforts to adapt wargaming techniques to explore an opposed networked environment. Conducted direct international liaison with various foreign governments aimed at improving their wargaming capabilities. Managed a \$2.5 million budget that included strategic investments in new wargaming capabilities and strategic restructuring of the department.

Director, Research and Analysis Division, Wargaming Department: U.S. Naval War College, Newport, RI.

April 2001 to April 2004

Directed an advanced analytic effort to analyze wargame results, conduct command and control experiments and perform detailed warfare analyses on current and future issues. Also designed and directed large-scale games involving both joint and international stakeholders.

Deputy Dean, Center for Naval Warfare Studies: U.S. Naval War College
Newport, RI

August, 1999 to present

Assisted the Dean in the management and development of a research and war gaming organization. Prepare and execute a \$1.8 million budget. Oversaw the hiring, assignment, performance and morale of 152 personnel; military, Title V and Title X civilians, and contractors. Developed organizational strategies and performed staff work as assigned for the Dean, Provost and President.

Instructor and Colin Powell Chair of Joint Warfare: U.S. Naval War College, Newport, RI

July, 1998 to August, 1999

Instructed military students in joint and naval operational art. Advised President, Naval War College and academic departments on all matters

pertaining to the integrated employment of U.S. military forces. Maintained liaison with the Joint Staff and ensured NWC curricula reflected current joint doctrine. Promoted and advised student research on joint and naval matters. Also advised Dean of Academics on joint education policy matters.

Inspector General: United States Southern Command
Quarry Heights, Panama
July, 1996 to June, 1998

Provided leadership, management, assessment and strategic planning to maintain operational readiness through inspection and assessment of subordinate joint commands and the headquarters staff; investigated allegations of fraud, waste and abuse; rendered assistance to personnel who requested it; and coordinated inspection and assessment activities of outside agencies. Worked extensively with State, Justice, Transportation and other U.S. government departments.

Instructor/Accreditation Team Member: U.S. Naval War College
Newport, RI
October, 1991 to June, 1996

Instructor for military planning and decision making using various methodologies. Participated on Joint Chiefs of Staff accreditation team as Navy representative; assessed the organization and methods of U.S. military staff and war colleges, including the Naval Postgraduate School. Developed curriculum, including structure and methodologies. Researched military history and strategy and published articles in professional journals. Designed and executed war games.

Executive Officer (Dec 88-Jun 90) Commanding Officer (Jun 90-Sep 91)
Strike Fighter Squadron 131, Naval Air Station, Cecil Field, FL
December, 1988 to September, 1991

Commanded a squadron of 230 personnel and 12 F/A-18 Hornets. Personally accountable for over \$300M worth of equipment and managed a yearly operations and maintenance budget of over \$4M. Participated in Desert Shield and successfully engineered transition to a new model aircraft under conditions of austere support.

Skills:

Spanish: Capable in Spanish. Achieved 3/3 professional level qualification in Spanish through Defense Language Institute. Able to conduct business in Spanish without interpreter. Wrote and orally defended in Spanish a thesis-length paper on anti-ship missiles.

Strategic Planning: Extensive strategic planning experience through study, teaching and writing on strategic and campaign planning, as well as application during war games, exercises and actual military operations.

Assessment: Five years' experience in assessing various types of organizations; diagnosing strong and weak areas and developing recommendations for improvement.

Multi-national Operations: Over the course of 29 years of Service, worked frequently with Spanish, British, Egyptian, German and Latin American officers in planning and conducting exercises and war games.

Awards:

Civilian Superior Service Medal (2 awards)

Awarded for design and leadership of Navy strategy development effort resulting in "A Cooperative Strategy for 21st Century Seapower." Second award for leadership of NWC research producing significant beneficial effects for the USN.

Joint Superior Service Medal

Received for strategic planning and assessment efforts in developing an all-encompassing military-diplomatic engagement plan for Latin America

PUBLICATIONS

Monograph

Writing to Think: The Intellectual Journey of a Naval Career, Newport Paper 41, June 2014
[http://www.usnwc.edu/getattachment/c9139743-0da5-4000-aa01-629b7a159432/NP_41_Rubel-Web-\(1\).pdf](http://www.usnwc.edu/getattachment/c9139743-0da5-4000-aa01-629b7a159432/NP_41_Rubel-Web-(1).pdf)

Book Chapters

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**DISCLOSURE FORM FOR WITNESSES
COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES**

INSTRUCTION TO WITNESSES: Rule 11, clause 2(g)(5), of the Rules of the U.S. House of Representatives for the 114th Congress requires nongovernmental witnesses appearing before House committees to include in their written statements a curriculum vitae and a disclosure of the amount and source of any federal contracts or grants (including subcontracts and subgrants), or contracts or payments originating with a foreign government, received during the current and two previous calendar years either by the witness or by an entity represented by the witness and related to the subject matter of the hearing. This form is intended to assist witnesses appearing before the House Committee on Armed Services in complying with the House rule. Please note that a copy of these statements, with appropriate redactions to protect the witness's personal privacy (including home address and phone number) will be made publicly available in electronic form not later than one day after the witness's appearance before the committee. Witnesses may list additional grants, contracts, or payments on additional sheets, if necessary.

Witness name: Robert C. Rubel

Capacity in which appearing: (check one)

☒ Individual

☐ Representative

If appearing in a representative capacity, name of the company, association or other entity being represented: _____

Federal Contract or Grant Information: If you or the entity you represent before the Committee on Armed Services has contracts (including subcontracts) or grants (including subgrants) with the federal government, please provide the following information:

2015

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
None			

2014

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
None			

2013

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
Spl Govt Empl	Navy	\$1000	CNO Adv Board

Foreign Government Contract or Payment Information: If you or the entity you represent before the Committee on Armed Services has contracts or payments originating from a foreign government, please provide the following information:

2015

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment
None			

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2014

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment
None			

2013

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract or payment
None			