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Thank you for participating,

Gregory Hamilton
President
Aviation Week Network

Acknowledged, agreed, and submitted by

_____ 5/2/2022

Nominee's Signature Date

Nominee's Name (please print): Niraj Nayak _____

Title (please print): Director, Engineering _____

Company (please print): Northrop Grumman _____

NOMINATION FORM

Name of Program: Protected Tactical Satcom

Name of Program Leader: Niraj Nayak

Phone Number: 310 812 0986

Email: niraj.nayak@ngc.com

Postal Address: 1 Space Park Redondo Beach CA, 90278

☒ Customer Approved

- Date: 5/2/2022
- Customer Contact (name/title/organization/phone): Mr. Justin Bruner, PTS Program Manager, Space Systems Command, 310-653-9444

☐ Supplier Approved (if named in this nomination form)

- Date: N/A
- Supplier Contact (name/title/organization/phone): N/A

PLEASE REFER TO PROGRAM EXCELLENCE DIRECTIONS
AS YOU COMPLETE THIS FORM.

EXECUTIVE SUMMARY: Make the Case for Excellence *(Value: 10 pts)*
What is the vision for this program/project? What unique characteristics and properties qualify this program for consideration?
(12 pt. Times New Roman) LIMIT YOUR NARRATIVE TO THIS PAGE.

Vision of the Program

The vision of the Protected Tactical Satcom (PTS) program is to provide unprecedented capabilities with unprecedented speed and agility, through a transparent partnership with the Customer, and agile, rapid prototype execution. By breaking down the traditional barriers that exist between contractors and customers, alignment towards common goals is facilitated. On PTS, we do not refer the the government as the customer, but instead as the PTS Program Office (PTS PO) – directly stating that we are one integrated team. Through rapid prototype execution, with capabilities incrementally demonstrated, the system can be developed simultaneously with the requirements maturing. Not only does this enable capabilities to be developed quicker, but it also enables the capabilities to be delivered in an agile, prioritized manner. The dynamics of the world and evolving threats move at a pace that is significantly more rapid than a traditional program is executed. Programs delivering capabilities cannot predict the future, therefore they must find a way to be agile and adaptive to still provide value. On PTS, Northrop Grumman and the Space Force PTS PO are trailblazing enhanced methods of program execution and collaboration. Our goal is not only to deliver success on this program, but to lay the foundation for a new paradigm of program excellence

Unique Characteristics and Properties

Protected Tactical Satcom has several unique characteristics and properties. First, it is a rapid prototype program culminating in an on-orbit demonstration. Traditionally, space programs either culminate in ground-based risk reduction demonstrations, or deliver mission capability to warfighters immediately when deployed on-orbit. The disadvantage of these approaches is the lack of an opportunity to learn through the on-orbit demonstrations and measure operationally relevant results before handing the capability to the warfighter. Having an on-orbit demonstration phase gives the program the flexibility to push the boundaries of potential capabilities, ultimately delivering higher value capability to the warfighter. Additionally, even prior to delivery on-orbit, the program is demonstration focused rather than milestone focused. Traditional program focus on a sequence of pre-planned key milestones and reviews. PTS takes a different approach – capabilities are developed as fast as possible and demonstrated. The goal of the demonstration is not to succeed against a particular criterion, instead the goal is to learn as much as possible and inform subsequent development. This "fail fast" approach allows capabilities to be developed with unprecedented speed and agility. Finally, the program has multiple simultaneous aspects developments with still maturing requirement. Rather than "locking down" firm requirements, the development is focused on exploring what capabilities are possible to develop in the needed timeframe. These explorations are conducted through the demonstrations. The successes and failures are shared transparently with the PTS PO, allowing us to learn together and shape the potential capabilities of the system. Through predictive metrics, digital model-based engineering, innovation from tools and our suppliers, and a focus on people and teamwork, our team has been able to take on the challenges of this program with great success.

Do not exceed 10 pages in responding to the following four descriptions; allocate these 10 pages as you deem appropriate, but it is important that you respond to all four sections. DO NOT REMOVE THE GUIDANCE PROVIDED FOR EACH SECTION.

VALUE CREATION *(Value: 15 pts)*
Please respond to the following prompt:

- Clearly define the value of this program/project for the corporation
- Clearly define the value of this program/project to your customer
- Clearly define the value of this program/project to members of your team
- Clearly define the contribution of this program/project to the greater good (society, security, etc.)

(12 pt. Times Roman)

Value to Northrop Grumman

The value of the PTS program for the Northrop Grumman is the opportunity to trailblaze enhanced methods of program execution and a new framework of customer collaboration. PTS is a unique program that is executing at a rapid pace, developing groundbreaking capabilities, and culminating in an on-orbit demonstration. Requirement maturation, development, test, and verification are all occurring simultaneously and rapidly on multiple aspects of a complex system. The program objectives could not be met with traditional program execution. The mutli-faceted challenges of the program require agile program execution and a deeply intimate and transparent customer relationship. The lessons learned from the program will be invaluable to Northrop Grumman as we partner with Customers to deliver unprecedented capabilities with unprecedented speed and agility.

Value to the Space Force

The value of the PTS program for the PTS PO is delivering enhanced capabilities, that are needed now, to the warfighter as rapidly as possible. PTS is one piece of U.S. Space Force's future satcom architecture and offers advanced on-board protection features to mitigate jamming. It is focused on military users operating in contested areas where satellites are expected to be jammed.

Value to the PTS Team

The value of the PTS program for the members of our team is the experience and growth from executing this program. As part of a lean, rapid prototype team, personnel will be challenged to develop their technical and people leadership skills and satcom knowledge base.

Value to the Greater Good

The capabilities of the PTS program enhance security for the United States and its allies by providing secured, assured communications. As observed in recent and current world events, conflicts may arise that challenge the security of the United States and its allies. During those conflicts, assured access to communications, even in the most contested conditions, is essential.

METRICS (Value: 15 pts)
Please respond to the following prompt:

- What are your predictive metrics?
- How did you perform against these metrics?
- How do your predictive metrics drive action toward program excellence? Please provide examples.

(12 pt. Times Roman)

The NG PTS program team is using numerous predictive metrics to drive actions towards program excellence.

Supply Chain Predictive Metrics

First, predictive metrics were put in place for supply chain activities. Supply chain activities include finalizing the bill of material (a list of all material to be ordered), creating purchase requisitions (authorizing budget to purchase material), creating purchase orders (authorizing a contract with a supplier), fulfilling purchase orders (receiving the material), and kitting the material (making the material available for manufacturing activities. As this process involves many steps on thousands of line items, metrics were put in place to track timeliness from step to step. Predictive metrics were put in place to predict timeliness of the process based on past performance. Initially, the metrics were showing poor performance, in large part due to the initial inefficiency of working remotely during the pandemic. However, the metrics did show clear evidence of the bottlenecks. For example, they identified the time between preliminary and final authorization of a part was longer than expected. The root cause of that issue was overall lack of awareness that final authorization was needed. To solve this issue an automated workflow was implemented to speed up the lag between person to person. After these and other issues were solved, the metrics showed improved performance. Our team's predictive metrics ensured the impacts to the program schedule from supply chain challenges were minimized as much as possible, ultimately ensuring the system capabilities will be delivered to the warfighter as quickly as possible.

Agile Development Predictive Metrics

Secondly, predictive metrics were put in place for verification of requirements. There are numerous interface control documents and specification documents on the program. These requirements are verified over the course of the program. First, the risk is burned down on each requirement through agile development and demonstrations. Eventually, the requirements are characterized/verified through formal testing. Metrics were put in place to measure how quickly risk was being burned down, to help predict the timespan it would take to verify the requirements through formal testing. Initially, the metrics showed the team was burning down risk slower than planned, which perhaps was not surprising given the challenging development involved on this program. However, the team learned the the initial set of metrics did not properly take priority and value into account. For example, a particular requirement might be more challenging to implement and represents more value than a simple requirement. To solve this issue, the requirements were categorized by criticality, and the metrics updated to show a weighted risk burndown. With these updates, the metrics helped ensure the team was focused on testing system threads that had the highest value first, which helped accelerate the risk burndown. This transparent visibility to development performance allows the team to understand and shape the development in a meaningful and measurable manner.

DEALING WITH PROGRAM COMPLEXITY (VOLATILITY, UNCERTAINTY, COMPLEXITY, AMBIGUITY, OR VUCA) *(Value: 25 pts)*

Please respond to the following prompts:

- *10 pts:* Describe areas of VUCA faced by your program and why.
- *15 pts:* Explain how your team responded to these challenges.

(12 pt. Times Roman)

The PTS program faced VUCA in numerous dimensions.

COVID-19 Volatility and Uncertainty

First, the PTS program started right before the onset of the COVID-19 pandemic, exposing it to volatility and uncertainty. The volatility and uncertainty was in numerous dimensions, including overall impact to the program, dynamic changes in work locations, changes in information technology systems, and new meeting collaboration methods.

The program team responded to this challenge by increasing the frequency of communication. To increase the frequency of communication, an agile style meeting rhythm was deployed. All sub teams have "daily scrums" to facilitate daily check-ins on progress and roadblocks. Roadblocks are immediately raised to program management through integrated agile management tools, to facilitate real-time issue resolution. Additionally, program newsfeeds, collaboration sites and weekly newsletters were established, with a focus on "overcommunicating" to ensure all team members had the information they always needed. Keeping the team aligned ensured they could focus on delivering top performance for the PTS PO despite the volatility and uncertainty of the pandemic.

Rapid Prototype Complexity

Secondly, the PTS program is a rapid development program that is one part of an extremely complex government enterprise communication systems architecture, including numerous types of satellites, a ground segment, user terminals, and cryptography devices. Many parts of the system are under development simultaneously by different contractors. This creates the risk of interface incompatibility issues being uncovered late in the program lifecycle and causing significant cost/schedule impacts.

The program team responded to this challenge by embracing digital engineering and a modular open systems architecture. First, the team ensured that standard hardware and software interface types were put into the design to maximize compatibility with still maturing enterprise interfaces. Secondly, the team defined and obeyed modular open systems architecture standards for all places in the design that touched enterprise interfaces. Finally, the team employed model based "digital engineering". A system level model-based engineering diagram was developed, and all interface control documents were translated into interface control models. As changes to interface control documents were proposed or implemented, the team could ingest the details into the model, immediately view the impacts on the design and performance at the lowest levels and adjudicate the impact. This model is also used to automatically generate testing and verification products, to ensure that testing on enterprise interfaces provides sufficient testing to uncover potential issues. By solving this challenge, the program team is ensuring product quality across the entire enterprise despite a complex and evolving architecture.

Requirement Ambiguity

Additionally, due to the rapid prototype nature of the program, ambiguity exists in the system definition, requirements, and interfaces

The program team responded to this challenge by employing agile demonstrations to flesh out ambiguity. Sets of integrated functional capabilities (IFCs) are defined. These are sets of major capabilities that can be demonstrated. Withing each IFC, subsets of hardware/software capability sets (HSCs) are defined. This Agile development concept provides an efficient, low risk methodology of building complex capabilities. On a bi-weekly basis, the development teams execute agile sprints to prioritize capabilities within an HSC. On a monthly basis, the capabilities are demonstrated and shown to the PTS PO. In traditional programs the demonstrations might be delayed if there were issues or shortfalls. On PTS, the team has committed to taking a best effort approach and demonstrating both successes and failures to the PTS PO. The goal is to provide maximum insight into performance, maximize learning, and learn through failure. Based on the lessons learned from the demonstrations, the priorities within an HSC are adjusted.

The overall objectives of the IFC are also adjusted to match PTS PO and NG priorities. With this approach, the PTO PO has the benefit of being able to flexibly adjust requirements in parallel with the development. Ultimately this approach will result in a higher value system for the warfighter.

ORGANIZATIONAL BEST PRACTICES AND TEAM LEADERSHIP *(Value: 35 pts)*
Please respond to the following prompts

- *15 pts:* Describe the innovative tools and systems used by your team
- *10 pts:* Define how you developed, led and managed people
- *10 pts:* How did you leverage skills and technologies of your suppliers?

(12 pt. Times Roman)

The NG PTS program team is using numerous innovative tools and systems.

Innovative Tool: Model Based Collaboration

First, the team is using a newly developed model-based engineering collaboration tool. Across the defense industry the use of model-based engineering is being used to accomplish higher quality engineering. A challenge the industry is the lack of a standard model-based tool and insufficient training in using model-based engineering tools. Additionally, many engineering artifacts are generated using traditional methods instead of model-based methods. For example, a communications link budget might be calculated in mathematical spreadsheet software. The collaboration tool our team is using allows traditional and model-based artifacts to be seamlessly integrated into a "digital portal", bridging the gap as the engineering culture evolves. Additionally, the tool can produce this package in a tool agnostic format, enabling the entire internal and customer team to participate without being an expert on model-based engineering or possessing a particular model-based engineering tool.

Innovative Tool: Mission Simulator

Secondly, the team has developed and is using a mission simulator system. The PTS program has complex mission requirements and scenarios. Our mission simulator system allows the team to directly emulate the scenarios with real-time signals that can be tested against the hardware and software in real time. This allows the team to evaluate performance directly against mission scenarios of interest. When the team and the customer jointly review the results, it deepens understanding of the scenarios, provides a way forward to update the scenarios for clarity, and shapes the options for the future of the program.

Innovative Tool: DevOps Tool Chain

The development involves numerous sets of hardware and software code. The code is developed using the "Continuous Integration and Continuous Deployment" (CI/CD) pipeline concept. This concept ensures rigorous configuration management of code, keeping track of when it is ready to be integrated and ready to be deployed. To facilitate the CI/CD operation, a development operations (DevOps) toolchain has been established. The DevOps toolchain takes a best of breed approach of customer and standard tools, integrated together to ensure all parts of the pipeline are working together without issues. Deploying a CI/CD pipeline enables new capabilities to be injected into the system at a more rapid pace without compromising quality. The PTS PO can take advantage of this capability throughout the development cycle to ensure the system capability is aligned to requirements in a prioritized fashion.

The PTS program is using numerous techniques to effectively develop, lead and manage people.

Flat Organizational Structure

First, the team is employing an organizational structure with a fl at hierarchy. Rather than having numerous layers in a reporting structure, approxi mately a dozen managers report dire ctly to the pro gram manager. Employing this construct speeds up the decision-making process, allows greate r lead ership responsibility to be given to the managers, and pro vides leadership dev elopment opportunities for the managers. This also allo ws all program pe rsonnel more rapid insight into the overall prog ram. Overall this increases the spe ed o f issue resolution, which enables the dev elopment to occur at the p ace n eeded to meet the aggr essive sche dule of a r apid prototype program

Decision Making at the Right Level

Secondly, decisi on making is pushed down to the lowest levels through agi le style meeting rhythms. All sub teams have " daily scr ums" to facilitate daily c heck-ins on progr ess and roadblocks. Issues are elevated during "scrum o f scrums" me etings, wher e team lead ers gather to r eport from their te am's scrum. Roadblocks ar e immediately raised to pro gram managem ent throu gh integrated agile man agement tools, to facilitate real -time issue resolution. Rather than having all de cisions be approved by p rogram management, sub team s i n the organization a re giv en full authority to make cost, schedule, and t echnical decisions, if the impacts are coo rdinated and adju dicated. This allows pro gram personn el to feel m ore ownership in the succ ess of the program and gives them the confidenc e that they are trusted to mak e sound decisions.

Direct Customer Communication

Additionally, junior program personnel p resent dir ectly to the PTS PO with out additional internal re view. The program moves at a rapid pac e, and the te am is encourag ed to pre sent t heir analysis products dir ectly to the customer at our w eekly meetings, often " hot off the press ". This method gives the junior members of the team con fidence that they are t rusted to pro duce quality results. It pr ovides an opportunity for them to hone their communication and technic al leadership skills. Eliminating the unnecessa ry layers of review allows communication and decision makin g to occur at a mo re r apid pace, whi ch enables the development to occur at the pac e need ed to meet t he aggressive schedule o f a rapid prototype p rogram.

Frequent Recognition

The team employs seve ral methods of recognition. Team accomplishments, including pictures are highlighted in a program wide newsletter. Th ese accomplishments are also highlighted at program re view with senior leadership to give them exposure to N G leaders, as well as reviews with the PTS PO. The recognition ensures th at the team members kno w their contributions to the program are valued by NG and the PTS PO . The PTS P O benefits by ge tting to know the contributors on the team more , whi ch cr eates a more intimate team envir onment.

Mission Intimacy

Finally, the team is enco uraged to be intimate with the program mission . Program wide " lunch and learns" are h eld to share customer mission details, technical solutions acros s teams, and special topic s of interest, including tutorials. This allows program personnel to develop a gr eater und erstanding of th e mission need of the customer, a greater appreciation of the work their te ammates are doing, and an i nsight into the program technic al solution that may help them with their own tasks. A team that understan ds and believes in the mission ultimately will be motivated to deliver the best valu e to the PTS PO and the warfighter.

The PTS program is using numerous techniques t o leverag e skills and tech nologies of our suppliers.

"Badge less Team"

First, we take a "badge less" approach to an integr ated team. The suppliers are fully integr ated into the previously mentioned fla t organization cha rt and r eport directly to progr am leadership just like the NG personnel do. Multi -party non-disclosure ag reements have be en implemented to allow suppliers to directly share data with each other without using NG as a "middleman". The s uppliers pres ent direc tly to the customer without add itional NG internal revie w. These methods f acilitate a one t eam appro ach and ensures the suppliers feel valued and motivated to contribute to the program 's success. Th e PTS PO benefits by having a mor e direct insight into the work the suppliers per form.

Leverage Supplier Best Practices

Secondly, the program employs a " supplier best p ractice" strategy. For example, suppliers producing hardware and so ftware pr oducts are given th e flexi bility to use their internal standards for qu ality assurance if suffici ent justification and heritage is provided. Using supplier best practic es eliminates unnecessary overhead to align to NG processes, allows the supplier to produce products in a p roven manner, and p rovides the best value to the PTS PO and wa rfighter.