

An Interview with Christopher C. Bogdan

On May 12, 2015, Dr. William T. Eliason, Editor in Chief of *Joint Force Quarterly*, interviewed Lieutenant General Christopher C. Bogdan, USAF, Program Executive Officer for the F-35 Lightning II Program, at Bogdan's office in Arlington, Virginia. Erin L. Sindle transcribed the interview.

JFQ: Most critics of the F-35 start with the cost of the program. What did you and Assistant Secretary of the Navy for Research, Development, and Acquisition Sean Stackley recently tell Congress about the state of the program and this issue of cost?

Lieutenant General Bogdan: We said that costs are stable and actually coming down. When we look at cost, we look at three different areas. First, the cost of finishing the development program; and we have not asked for a penny more than what we were given in 2011 when we re-baselined the program. We believe that we're going to finish the development program without asking for any more money. The second piece is the cost of producing the airplane; and the price of buying the airplane has continued to come down. We think that trend will continue. In fact, we've set a target (delivered price per aircraft) for 2019 that when we sign the contract for those airplanes in 2019, we're looking for an airplane with an engine, with fee in then-year dollars, to be \$80–85 million per F-35.

It's important that I give you those three caveats (aircraft, engine, and fee) because sometimes industry likes to report without the fee, which is just the cost. Sometimes the airframe guy likes to report his cost without the engine, and a lot of times they like to report the anticipated cost of a delivered F-35 in 2019 in base-year

dollars, like FY12. We think we can get to an \$80–85 million aircraft. So from a production point of view, we think we have a good understanding of the costs and what the drivers are to bring those costs down.

The big number is the O&S—the operations and sustainment cost. That's an estimate and, unfortunately, in this program it's a 50-year estimate; and it's an estimate that includes 2,443 U.S. airplanes. So by anybody's measure, that's going to be a huge number; and that's what gets people taken aback when we talk about the O&S cost of the F-35 program. That's where we get the “T” word—the trillion-dollar number. That number doesn't mean a whole lot to me. What I care about is what are we doing today in this program—concrete things—to drive that cost down, and are we seeing the results? The answer is yes. The bottom line is since 2011 we've dropped that estimate down 13 percent, and the CAPE [Cost Assessment and Program Evaluation] came in last year and did its own independent cost estimate of the O&S costs, and it validated that from 2011 to 2013 we dropped 9 percent. But the real issue is what are we doing now to reduce future O&S costs. We started a full-blown reliability/maintainability program, and we started a so-called “war on cost” room where we actually put the industry guys in along with some of our consultants and the program office folks. Any idea on how to reduce costs gets vetted. We look at return on investment and what it costs to invest; we look at the payback time; we look at how long it will take to implement; the team comes to the front office once a quarter and we decide on which things we will invest in and then adopt those improvements. We start taking concrete action today to drive down costs later. We think that by about the 2021 timeframe, we can at least get an A-model (U.S. Air Force version

F-35) within 10 percent of the cost per flying hour of an F-16. (That's the best apples-to-apples comparison because the current F-16 cost per flying hour is a standard measure for operating costs of military aircraft.) Right now, despite what people think, that curve is coming down pretty nicely and we clearly understand in the program office that there are a lot of skeptics out there; we understand that the only way we can change minds is by showing them results. The words don't mean much—the results mean everything. Relative to cost, I would say we understand the three areas of development, production, and O&S. They're stable, and in those key areas we're doing things to drive them down.

JFQ: When you speak to public audiences about the program, how do you describe the capability of these weapon systems compared to current or legacy aircraft, both U.S. and foreign made?

Lt Gen Bogdan: I concentrate primarily on two attributes that this airplane brings, and I listen to what warfighters say and what they believe are game changers. The first of these game changers is the notion that a pilot can fly this airplane into complex, heavily defended areas and be survivable. The survivability comes about because of a combination of three aircraft characteristics: stealth, speed, and sensors.

Second, when this airplane is working right, it is extremely smart. It has multiple sensors that absorb lots of information, and then it can fuse that information to give the pilot a picture of the battlespace that is clear, concise, and accurate. It can also do that in places where the airplane remains virtually undetected. The pilot can get into a battlespace, see things, and then leave. That kind of situational awareness is not only important for the

F-35, but it's important for the rest of the weapons systems around the F-35. When we connect with them, it makes them and all those around the F-35 that much smarter and more survivable.

JFQ: How has the program evolved since you arrived as its Deputy Program Executive Officer and later moving up to lead it?

Lt Gen Bogdan: My predecessor came in and re-baselined the program because it had run off the rails. Vice Admiral David J. Venlet did a great job of putting some realism into that new baseline, and he brought some credibility back into the program. I picked up the ball, and now we've been executing—and we've been executing pretty well. Schedule-wise, we haven't missed a major milestone. We are still on track for Marine Corps IOC [initial operating capability] this summer and Air Force IOC next year. We are also on track to meet partner and FMS [Foreign Military Sales] deliveries in the future.

Another aspect of the program that is accelerating is the building of a global sustainment enterprise. This is a major undertaking. There are some additional complicated undertakings for which the program is responsible that I am sure people are unaware of in this area. For example, we're building two factories other than just the one at Fort Worth to build this airplane; we're building a factory in Italy and a factory in Japan to fabricate and check-out F-35s. For the engine, we're also building a factory in Turkey and another in Japan. We are also building a supply, repair, and heavy maintenance capability in both Europe and the Pacific regions—just like the one we are building here in North America. Creating a global sustainment enterprise with 14 different customers across 3 regions of the globe is a very, very complex task.

From a fundamental level, since I took charge I've tried to institute four different principles in the way we do business here, and I think if we get these four right, we've got a better shot at succeeding.



Lieutenant General Christopher C. Bogdan, USAF (U.S. Air Force/Andy Morataya)

First and foremost, the most important principle is integrity. You've got to run the program with integrity—and that starts with me. My team knows that we always do things with integrity so people believe us and we remain credible because the program runs on trust. We tell people the truth whether it's good, bad, or ugly, and we don't spin things.

The second principle is transparency. When you're spending the kind of money we are spending and you're the biggest program in DOD [Department of Defense] history and you've got 14 customers who are depending on you, you had better bet your bottom dollar that people are going to want to know what's going on. For us, transparency is a way of life. Every decision we make, every dollar we spend, we'd better be ready to stand up in front of whomever and tell them

what we did and why we did it. Whether it's the parliament of a partner nation, whether it's Congress, whether it's the press, or OSD [Office of the Secretary of Defense], people need to know what we're doing and why we're doing it so they can continue to have trust in what we're doing.

The third principle is accountability. Accountability in one direction is easy. The program office is going to hold the contractor accountable—this is a simple concept to understand because that's what people expect, that's what's built into our job title in the program office. What's a lot harder with accountability is holding yourself accountable and holding the rest of the enterprise and stakeholders accountable because if you're not careful, your stakeholders and the people who have an influence on this program can do

some pretty bad things to it despite their best intentions. So we preach 360-degree accountability. We make commitments, we hold ourselves accountable to those commitments, but we make sure everyone else in the enterprise also recognizes that they have to be held accountable to their commitments also.

Finally, the last principle is discipline. We don't have the time or the money, and the enterprise doesn't have the patience anymore for us to have to do things over again. We just can't have "redos." The way you can avoid do-overs is with discipline up front. You've got to start things with discipline and then you've got to keep that discipline throughout—even if it might take you a little bit longer initially—because in the endgame it won't take you longer if you get it right. It will take you a lot longer if you have to redo it.

With those four principles, no matter what program you're running, if you have those in place and you have your team operating and behaving that way, you probably have a better chance of success.

JFQ: A number of earlier issues were widely reported in the press, each seemingly difficult to solve, such as the specialized flight helmet. Are any of these issues showstoppers in terms of meeting your planned schedule? If so, which ones and how are you dealing with them?

Lt Gen Bogdan: That's a great question. If you'd taken a snapshot of the program 3 years ago, I could give you a list of four or five technical things that were always in the front of everybody's mind. We had a problem with the hook on the C-model; it couldn't catch the cable. We had a problem with the helmet, which had glow problems, "jitter" problems, and stability problems. We had problems because the plane couldn't fly in lightning. We had problems when we released fuel out of the wing dump system; fuel would stick to the bottom of the wing and migrate into panels in the fuselage. We also had reliability and maintainability problems.

Here's what I can tell you today. Every one of those problems is either solved or on the path to being solved. So for us, the measure of a good program is not zero problems; the measure of a good program is having problems, making discoveries, and solving them—and you solve them in a way that keeps the program on track. But now a different set of problems is in the headlines. Last year we had an engine problem that created a fire on the airplane. Guess what? We have all of that taken care of. Production engines are now being built with new pieces and parts so that won't ever happen again. We are retrofitting the entire fleet with new parts as well. So with that engine anomaly, which was a significant negative event on the program, we got to the root cause, we got to the solution, and we implemented the solution.

What's not behind us yet is software—there are more than eight million lines of code on this airplane. That's about four times as many as on legacy airplanes. Offboard, the systems that surround the airplane—mission planning, reprogramming, ALIS [Autonomic Logistics Information System]—contain *twice* that amount of software. If we don't get software right on this program, we're going to be in big trouble. That's number one. Number two is our Autonomic Logistics Information System (ALIS), which is a heck of a lot harder than anybody ever thought. We treated the ALIS system early on in this program like a piece of support equipment. It's not; it's way more complicated and important than that. It's the brains and blood of operating this weapons system. It has the maintenance information in it. It has the logistics information in it. It has the airplane configuration in it. It has all of the training for the maintainers and the pilots in it. It talks to the ordering systems when it needs parts. We fielded an airplane—long before ALIS was mature—and that ended up putting a lot of stress on the maintenance guys out in the field.

We treat ALIS today as if it were its own weapons system with an engineering

discipline, software metrics, testing, design reviews—all the stuff we lacked years ago. From my perspective, there are always going to be problems. There are going to be things you don't know about now but you're going to know about later. The mark of a good program is that you can get over them.

The last problem I will share with you is the structural integrity of the B-model, which has cracked in places where we thought it might from the models, but more severely than we thought it would. There are a couple of reasons for that. The first reason goes back to early in this program when the B-model went through a weight-reduction. It was thousands of pounds overweight. One of the ways we took weight out was to reduce the thickness of a lot of the structure. We also switched from titanium to aluminum on a number of structures, which is lighter, but not as strong. That has come back to haunt us a little bit. We went through a significant event last year when we cracked the main bulkhead on the B-model. We thought it could crack, but when it did, it transferred loads to a bunch of the other bulkheads and they cracked too. So we have been working for over a year to come up with a newly designed bulkhead, which we now have in production for lot number 9. We also are trying to get a process known as laser shock peening qualified on the airplane. This process can reinforce and strengthen the crack-prone areas of the bulkhead without adding weight and without having to tear apart the bulkheads.

JFQ: As the largest customer of the aircraft, what does the U.S. Air Force think about the F-35A's ability to meet all the missions it expects it to perform, particularly close air support [CAS]?

Lt Gen Bogdan: The part of the dialogue that has been missing about the CAS mission is that we are delivering CAS capability in two increments. We designed the program so that in the initial years, it wouldn't have all its capability; it's incremental. Will F-35 be a good CAS airplane by 2018? You bet. But it's not there yet. It will have a gun,



Captain Brent Golden, 16th Weapons Squadron instructor, taxis F-35A Lightning II at Nellis Air Force Base, January 2015 (U.S. Air Force/Siuta B. Ika)

and that gun will work, but it's not the only thing we use in the CAS mission. It will be used in conjunction with other capabilities such as precision-guided munitions. It will have the right kinds of communications systems to work with ground forces. Eventually in Block 4, we'll have full-mission video. The jet already has incredible sensors, so at night and in inclement weather you have the same capabilities as daytime. I think it's a little unfair when folks who have an affinity for other airplanes in the CAS role compare those aircraft to an F-35 without acknowledging that the F-35 can do so many other things that those aircraft cannot do beyond the CAS mission. When you build a multirole airplane, it's probably not going to be a superstar in everything it does, but it's going to do a lot of things really well. And, when you compare the

F-35's survivability, sensor fusion, and the situational awareness it brings, you have an excellent weapon system.

JFQ: Can you talk about the international portion of the program and how that has evolved?

Lt Gen Bogdan: There's a much deeper relevance to the international part of the program, and I'll start first with the partnership itself. There are nine partners in the program when you count the United States as a single partner; so we have eight other partners, with most of them in Europe. The only two not in Europe are Canada and Australia. The first important piece about the partnership is that the partners get a say in what happens with this program, and for some of them, that experience of being part of a big and complicated airplane acquisition program

is a great lesson for them. Also, we have all eight of our other partners' personnel in the program office who work as part of the program—another great learning experience for them and for us.

There are two other important aspects of the partnership. First is the ability for our partners to be able to fight alongside us as equals and be able to use the same ROEs [rules of engagement] because their airplanes, pilots, and maintainers are just as capable as we are. This means they can also lead in the hardest missions. The last piece has to do with the fifth-generation technology and our partners' industries participating in the program. We're providing technologies that we expect our partners to protect, just like we would. So, in one sense, we're requiring them to upgrade their security infrastructure to a level beyond what they may already have. Also, many partner



F-35B Lightning II Joint Strike Fighter taxis on flight deck of USS Wasp during night operations as part of Operational Testing 1 (U.S. Marine Corps/Anne K. Henry)

industries involved in the program are getting an opportunity to understand and be part of modern manufacturing techniques and advanced technologies and are being asked to hold themselves to a pretty high standard if they want to be suppliers on this program. From the DOD's perspective, a stronger, allied industrial base gives us future access to better technologies and also pushes U.S. industry to get better.

JFQ: News media reports have mentioned an increasing number of cyber attacks being conducted against the Defense Department in recent years. What impact has this growing threat of cyber attacks had on your program's ability to deliver a capability that can effectively deal with these cyber-related concerns?

Lt Gen Bogdan: When we talk about cyber threats to this program, we talk about them in two different environments. The first environment is the infrastructure we use to design, develop, sustain, and field the airplane; for example, the F-35 IT system we use to pass program and design information among the partners, services, and program office. From this perspective, I have the utmost confidence in the protections the Department of Defense has put in place for those IT systems. We still have to remain extremely vigilant when it comes to industry's systems. In the past, this is where we have found vulnerabilities in the F-35 program. Consequently, DOD and industry have worked together to increase the protections we put in place to prevent F-35 information from getting into the wrong hands. Each and every day we're feeling a little bit better about both government IT and industry IT systems. I say this because a number of times every year multiple agencies—to include [U.S.] Cyber Command and 22nd Air Force—visit the F-35 program and do penetration and vulnerability testing. Not of the airplane and the weapons system, but of our IT systems. So from that perspective, they are truly helping us by showing us what we need to do to make ourselves more resilient, robust, and secure.

Now let's talk about the airplane and the weapons system itself. Without getting into details, what I will tell you is if you know from the beginning of a program you will be exporting the weapon system—and you want to hand it to allies to let them operate it in their own environments—you can, from the start of the program, build in the appropriate protections. This is one of the first airplanes that I know of where at the start of the program we consciously knew it would be an exportable weapon system. Therefore, from a design and architectural standpoint, one of the upfront requirements was to protect the critical technologies of the weapons system. That is pretty powerful when you start from the beginning because you don't have to adapt, you don't have to strap things on, you don't have to make what I would consider to be secondary or tertiary changes to protect things. As a result, it has what I would consider to be a very strong built-in protection scheme.

JFQ: What challenges and risks do you see for the program ahead and what will you recommend your successor focus on?

Lt Gen Bogdan: From a technical and performance standpoint, I think we will be able to solve any problems we encounter. We have to think about continuing to evolve the airplane to meet future threats. The good news is the architecture of the airplane was built such that it has growth potential. We're working toward things like open-systems architecture for sensors. We have already done our first upgrade of all the major computers on the program and are planning another upgrade in about 4 or 5 years. So from a technical standpoint, I would tell my successor to keep an eye on the need to make the weapon system more open. In addition, I would tell my successor that from a business perspective I think we're starting to get costs under control, but we must continue to take deliberate actions now to drive down future costs. The real big thing that's still out there is building what I call the global sustainment enterprise. If you think about where we're going

to be in 10, 15, or 20 years, we'll have 2,000-plus airplanes out there, located all over the globe and being flown by at least 14 customers. We are trying to build the support and sustainment system to take care of all those airplanes. We're building depot and heavy maintenance capabilities in the Pacific and Europe just like we have here in the United States. We are creating a global supply chain; we are creating a global network of repair capability in all 3 regions. All of this is not fully built or mature yet. Over the next 5 to 7 years the person who comes next is going to have to take that onboard full steam because our partners and FMS customers will have aircraft in operations soon. We're adding 17 operating locations in the next 5 years and almost half of them are overseas. We've got to be ready to have a global sustainment structure in place and ready to operate. We're on a really tight timeline to get that done for our partners and Foreign Military Sales customers. They expect that the day they get their airplanes in country, all the infrastructure they need to support the weapon system will be in place and ready to go: supply chain, repair chain, maintenance manuals, training systems, etc.—all of it. That's big. From that perspective, it's probably where the focus really needs to be in the next 5 years.

JFQ: Would you recommend future weapons systems that meet similar requirements for multiple Services be managed by a joint program office such as this one?

Lt Gen Bogdan: First, if the warfighters and customers are willing to compromise with each other on the requirements, joint programs can work. Our history of joint programs is such that they don't work very well—not only because of the lack of compromise but because we've also thrown on some mismanagement. When you put those two together—folks who weren't willing to compromise with their requirements along with a program that doesn't have those management and leadership fundamentals down pat—you've got a train wreck coming. We've



Navy test pilot flies F-35B Joint Strike Fighter aircraft BF-3 with inert AIM-9X Sidewinder missiles over Atlantic Test Range (U.S. Navy/Courtesy of Lockheed Martin/Michael Jackson)

seen that in the past and the result is that the program dies or is split up along Service lines.

Congress has asked me this same question a number of times. If you would have tried to develop an A-model for the Air Force, a B-model for the Marine Corps, and a C-model for the Navy as separate programs, I think you would have probably run into similar problems, but the solutions and cost and time required to implement those solutions would have been a unique Service problem versus a partnership problem. The advantage this program has over three separate programs is that there are huge economies of scale to be had: for example, global supply pooling (where one part can service many customers) or multiple repair facilities around the

world can be very effective and efficient. If you're a U.S. Marine Corps B-model deployed in the Pacific and something goes wrong with the airplane, you can get a part or repair in the Pacific theater from a partner or FMS customer. From that perspective, I think the program has an advantage over a single-Service program. But joint programs are hard to manage. They tend to be riskier for all the reasons discussed compared to single-Service programs, but the rewards are greater if you can get it there.

Additionally, in this austere budget environment, the Department and Services must share technology, not duplicate effort, and build airplanes that can adapt and do many things. Adaptability is very important. If we're going to keep airplanes around for 30

or 40 years, you'd better start building them so they have growth potential and adaptability.

JFQ: Is anything you would like to add that we have not discussed?

Lt Gen Bogdan: The biggest issue I would like your readers to understand is that this is not the same program it was years ago. We had some really rough times in the past, and I think the Department, the partnership, and industry have begun moving this program in a better direction. We're not there yet, but like a large ship, it takes a long time to turn . . . but it is turning. I would ask people to judge the program on the progress it's made since the re-baseline and not look in the rearview mirror. JFQ