Additive Manufacturing Business Model Wargame II

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AMMO Additive Manufacturing for Maintenance Operations

America Makes

LMI

Executive Summary

Additive manufacturing (AM) is a revolutionary technology that is changing the manufacturing business model and the maintenance and sustainment communities it supports. In May 2016, America Makes and the Department of Defense (DoD) conducted the first AM Business Model Wargame, a simulation that focused on the business transactions involved when DoD requires that repair parts be additively manufactured at a DoD depot or third-party location to support immediate readiness goals. In response to the 2016 wargame, the AM Business Model Planning Group, consisting of members from the Additive Manufacturing for Maintenance Operations Working Group and America Makes, was formed to build upon the business model aspects of AM for sustainment. The resulting event, AM Business Model Wargame II, took place in May 2017 at the Lockheed Martin Global Vision Center in Arlington, Virginia.

The scenario for the second wargame was expanded to include life-cycle platform considerations relevant to the business environment required to support the continued adoption of AM capabilities. The revised scope included business practices regarding intellectual property (IP), data rights, and contracting issues specific to AM; risks to the industrial base; legal concerns and liability shifts from industry to government; government needs; and brand and reputational concerns.

Four teams, representing four business models, dealt with the same scenario involving a need to manufacture repair parts via AM capabilities at the point of use:

1. Team Buy-Out—traditional government acquisition
2. Team Loaner—government leases the end items
3. Team CLS—contractor provides commercial logistics support (CLS)
4. Team Net-Flix—government and original equipment manufacturer set up a “pay as you go” IP arrangement to allow AM part production in the field.

The results of the simulation revealed common issues among all teams and unique opportunities and business model considerations particular to each team. The issues included the need to negotiate a value for access to IP, warranty impacts, liability shifts, brand risk concerns, and an increased reliance on data and the security of that data, also identified in Wargame I.

To incorporate the unique capabilities that AM possesses, the teams recommended creating technology refresh opportunities, developing revenue cost models, and reviewing and updating the contractual language in the Defense Federal Acquisition Regulation Supplement. Despite these challenges, there was general consensus that with the proper cost-benefit business models in place, AM has significant potential to increase flexibility within the supply chain and improve sustainment support to the warfighter.

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Introduction

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Additive manufacturing (AM) is a rapidly advancing capability; new uses are being discovered at a frenetic pace, and new materials and processes continuously emerge. It is important that the Department of Defense (DoD) advances along with AM so that once its technical issues are resolved, DoD is prepared for the paradigm shift enabled by distributed manufacturing. The maintenance and sustainment communities have a vested interest in this technology and want to be on the forefront of planning for the needs of all involved.

As part of this planning, DoD has completed two AM business model simulations, known as wargames, to address the aspects of employing AM technology and techniques to sustain DoD equipment in multiple scenarios. This report reviews the findings of the first wargame and provides a detailed report of the second wargame.

Current State of AM

The potential uses for AM are staggering. Significant short-term and long-term benefits to both private industry and DoD could result in millions of dollars saved in maintenance and sustainment costs, as well as improved warfighter readiness and flexibility. But there are several issues to carefully consider as the technology advances, such as security, workforce training, intellectual property (IP), pricing models, technology certification processes, and supply chain management.

DoD has recognized the incredible potential and opportunities associated with AM and has made significant investments in this capability. Current uses include producing tools, mounts, molds, and jigs to support conventional manufacturing and maintenance; making prototypes for rapid innovation and reverse engineering; repairing conventionally manufactured parts; and manufacturing parts typically produced using conventional methods. In the near future, DoD expects to produce new parts and systems designed for and manufactured using AM.

AM is a business ecosystem composed of a network of organizations—including developers, suppliers, distributors, customers, competitors, government agencies, and academia—involved in delivering a specific product or service through competition and

cooperation. Each organization in the ecosystem affects the others; this continuously evolving relationship means each business must be flexible to survive.[1]

For this ecosystem to function effectively, it needs a shared vision. In 2016, America Makes and the military services developed the DoD AM Roadmap[2] to do the following:

- Identify common areas of interest
- Create a framework to guide coordination and collaboration
- Track progress toward goals
- Inform industry of DoD needs.

The DoD AM Roadmap identified four focus areas that exist within the ecosystem:

- Design
- Materials
- Process
- Value chain.

The roadmap recognizes the enormous opportunity that AM offers and concluded that the advantages of DoD-wide AM utilization are vastly greater than the risks from unknowns and challenges.

Why Use Wargames?

A wargame exercise is a useful tool in dissecting, discussing, and diffusing real-world situations, eliminating scenarios that will not work, and establishing cases that might translate into best practice policies, with forethought and alignment with all stakeholders. The AM Business Model Wargames were simulations of a sequence of events using AM technologies within the DoD environment. The stakeholders were a combination of individuals from government, industry, and academia who worked together to collaborate and initiate the development of best practices in advance of the AM innovation shift. These practices and resulting policies need to be synergistic, comprehensive, and adaptable.

AM Business Model Wargame I

In May 2016, the DoD Additive Manufacturing for Maintenance Operations Working Group (AMMO WG), in collaboration with the America Makes AM for Maintenance and Sustainment Advisory Group, co-sponsored AM Business Model Wargame I in Suffolk, Virginia. The purpose was to bring together participants from DoD and industry and illuminate the required business transactions when DoD needs repair parts to be additively manufactured at a DoD depot or third-party location in support of an immediate readiness goal. The wargame also assessed gaps and challenges discovered during the simulation to begin developing the necessary environment to support the continued adoption of AM capabilities.

[1] Investopedia, s.v. “business ecosystem,” http://www.investopedia.com/terms/b/business-ecosystem.asp.

[2] America Makes, Technology Roadmap Overview, https://www.americamakes.us/our_work/technology-roadmap/.

Concept and Objectives

While using a realistic scenario, the Wargame I exercise employed separate U.S. government and industry teams to develop a solicitation involving the use of AM in a remote location. The teams were required to identify what business model issues needed to be addressed and the associated implications. Specific objectives included exploring contract terms and conditions, exploring business model gaps and challenges related to AM adoption, and understanding what an AM ecosystem looks like.

AM Business Model Wargame I Findings

The first wargame identified the following common areas affecting both industry and government with the emergence of AM:

- Lack of a tailored business model
- IP, legal, and security aspects
- Terms and conditions; contracting vehicles
- Warranty and liability
- Quality control and assurance; technical requirements; qualification and certification
- Need for collaboration and partnerships
- Pricing and value—“rent versus buy;” variable pricing per demand
- Technical data package (TDP)
- Processes and training.

Identified Focus Areas

Upon completion of the simulation, participants recognized that the status quo of the existing government–industry ecosystem and business models would need to change to successfully implement AM on a broader scale. The following focus areas were identified for further study:

- AM ecosystem—business model ideas that include acquiring IP and technical data rights and investigating public-private partnership (PPP)
- Liability and quality—liability shift and brand reputation
- Security—IP and TDP protection and business risk
- Cost and profitability—revenue stability, pricing models, and profitability are threatened by uncertainty stemming from a non-traditional manufacturing process.

AM Business Model Wargame I Final Report

Refer to Appendix A for the AM Business Model Wargame I Final Report.

AM Business Model Planning Group Findings

Upon completion of AM Business Model Wargame I, the AM Business Model Planning Group identified the following issues requiring resolution before AM can be successfully implemented:

- IP and legal—IP ownership, transfer, and risks
  - Qualification and certification
  - Parts safety; government and industry specifications
  - Development of a “digital thread” TDP to create consistency and standards for AM applicable parts
- Traditional pricing models—threatened with uncertainty
- Warranty and liability—what the contractor would warrant and where their liability begins and ends
- Federal Acquisition Regulation (FAR)—not adapted for AM
- Cybersecurity—protection of digital data between industry and government.

AM Business Model Planning Group Recommendations

The planning group recommended these actions in response to the findings:

- IP and legal—establish working groups with legal and technical experts to determine what IP could be controlled and what is acceptable.
- Qualification and certification—work with technical parts experts to establish quality specifications and allowed variances, ways to measure specifications, and the equipment and training necessary to perform these quality validations.
- Qualification and certification—conduct a second business model wargame to review forward deployment versus regional depots, field service representatives’ (FSRs) use, and pricing models.
- Traditional pricing models—establish pricing for various contracting scenarios through partnering with industry and government, including subsidized possibilities.
- Warranty and liability—conduct an AM wargame that responds to situations involving parts failure to mitigate negative affects toward industry when government is responsible and vice versa.
- FAR—review and revise FAR and DoD policy with AM-specific language.
- Cybersecurity—secure TDP sharing and machines; prepare for securing the developing digital infrastructure.

AM Business Model Wargame II Concept Development

Why Conduct AM Wargame II?

The AM Business Model Planning Group’s intent in conducting another AM business model wargame was to follow up on the findings from the 2016 AM wargame and develop business models that examine the value chain within the AM ecosystem. The

planning group invited representative stakeholders for an in-depth look at the business needs to perform the following within the value chain:

- Value proposition
- Competitive assessment
- Revenue model.

The AMMO WG wanted to ensure the scope included the exploration of contracting aspects as they relate to AM, including IP, TDPs, cost, security, warranties, and liabilities that fit within the current and anticipated needs to support the warfighter. The AM Wargame Planning Team actively sought government and industry members with experience in contracting, legal, procurement, and business. The planning group developed the scenario with this scope in mind. Considering DoD's future needs and the opportunity that AM offers, it is critical that the business aspect be in lockstep with the technology.

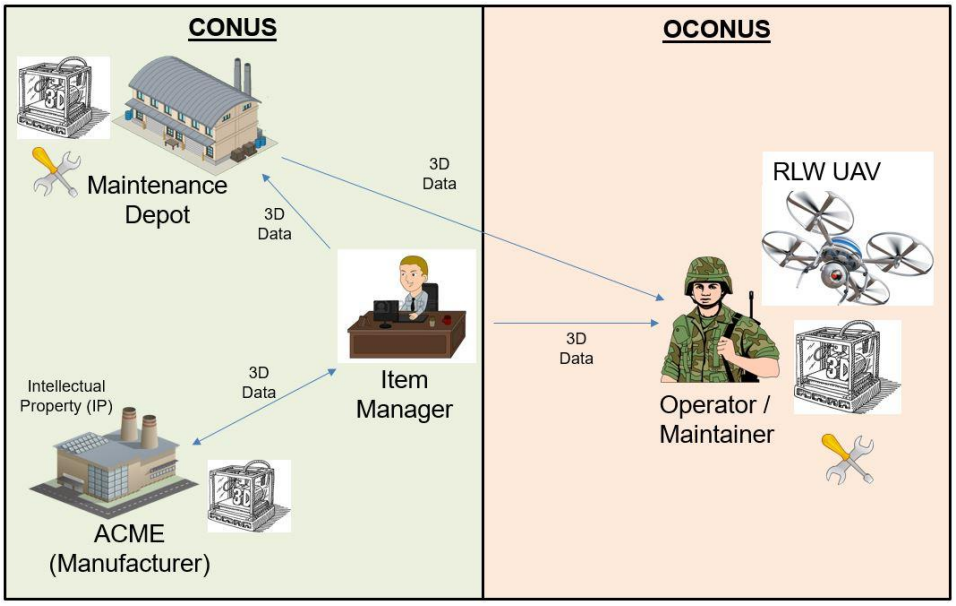
Scenario

The AM Business Model Wargame II scenario is the prequel to the Wargame I scenario conducted in 2016; Appendix B presents this prequel scenario, which begins with DoD issuing a request for proposal (RFP) to develop and acquire a reconnaissance lightweight (RLW) unmanned aerial vehicle (UAV) capable of being deployed in austere environments. DoD required the awardee to produce a prototype within 6 months and the first production unit within 1 year after contract award. Most performance capabilities required by DoD can be performed by commercially available systems. However, the government will provide mission systems, such as communications and surveillance and reconnaissance, and cannot share the base technology with the drone manufacturer, which must work with the industry team to integrate those systems into the drone.

DoD selected ACME, Inc., an original equipment manufacturer (OEM), as the UAV manufacturer and awarded a contract to deliver 1,000 RLW UAVs. The contract specifies that the first prototype be delivered within 6 months after award and used as technical demonstration evaluation, qualification, and certification for production acceptance. The contract also stipulated that initial sustainment would be performed by ACME for the 3 years in which it delivers RLW UAVs to DoD, at its commercial facility for depot-level maintenance and at selected field locations around the world, including aboard ships.

After ACME has delivered all 1,000 of its RLW UAVs, DoD will provide organic sustainment, including additively manufactured items originally produced by ACME under contract; this is a significant portion of the RLW UAV parts. In fact, all parts identified as potential sustainment items required for 6-month deployments of the RLW UAVs must be AM parts by contract. This would give DoD the ability to self-sustain operations in locations where reach-back logistics chains may not be available. Figure 1 depicts the current state of the scenario.

Figure 1. Current State of the Scenario



Four Business Models

The 2017 AM Business Model Wargame II sought to address the business model aspects of AM for sustainment and production, consistent with PPP principles in parallel with AM technical community efforts. Table 1 depicts the four business models. The scenario addressed deployed AM business models to encompass the life cycle of the UAVs, including design, configuration management, production through AM methods, procurement, and fielding. The intent was to align the scenario with the four areas in the DoD roadmap.

Table 1. AM Wargame II Business Models

No.	Name	Model	Description
1	Buy-Out	Traditional government acquisition	• #1A—government purchases unlimited data rights from ACME. • #2A—government purchases purpose data rights.
2	Loaner	Lease 1,000 RLW UAVs	• Government completes all integration of reconnaissance capabilities. • ACME provides government-purpose data rights to commercial IP. • Government organically sustains RLW UAVs through life.
3	CLS	Government purchases 1,000 RLW UAVs	• Government and ACME work together to integrate reconnaissance capabilities. • ACME provides commercial logistics support (CLS) for UAVs through life.
4	Net-Flix	Government purchases 1,000 RLW UAVs	• Government and ACME set up Net-Flix type of “pay as you go” IP arrangement.

Four Moves

To follow the likely flow of a business plan, the 2017 AM Business Model Wargame II simulated a sequence of four events, also known as moves. The moves produced a specific deliverable, as shown in Table 2. Each team received templates of the deliverables required for each move; Appendix C contains the templates provided to the teams.

Table 2. AM Wargame II Moves and Deliverables

Move no.	Objective	Deliverable
Move 1	Deconstruct scenario	Compliance matrix
Move 2	Strategy	Technical approach, schedule, performance work statement, TDP, acquisition strategy, and life-cycle sustainment plan (LCSP)
Move 3	Revenue model	Business model guide or “canvas”
Move 4	Assess to value proposition	Contract administration

- The first move deconstructed the scenario, producing a compliance matrix as the deliverable. The matrix is composed of the government and industry requirement, how industry achieved compliance, how well the government determined that the compliance is achieved, and any comments.
- The second move focused on the development of a team strategy with six extensive deliverables: the technical approach, performance timeline, performance work statement, TDP and its discussion points, acquisition strategy, and LCSP.
- The third move developed a revenue model with a business model guide, or “canvas,” as the deliverable from the OEM’s perspective. The business model comprises key components such as partners, activities, resources, cost structure, revenue streams, and value propositions.
- The fourth and final move assessed the value proposition, with a deliverable of a contract framework. The deliverable is a combination of the technical approach, terms and conditions, assertions, warranty, and liability.

AM Business Model Wargame II Teams

Team Descriptions and Integrated Compositions

The 2017 AM Business Model Wargame II had 97 participants divided into four teams of 20–30 people. Some of the “players” were veterans from the Wargame I exercise; others were new to the experience. The four teams were composed of representatives from government, the military services, academia, and industry, with disciplines in contracts administration, engineering, enterprise IT, legal, logistics, and program management. Each team had a government co-lead, an industry co-lead, a facilitator, and a coordinator. Figure 2 shows the demographics of the Wargame II players.

Figure 2. AM Wargame II Demographics

Team Observations

As part of the exercise, the teams documented their observations after each move. These were later compiled into a final out-brief presentation. The following are individual team observations.

Move 1: Deconstruct Scenario

Move 1 resulted in the completed compliance matrix, which required the teams to deconstruct the scenario containing information from the RFP, awardee, performance period, and scope of work. The compliance matrix consisted of a list of requirements generated by the teams, how they achieved compliance on each of those requirements, how well the government thought they achieved it, and any comments from the government or industry team members.

Team Buy-Out knew that it would not come to an agreement on the government acquiring unlimited or government-purpose data rights due to the complexity of determining the fair market value. This determination led to negotiated data rights for the five additive-manufactured parts, with the rights based on the contents of the TDP. The team decided that the TDP would include design, the build file, material and process specifications, a testing plan, machine parameters, parts requirements, and a sustainment plan. The rights of the AM parts would be negotiated based on the printing capabilities. To ensure organic sustainment, the team required a training plan in place, with a transition in the field via a CLS contract. The OEM would provide initial training to the government at a

cost, with cross-training of government personnel to expedite certification and qualification of operators and sustainment. The OEM would also oversee all training, operation of machines, and parts building, as well as provide training manuals.

Team Buy-Out agreed that industry would provide annual software and hardware updates and requalify the printers for manufacturer-driven changes, but the government would pay for FSRs' and any above and beyond printer capability modifications. Team Buy-Out could not agree on the repair or replace method; industry would like to complete repairs for the UAV due to the OEM repair capabilities and commercial off-the-shelf (COTS) items. However, the government would like to complete all field repairs to ensure efficiency, which includes printing new AM parts in the field.

Team Loaner created a list of five requirements and agreed on most. The government must be able to print in the field using printers that are equivalent in material, process, and resolution to those used by the OEM. The OEM would agree to this requirement only by licensing the TDP to the government. Team Loaner decided that the government should provide a level of usage and employment data, or feedback, on a regular basis to the OEM; this includes part replacements related to performance. The team did not agree that the government would protect the IP for the life of the lease and that the government would be liable if the IP were compromised. The OEM proposed that the government delete all information related to the TDP upon expiration of the lease; the teams acknowledged that the license terms would need to be negotiated for this requirement to be compliant. Team Loaner could not agree on the requirement for the government to print in the field with a non-OEM approved printer; the OEM would not be willing to negotiate this time.

Team CLS focused its compliance achievement on the contract language. The members agreed upon a 30-year sustainment strategy, with a 5-year technology refresh option and five successive 5-year government options. As most teams experienced, Team CLS would need the IP for sustainment, but again, the team was unable to come up with the fair market value. Team CLS wanted the OEM and the government to share historical use and performance data where appropriate to inform sustainment planning and other life-cycle management activities. The team negotiated that the design is reconfigurable to meet design compliance given DoD's architecture standards. Team CLS did not agree on a warranty due to its complexity, especially if the government were to print a part without the involvement of an FSR. The team was also unsuccessful on achieving the requirement that all sustainable parts were to be designed and qualified for the AM process; if possible, that would be achieved through the contract language and TDP.

Team Net-Flix composed an extensive list of requirements for the compliance matrix. Its main concern revolved around cybersecurity and secured access for the digital delivery of the IP; the OEM would control this by providing access to the government through user access control, encryption, or secured computers. The team agreed that the government and industry would share logistics and reliability information throughout the product's life cycle, with the goal of continuous product improvement. Another requirement was a subscription package to the UAV's TDPs and its availability to be accessed along with a licensing arrangement to be negotiated based on government usage reported monthly. Team Net-Flix also requested that an FSR be accessible and engineering technical support service be available 24/7, including remote and diagnostics ability. The team did not agree on manufacturing as a service, such as a suite of material and equipment (full-service turnkey solution for organic manufacture). However, the OEM

would provide the TDP for the process and match the government equipment with the completed build file. Industry added that it would need to ensure the integrity of software. The team was also unable to agree on the government's proposal to improve readiness by the reduction of post-processing and manufacturing time and requirements. Industry countered with the unknown of material availability, operational availability, and material readiness. It should be noted that in an actual arrangement, many of these unknowns would be known, facilitating a mutually beneficial agreement.

Move 2: Strategy

The teams produced the most deliverables at this strategy-focused move. These deliverables consisted of a technical approach, schedule, and performance work statement, with the assumption that there were no technology-related constraints, and defined how they implemented their model. The TDP discussion deliverable focused on storage, transmission and security, updates and configuration management, guidelines, availability, and conditions.

Team Buy-Out followed the scenario's timeline of 1,000 UAVs delivered by the end of year three but added a transition plan milestone at UAV 500 to enable the OEM to integrate the government capabilities and facilitate necessary training. The team's technical approach focused on its main concerns from the compliance matrix, such as initial and relevant training, completion of all surge repairs for the five AM parts, and completion of all COTS repairs at the OEM facilities. During its TDP discussion, the team established that digital files would be stored in a native format whereas data files would be provided in AM-capable rich formats. However, while in CLS, the contractor would host data in its managed database. The TDP updates would be delivered downstream, and data files could be transferred via CD-ROMs or a secured network. Under the specially negotiated data rights, the OEM would restrict data permissions; however, the TDP would be available to the government for the negotiated AM parts.

Team Loaner decided to extend the scenario's timeline to 5 years, with a procurement decision made by the end of the first year. Its performance work statement included a variety of items, such as a co-developed qualification with the OEM, government, and manufacture; and the OEM would deliver 50 units per month after the first year of production. This team tailored its TDP to the U.S. Marine Corp's field regulations and agreed that the TDP would be stored and transmitted through a data rights management system, with DoD-grade encryption during transportation and in storage. The license agreement states that the TDP would be for government use only and specific to particular printers and materials with training standards for all operators.

Team CLS developed a technical approach tailored to its model. The team decided the contract must maintain compliance with the most current DoD IT standards. The OEM would be responsible for integrating the intelligence, surveillance, and reconnaissance (ISR) package with government authorities and manufacturing to standards. Team CLS altered the scenario so that the contractor would provide a 30-year readiness-based sustainment plan that comprises an initial 5-year sustainment and technology refresh with five successive 5-year government options. This structure provides the OEM with multi-year cost and revenue certainty while affording the government with avenues to opt out if the system no longer meets fiscal or operational requirements (e.g., overtaken by more advanced technology).

Under Team CLS's model, the OEM would be primarily responsible for sustaining the UAVs. The government would want sufficient IP and data rights, with the initial TDP and with each successive technology refresh to sustain the UAVs in critical, unplanned, and surge situations. The OEM would provide training, along with the responsibility of maintaining the training materials, in order for the government to sustain the UAVs in these situations. The delivery of this at a high quality is in the OEM's best interest; it is critical for the government to have part-printing capabilities during emergencies, as well as improved program readiness metrics against the thresholds in the CLS contract. A 1-year warranty would accompany the UAVs, although it would exclude government-printed parts without an OEM FSR onsite. The OEM and government would collect and share historical data to improve sustainability and the readiness of the UAVs. The OEM would deliver UAVs using an open-architecture approach, with standard interfaces that allow for substitution of components on either side of the interface as well as delivering technical manuals to government.

Team Net-Flix developed its technical approach around control by the OEM. The OEM will identify, test, and field an integrated data environment that serves as the foundation for all configuration-managed digital data, including asset requirements, engineering data such as models and reports, and manufacturing process information. The OEM will also provide secured access to required personnel under the subscription service. The team's performance work statement includes a requirement that the OEM is proven, tested, and a current leader in commercial market solutions. Team Net-Flix also placed a monetary amount on the acquisition—$2.9 million for the five AM parts—and a provision that they would qualify at the customer's site. Their timeline would be 1,000 units over 3 years at a cost of $1.23 billion, with a provision of the entire TDP for independent government production at the end of the 3 years. Team Net-Flix's TDP discussion reflected its compliance matrix, with access being restricted to required personnel and encrypting the data to reduce risk. Finally, the team developed a simplified acquisition strategy and an LCSP, answering a series of questions that should be considered in an AM-specific acquisition.

Move 3: Revenue Model

The third deliverable was to create a business model guide to help teams identify key partners and activities, assess the value proposition, discuss key resources, establish cost and revenue approaches, among other areas. Move 3 focused on the completion of a revenue model.

Team Buy-Out's main partners for this model were the government and OEM, with the manufacturers of the printers and material suppliers as subcontractors to the OEM. Key activities were listed as the integration of the government, sustainment of the parts, data right negotiations and permission, and cybersecurity. To achieve the value proposition, the OEM would enable organic sustainment, improve operational readiness, and focus on reducing production lead times and inventory through quality, continued improvement, and ensuring cost savings. The OEM revenue stream would generate from the licensing the data rights for AM parts and a pricing premium for shortened lead time.

Team Loaner's main partners for its leasing model were the government, the OEM, manufacturers, material suppliers, equipment providers, test facilities, and cybersecurity firms. The two key activities are allowing qualification and certification by the OEM in the government facilities and protecting data during transmission and storage. The business model is an industry-focused guideline; value propositions were maintaining the leased

UAVs, allowing the AM IP to be readily available through terms of lease without restriction, and the government returning usage and reliability on AM parts to help future products. Team Loaner also noted that while other customer relationships were not considered on the canvas, they are viable alternate sources of revenue for a leasing model. The cost structure and revenue stream centered on the lease services, UAVs, printers, and support to fielded upgrades.

Team CLS's main partners for its model were the government, the awarded OEM, tier 2 and tier 3 OEMs, vendors, material suppliers, and customers. The CLS model encourages collaboration between the OEM and government to achieve performance-based readiness targets. The OEM contributes to these efforts by manufacturing parts to stock by AM or conventional methods. The OEM then positions inventory at optimal locations to meet anticipated demand levels, with some buffer for demand surges, and provides life-cycle management support such as an FSR onsite. The government augments inventories with its capabilities to additively manufacture parts at or near the point of need to meet critical demand cheaply or more quickly than the traditional supply chain. The team's key activities included a digital thread, end-user training, replenished retail stock, and the creation of publications.

The team's key resources were engineers, lawyers, program managers, FSRs, and government maintenance personnel. To successfully implement sustainment, they allocated resources to printers, materials, and training. The key technology to the model is the ability of printers to manufacture parts within the OEM specifications. To maximize the value proposition, CLS's goal is reduced inventory, procurement and sustainment costs, and lead time. The team prefers rapid acquisition and maximum up time as well as technology updates every 5 years, with the hope of sustainment tail reduction as product quality improves over time. The cost structure includes an upfront wholesale pool, replenishment and replacement of stock, equipment leases, engineering required for the model, and creation of the TDP. The OEM would ensure its revenue streams through sales of vehicle and initial provision, providing incentive thresholds, and cross-market sales, as well as refreshing technology to consistently meet operational demands and trigger successive government options. The OEM would also rely on the performance-based logistics aftermarket support, such as parts, FSRs, TDP, and engineering.

Team Net-Flix's main partners for its "pay-as-you-go" option are the OEM, government client and government offices, manufacturer, and software vendors. Key activities include production and sustainment, development and qualification of secure data, user feedback, demand and usage capture, and storage and transfer training. Key resources are secure and stable IT infrastructure and proven customer relationship management. The team would also rely on human capital, such as FSRs and material scientists. The cost structure mostly relies on production and sustainment, allowing for a continuous revenue stream. Team Net-Flix would focus the revenue stream on the improvement of readiness and mitigation of counterfeit parts, as well as end-to-end network security through production.

Move 4: Assess to Value Proposition

For the fourth and final deliverable, teams produced a contract framework with terms and conditions, assertions, warranty, liability, and a form of cost. Move 4 focused on the assessment of value proposition.

Team Buy-Out agreed to a specifically negotiated licensing agreement. Its technical approach for this agreement required the OEM and government to agree beforehand to a negotiated license that covered 3 years of CLS and the sustainment period post-CLS. They agreed on a few terms and conditions, including a non-compete clause, production for government only, cybersecurity reporting, and a component improvement program. The OEM reserved the right to sell improvements to international markets, excluding export considerations. To validate funding representations that underlie the restrictions, the OEM would be the sole provider. The team deliberated on whether the OEM would offer certification (then the government would desire a product warranty, at no additional cost) but decided that the government did not desire a warranty at an additional cost. However, if the government were to pay for certification, then the OEM would assume the liability. The team agreed on a compensation system with four payments through annual milestones and explored shared-profit opportunities achieved through supply chain efficiencies.

Team Loaner agreed that the OEM would provide a lease of 1,000 UAVs per the schedule furnished by the government. The environment may be restrictive, but AM sustainment would be mobile, containerized, secure, and in climate control-approved facilities. The team incorporated an addendum option to co-design the integration of ISR government-furnished equipment, digital library and databases, training, and quality control services. By maintaining the leased UAVs via multiple AM fabrication sources, it reduces logistics, as well as the operations and maintenance chain for the customer. Team Loaner's UAV services are a platform for the sensor systems. The team would return data to the OEM and other key partners for insight of product usage and reliability on AM components to improve future parts. The contract also allows the AM IP to be readily available through the terms of the lease, enabling rapid fabrication of replacement parts without restriction.

Team CLS's contract consisted of a 30-year sustainment timeline with a technology update every 5 years, with the upfront cost being lower to the government. This allows stable revenue for industry over the near and midterms, with potential to increase profits over the system life cycle as the OEM drives down costs or improves operational availability. The OEM would offer access to historical data, spare parts, training, and publications at a lower cost to government while allowing a stable revenue for industry. The team decided on a warranty agreement for parts and a TDP that increases the cost to government but would exclude government-printed parts manufactured without an OEM FSR onsite; this is also a higher risk for industry. Government and industry agreed on the assumption that all sustainable parts must be designed and qualified for the AM process. Team CLS did not agree that the design could be reconfigured to comply with DoD open-architecture standards. While open architecture could allow the government to open the CLS contract to competition, building in reconfigurable design is an increased upfront cost to the government and dependent on complexity and performance, while the cost to business depends on the complexity of the integration of government-furnished equipment.

Team Net-Flix's contract allocates the cost into five elements:

- Turnkey solution. The major element of the contract is allocated to buying a turnkey solution for DoD by providing the TDP, training, and end-to-end manufacturing process. This does not include product updates but would include the printer, files, and materials. The terms and conditions would be standard for services. The OEM

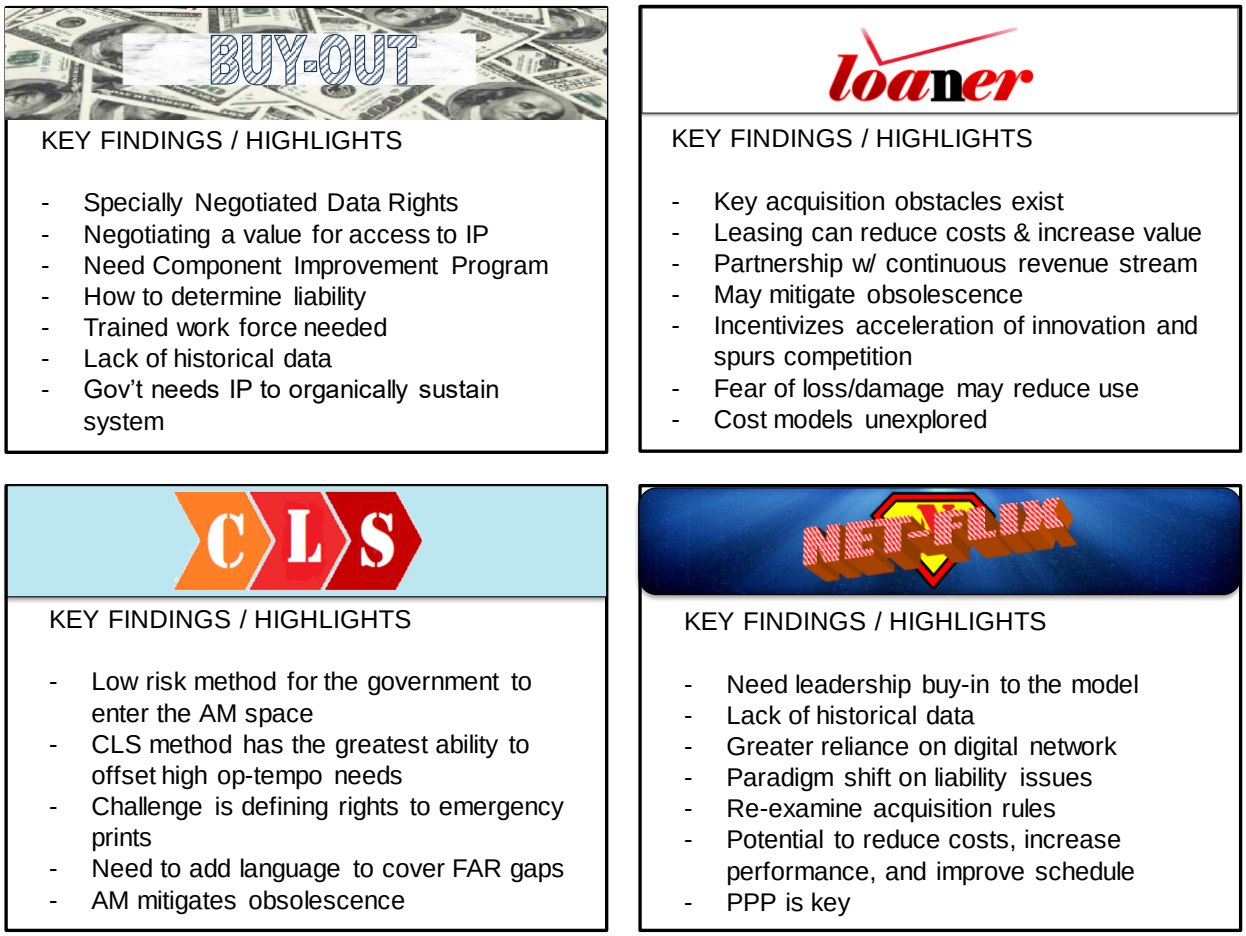
would offer a standard commercial warranty on machines and support equipment, with the possibility to negotiate an extended warranty. The liability would be the sole responsibility of the OEM, if the process were followed.

- Engineering services. The second-largest element of the contract is allocated to engineering services, which include configuration management, product updates and improvements, FSR support, and software and firewall parameters. The terms and conditions for this element were split into three parts: (1) agreed-upon clause on a commercial license for the printer, (2) response time metric (variable), and (3) standard terms and conditions for services. The data rights may be negotiated on updates and modifications. The warranty offered would be applied to the outcome, and the liability would be negotiated between the OEM and government.
- Digital library. The OEM would provide a digital library with terms and conditions that allow for its transportation within a cyber-secure environment. The OEM would offer data warranty, cyber protection, and data validation. It is the responsibility of the OEM to ensure the build file is usable, current, and accurate. The OEM assumes liability if it does not comply with this requirement.
- Subscription services. The subscription (cloud) technical approach offers two options: a blanket subscription for unlimited use and a basic subscription. The OEM would offer a standard commercial warranty to the government.
- Initial sparing and provision. The smallest element of the contract is initial sparing and provision, which applies to all technical approaches such as data right clauses, the patent indemnity clause, and Defense Federal Acquisition Regulation Supplement (DFARS) and FAR clauses. Standards terms and conditions, warranty, and liability apply to this requirement.

Key Challenges and Findings

At the end of the 2-day exercise, the teams presented short out-briefs of findings. Each team's entire brief can be found in Appendix D. Refer to Figure 3 for the highlights of each team's findings. The subsections that follow detail the most significant challenges and findings that each team presented.

Figure 3. AM Wargame II Highlights from Four Briefs



Team Buy-Out

- Our experience showed us that industry is not likely to agree to unlimited or government-purpose rights. Instead, industry preferred a specially negotiated licensing agreement that included sustainment, warranties, liability, cost, and sole-source designation.
- How to negotiate a fair market value for the contractor yielding its sole-source premium for the limited rights to the technical data ("OEMs selling the secret sauce").
- How to capture or continue product and technology improvement post contract (component improvement program).
- If industry will not certify a government-manufactured AM item, can liability be placed on an AM part manufactured with the OEM's technical data?
- We need a future workforce with machinists and software engineers who possess the talent to design for AM.
- There is a lack of data to support the long-term viability for AM-produced parts.
- The government needs the IP to organically sustain AM parts, or sustain the system as a whole should the OEM decide to end support.

Team Loaner

- Leasing over the life cycle of a system can save money and provide a better value (e.g., no disposal costs, increased readiness).
- Provides potential to establish a long-term business relationship and the OEM to receive a continuous revenue stream.
- Currently, DoD regulations do not allow a lease option.
- Leasing can mitigate obsolescence issues in systems that have rapidly evolving technology.
- Leasing incentivizes the acceleration of innovation and spurs competition.
- Leasing provides the OEM the opportunity to leverage AM profitably across both government and industry clients.
- Penalties for going beyond the leasing degradation percentage may discourage operational use (e.g., operational forces are less likely to use expensive assets, leased or otherwise, due to fear of loss or damage and potential repercussions).
- Cost models are for the most part unexplored and may be more expensive for government than industry.

Team CLS

- CLS is a relatively low-risk method for the government to enter the AM space. The model enables multi-year cost stability and encourages the OEM to collaborate with the government to achieve performance targets.
- The CLS method has the greatest ability to offset high-OPTEMPO needs and incentivize readiness. The OEM and government combine traditional inventory methods with as-needed AM production to operate effectively while achieving availability thresholds codified in the CLS contract.
- The challenge is defining the rights to emergency prints for government printing. The government leverages its printing capabilities to meet demand or near the point of need to improve performance against program readiness metrics. However, from the OEM viewpoint, each use of the TDP outside of its immediate control is a potential liability issue, or a breach of IP. This is particularly concerning in the theoretical case where instead of using a government-leased printer, the government hires a commercial printing service to manufacture a part using the OEM's data.
- Commercial contract: add language to cover FAR gaps.
- CLS is the way to go for a high level of operational availability and stable cost structure. CLS encourages product and process improvements that advance system availability, particularly when the contract is structured so improvements benefit both the government and the OEM.
- AM streamlines incorporation of performance and reliability improvements and mitigates obsolescence.

- Extremely high turnover of replacement parts requires good configuration management.
- Difficult for OEM to contract with different services and agencies.

Team Net-Flix

- Challenge to get leadership to adopt subscription business model.
- The subscription model can be tailored to meet demand.
- Lack of historical data for the subscription business model.
- Need to demonstrate value above traditional methods and processes.
- Greater reliance on connectivity and the digital network.
- Potential for new ground on liability issues (paradigm shift).
- Rules of acquisition need to be reexamined.
- Potential to reduce cost, increase performance, and improve performance schedule.
- PPP is key.

AM Wargame II Hotwash

The AM Wargame Planning Team, co-leads, facilitators, and coordinators conducted a hotwash on May 31, 2017, to discuss feedback from Wargame II to learn from their firsthand experience as well as shape future wargames.

Hotwash Observations

- Collaboration between government and industry team members allowed trust to grow between them.
- The number of deliverables within the 2-day time constraint created a sense of “racing” amongst the team members.
- The event was much more collaborative than the first wargame.
- Recommend more diverse industry participation in the future, such as small business and AM system manufactures.
- Existing government restrictions will limit many organizations’ use of the model developed by Team Loaner.
- Teams struggled with conducting a “fair-price” value and suggested pricing and the creation of a revenue model for a future AM wargame.
- Pre-meetings prior to the wargame helped with team dynamics and collaboration.
- Breaking the 20+ person teams into smaller groups led people to become more involved and productive.
- The Lockheed Martin facilities were tremendous and greatly appreciated. The whiteboard space was a great tool.

Hotwash Recommendations

- Move to a 2-day format with a specific focus or fewer deliverables.
- Create a more structured method of sharing contacts. Establish a restricted-access AM Wargame "Community of Interest" on the AMMO WG website at https://ammo.ncms.org/.
- Solve a specific problem during a follow-on wargame, such as warranty, liability, or gaps in the FAR.
- Include critical items such as flight safety repair parts manufactured through AM.
- Focus another wargame on the development of a report with a smaller number of deliverables. Examples include writing a contract, performance work statement, or warranty with a smaller group possessing the proper skill sets.
- Have the teams summarize unsolved questions and problems, then possibly hold focus groups with related disciplines to conduct a deep dive.
- Designate a dedicated recorder, possibly with audio/visual equipment, to observe and capture conversations, as the coordinators were busy developing the products and facilitating the group.
- Continue AM wargames on an annual basis.
- Look at how current and future states of AM technology will drive implementation and how that will affect contracting in future wargames.

AMMO WG Brief Comments

The AMMO WG conducted a teleconference on June 7, 2017, to focus on the series of out-briefs from the co-leaders, facilitators, and coordinators of the four AM wargame teams. This session afforded the team participants more time to discuss their findings than was available during the out-briefs. Their added comments are below.

Team Buy-Out

- AM is not a traditional manufacturing process; therefore, it presented challenges to a traditional acquisition approach.
- We prefer specifically negotiated data rights rather than unlimited rights or government-purpose rights.

Team Loaner

- The leasing model was very complicated due to the internal government and DoD regulations not allowing a lease option. Currently, the General Services Administration is the only agency able to allow a lease option.
- The leasing model does have value; it would allow a reduction in the logistic chain, IP access would enable rapid fabrication, and the product updates would be readily available.

Team CLS

- The government does have the ability to do this type of work, if needed, and it allows flexibility.
- A 5-year option allows for a technology refresh.
- CLS is a low-risk method for the government to enter the AM space.
- CLS has the greatest ability to offset high-OPTEMPO needs.

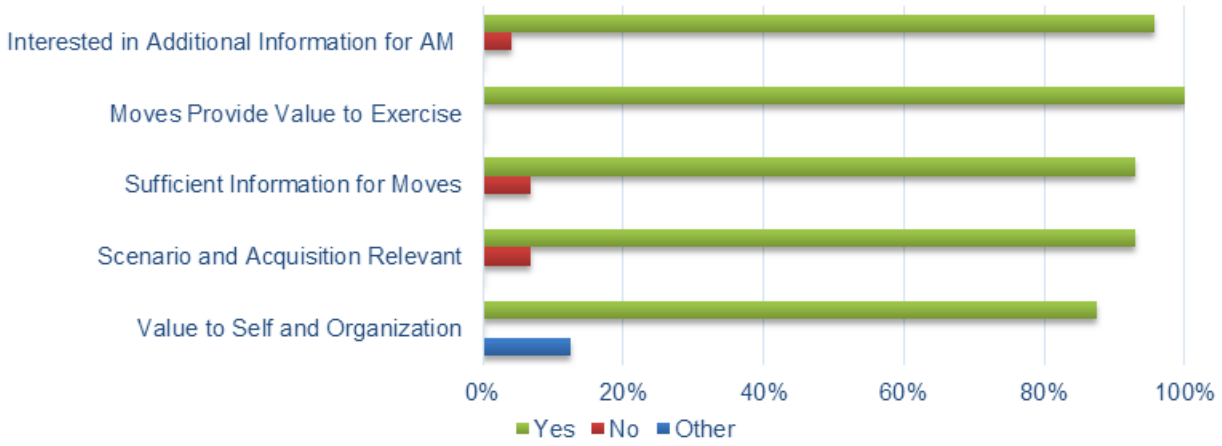
Team Net-Flix

- Solving the challenges to the model such as liability, warranty, and properly capturing data to categorize is critical.
- Metadata would help the model by affording AM manufacturers information about the creation of the part such as where and when, as well as which machine was used to produce the part.
- There are potential cost savings by eliminating non-value-added steps of the supply chain and automating other parts of the process.
- The “pay as you go” model allows adaptation to changing technology and is a better value for the government.

Survey Results

A survey was distributed to the 97 participants after the wargame, with a variety of questions to solicit feedback and help shape future wargames. Figure 4 shows the survey results.

Figure 4. Survey Results from the AM Wargame II



Analysis of Results

Commonalities

A review of the observations and findings from all four teams reveals common threads, despite the fact that the teams used different business models. Each of these findings will require examination and solutions as AM business models are developed for future implementation across the DoD community. Here are the most significant findings mentioned by the teams:

- Reexamine acquisition rules and the FAR. The incorporation of AM to manufacture parts for DoD systems is disruptive not only to the DoD supply chains but also to the commercial supply and manufacturing processes. Current acquisition and FAR guidelines need updating to take full advantage of AM capabilities.
- Institute a technology refresh and component improvement program. A model to capture or continue product and technology improvement post contract is required. AM hardware, materials, and software are advancing at a rapid rate, creating new and improved versions in relatively quick succession. Printers, powders, and the digital thread require frequent updates, and the model must consider how pricing, liabilities, warranties, and other aspects will be updated to keep pace with the technology.
- Furnish cost models. The teams were tasked with negotiating terms to support the use of a new capability, in an entirely new manner, using IP data transferred to a new user. The absence of pricing or cost models is a risky proposition for both the government and industry.
- Address manufacturing liability issues. Certification of the AM processes used is a key factor, but failure of a part could have a major impact not only on liability concerns but also on the OEM's reputation.
- Use AM to mitigate obsolescence. AM capability could be used to repair or produce otherwise obsolescent parts that no longer have a supplier. Modifications could be implemented much faster once the 3D data were updated and made available, as no changes were needed in the actual manufacturing equipment.

Wargame Recommendations

The change and opportunity that AM offers is very real and will require a business and operations paradigm shift. By noting the needs of all involved, the government and industry should experience a smoother transition. The following recommendations were compiled by all four teams:

- Continue the AM Business Model Wargames, preferably on an annual basis to be most effective.
- Keep the collaborative environment, which is much more productive than separate government and industry teams.
- Dive deep into cost and pricing, taking into account data rights.
- Afford additional time to work through the scenario.
- Set up a mock competition during which the government engages with industry (two teams).

- Structure Business Model Wargame III differently by conducting the phases over a few months.
- Use existing RFP and resources to design the next scenario.
- Enable more cross-government services coordination and sharing.
- Introduce variations of solving the problem to provide a richer body of knowledge.
- Focus future wargames on pre-contract award, as at least one team had difficulty attempting to negotiate the sustainment support after the production contract was awarded.

Future Focus Areas

The future focus areas of the AM planning group align to the gaps identified in developing the business models during the AM wargames. The planning group will organize wargames and working groups to develop solutions to these gaps that create improved sustainment opportunities for the warfighter. Ongoing and future actions include the following:

- The AM Business Model Legal Team is reviewing the contractual language in the DFARS to identify conflicts and recommend solutions to better incorporate the unique capabilities that AM possesses.
- An understanding of the needs and restrictions of both industry and government in such areas as security, technology certification, deliverables, workforce training, IP protections, and warfighter readiness should be established to develop a baseline platform from which gaps and solutions can be identified.
- Conduct AM Business Model Wargame III in May 2018 with an emphasis on developing possible solutions for identified gaps. Examples include
  - developing costing and pricing models involving the transfer of IP and
  - examining liability and warranty responsibilities.
- Use the wargame results toward the development of AM working groups, with recommendations to focus on the following:
  - Develop an AM contracting guide for DoD
  - Craft AM acquisition policy language
  - Determine how to secure data transmission for AM and the digital thread
  - Conduct an end-to-end “pathfinder” study to look at processes from contracting to delivery.

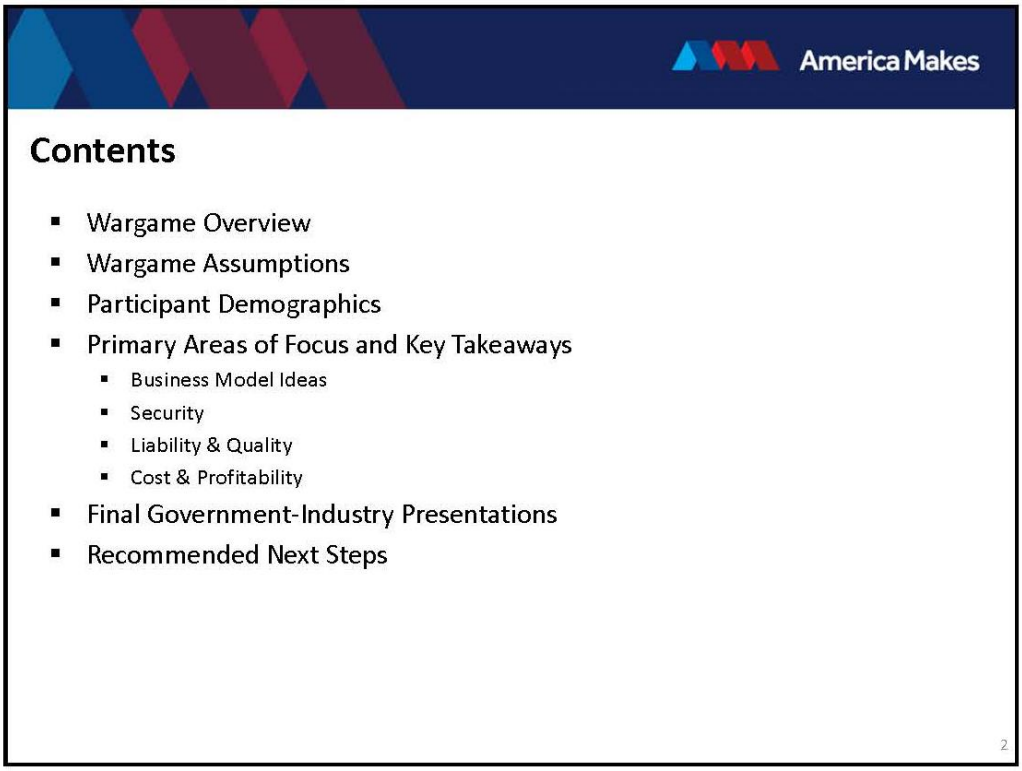
Conclusion

The AM Wargames revealed that within the realm of AM business models, there are myriad questions, new challenges, and great opportunities. Identifying and addressing these in a thoughtful manner and priority is vital to the successful implementation of AM within DoD. Government and industry need a better understanding of the AM business models. In addition, they must collaborate to develop a strategic plan that encompasses

an enterprise approach to the delivery of AM technologies, allowing for timely repair and a value stream for both government and industry.

> *Additive manufacturing has arrived. With continued growth expected over the next decade and beyond, the U.S. must embrace this new technology and seize momentum in guiding AM innovation to achieve national security objectives and global economic leadership.*
>
> Spring 2017 Industry Report
> Eisenhower School for National Security and Resource Strategy
> National Defense University
> Fort McNair

Appendix A. AM Wargame I Final Report



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Wargame Overview

Additive Manufacturing Wargame – The Simulation at a Glance

The intent of the wargame was to illuminate the required business transactions when the Department of Defense requires critical and non-critical parts to be additively manufactured at a DoD depot or at a 3rd party location in support of an immediate readiness goal. The wargame included assessing commercial gaps and challenges that may be discovered during this simulation in order to begin developing the necessary environment to support the continued adoption of Additive Manufacturing (AM) capabilities.

America Makes sponsored this strategic simulation (i.e., wargame) with the support of Deloitte Consulting LLP, the National Center for Manufacturing Sciences and Lockheed Martin Corporation to identify issues facing Government and Industry, potential courses of action, and solutions. The simulation brought together senior executives from both the DoD and Industry to gain a better understanding of respective goals with the objective of expanding the "intersection of interests" in order to deliver improved weapon system readiness and enhanced sustainment for the warfighter.

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Wargame Overview

Scope	Objectives
This event explored the commercial aspect of the transaction, communication, and government - industry relationship as participants worked through considerations such as tech data, IP, quality control, risk, cost, and pricing. The game included Five Moves, simulating a solicitation to draw out the issues. It concluded with government and industry participants teamed to develop a presentation of the top 3-5 key takeaways.	✓ Explore contract terms and conditions for a part that is 3D printed / additively manufactured by the government using industry intellectual property (IP) ✓ Explore industry business model gaps and challenges relating to AM adoption ✓ Begin to understand what an AM environment (ecosystem) looks like from a business perspective from both government and industry viewpoints

- Government (govt.) and industry (ind.) began to identify the "**what**" – What business model issues need to be addressed and what are the implications?
- Now government and industry need to identify the "**how**" –
  - How will government and industry take action to address the issues?
  - How to create an ecosystem supportive of the needs of government and industry?

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Wargame Assumptions

- Additive Manufacturing is the solution that will be used for the scenario
- The timeline is notional for the purposes of facilitating the conversation
- Sole source is allowed in this case according to FAR
- All technical hurdles are satisfied
  - Industry already has the file in STL format to be additively manufactured
  - The government has the technology to additively manufacture the parts
- The parts will not be produced in the US and shipped. They will be produced in-house, in-theater
- Continuous open communications are allowable in Q&A format

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Participant Demographics

40 Government Participants

35 Industry Participants

28 Government & 30 Industry Survey Responses:

17 Identify as "experienced" or "expert" in ***additive manufacturing***

48 have >10 years professional experience of which,

35 hold Master's Degrees

36 have >20 years experience

4 hold Doctorate Degrees

19 have >5 years in their current position

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Four Primary Areas of Focus and Key Takeaways

War game participants recognized that the status-quo of the government-industry ecosystem and business models need to change in order to successfully implement AM on a broad scale. The following areas of focus need to be further explored.

AM Ecosystem

- **Business Model Ideas:** Options presented for acquiring IP/Technical Data Packages (TDP): Performance-based printing, data licensing, leasing, and subscription model
- **Government – Industry Partnering:** Partnering is critical. There is no "silver bullet," and as technology matures the business models must evolve

Security

- **Risks to Business Viability:** Protection and use of IP/TDP presents long-term risks to business viability
- **IP/TDP Protection:** Govt. is willing to work with industry on measures to ensure protection of industry's IP/TDP and to prevent data theft or loss to outside parties
- **Define Transfer & Control of IP:** Terms surrounding transfer of IP and how it will be controlled must be clearly established and defined

Liability & Quality

- **Liability Shift:** Once the govt. receives the IP/TDP and additively manufactures the part, the liability shifts from industry to government, however brand reputation does not
- **Timeline:** Qualification and certification timing is a concern
- **FSRs:** Govt. and industry agree that having an approved field service rep (FSR) would be ideal, as FSRs would better enable security of the IP/TDP, oversee or perform part production on-site, convert the TDP, and provide QA
- **Brand & Reputation:** Industry concerned about brand/reputation and its impact on future revenue should the AM parts fail

Cost & Profitability

- **Revenue Stability & Predictability:** Stability and predictability are critical for industry to maintain cash flow, to control staffing levels, to plan operations, to establish physical footprint, etc.
- **Pricing Models:** Traditional pricing models are threatened by uncertainty in price and forecasting. How will pricing models change with a shift from traditional manufacturing to AM? Which suppliers will want and are able to adjust current operation and sales to participate?
- **Fair Price & Profitability:** Understanding by both parties that industry must be profitable and the government must receive a fair price

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AM Ecosystem | Security | Liability & Quality | Cost & Profitability

Business Model Ideas

Main Issues

- Business Model Ideas: Multiple options were presented for acquiring IP/TDP:
  - "Performance based printing"
  - Data licensing
  - Data leasing
  - Subscription model (e.g., Netflix, iTunes)

Potential Solutions

- Shift from a commodity provider to a software-as-service, subscription model
- Renting vs buying data – what is preferable? What helps the government meet requirements? Renting (short or long-term) was agreed to be right strategy for most cases; government challenge is figuring out how to rent data and still have the sustainment services necessary
- Mix of business models for providing both data and parts

Considerations

- Must plan the best approach for production location and strategy
- Economic impact of giving the government the potential to manufacture on-demand
- Redefining the supply chain – what is the impact to sub-tier suppliers?
- Trained personnel in AM – software acquisition and contracting are important in arriving at the appropriate AM arrangement
- Field Service Rep – close loop production
- Approved and certifiable fabrication facilities in the field
- Concern over capital equipment improvement over time
- Supply Chain Disruption: Disruption to the supply chain is a concern to industry—traditional manufacturing needs to be maintained
- Data compatibility: Build files can be used but are both machine- and material-specific. STL files offer more flexibility but are more expensive

Recommendations

- Determine the implications/impact of AM on Performance Based Logistics (PBL). When is it appropriate to use AM in a PBL contract, and when is it appropriate for a traditional manufacturing/maintenance/supply PBL contract?
- Consider block chain, a distributed database hardened against theft, for securing/recording date/time use of IP/Tech data and the identity of the user – provides reasonable assurance only authorized users can access IP/Tech data, and within the contracted timeframe
- Plan and develop a mature universally compatible digital thread that includes business models, legal models, cost variables, and qualification activities so AM can be broadly deployed vs. "pockets" of AM capability
- Through a continuing series of wargames, explore each potential business model/contract type to determine suitability for each known circumstance (including original new build of future products and sustainment/part replacement builds of fielded products)

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Government-Industry Partnering

Main Issues

- Partnering is critical
- As technology matures new business models must evolve
- Together govt. and industry need to figure out how to move to digital manufacturing/digital supply chain meeting needs of both parties
- How do we break paradigm of printing a part within hours/days without requiring weeks/months to negotiate a contract/agreement?

Considerations

- Contract type must be mutually agreeable and support the AM business model; industry prefers a firm fixed price (FFP), with a per part TDP usage and maintenance fee
- Understand govt.'s post-processing intentions and capabilities (IP)
- "Open books" concept – govt. prefers to have actual cost data to execute should-cost analysis for sustainment strategy, including an AM arrangement. Is this agreeable?
- The Federal acquisition process needs to evolve to be more responsive to govt. needs
- Industry may have to move from being a commodity provider, to a software-as-a-service provider, or hybrid model

Potential Solutions

- Hold a public/private working group meeting to continue developing and agreeing upon work products for shared data/common standards and longer term contracts for future AM situations
- Future standards for certification provided via the International Standards Office (ISO)

Recommendations

- Explore various ways govt. and industry can adopt digital solutions, potentially improving responsiveness and government weapon system readiness while keeping industry in business
- Explore how the govt. acquisition process can evolve to be more agile and AM friendly
  - Consider commercial best-practices for contracting, while complying with Federal Acquisition Regulation
  - Determine needed FAR revisions
- Continue support for public/private common data standards

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IP Protection & Control

Main Issues

- Industry has serious concerns over the govt.'s ability to protect its IP and technical data (data theft, loss, or accidental distribution, cyber attacks, hacking, etc.)
- Industry is concerned about losing control of its IP once it transfers the IP to the government
- The process of transferring the IP and technical data was left unresolved in this wargame. For purposes of the wargame, it was assumed that the government and industry had a mature process

Considerations

- How will govt. ensure that industry's IP and technical data will not be lost, stolen, or otherwise mishandled?
- How will the transfer actually take place?
- Who will have access to the IP and technical data once it is transferred to the government?
  - Will any 3rd parties have access?
  - Will government modify or change the existing technical data?
  - Can gov't transfer the IP amongst gov't agencies?

Potential Solutions

- Government and industry work together to define detailed standard operating procedures (SOPs) and system to safeguard the IP/TDP
- Government and industry expressed a willingness to do this as it was in the best interest of both parties
- Government providing encryption technology at contractor site, and moving it to the field
- Identify TDP with "shelf life" that is limited by the end user

Recommendations

- Government and industry SMEs in security, technology, contracting, and policy must collaborate on how industry can have reasonable assurance and auditable verification government will adhere to applicable IP laws and licenses/contracts
- With operational readiness and troop safety as considerations, parties should agree to terms prior to an urgent need
- Involve General Services Administration (GSA) in wargames and discussions
- Conduct a separate wargame on the processes and systems needed to securely handle the transfer of the IP (government and industry agree this subject could be its own wargame due to complexity)

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AM Ecosystem | Security | Liability & Quality | Cost & Profitability

Risks to Business Viability

Main Issue

- Industry stated that improper protection and misuse of IP/TDP presents long-term risks to business viability

Considerations

- If a breach of data occurs, will industry's underlying IP for multiple products be impacted?
- How do government and industry work together to mitigate the long-term risks to business viability?
- How and where will information be stored, distributed and protected?

Potential Solution

- Industry and government partner to secure files using controlled databases and transfer mechanisms
- Expand wargame to include IT and cyber experts to explore those types of questions along with the IP type questions

Recommendations

- Industry should clearly define where and how their business is impacted to drive discussion with govt. counterparts
  - Organize industry working groups to establish universal considerations and concerns
- Define and document within the contracts/licenses a mutually agreeable point at which the risk and legal liability transfers from industry to government as data packages transfer from one party to another

11

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AM Ecosystem | Security | Liability & Quality | Cost & Profitability

Liability Shift

Main Issues

- Once the government receives the IP/TDP and additively manufactures the part, does the liability shift from industry to government?

Considerations

- Government production in theater opens the possibility of inconsistency due to the varying external environments, and other local on-site variables
- IP/TDP is only one aspect of production - varying machine types and production environments impact part performance, quality, reliability, timing, and brand
- Industry has no insight into quality assurance/quality conformance (QA/QC) processes used in theater
- No contracting mechanisms exist today to mitigate liability issue of a failing part fabricated in field

Potential Solutions

- Standardize contracting language to prevent questions on liability and ownership
- Position field-level technicians familiar with AM technology and associated certification methods to be used in-field
- Develop a production certification – accepted by manufacturers and endorsed by government

Recommendations

- Conduct research surrounding mitigation strategies by government and industry experts, including contracting structures and field representatives; research should include:
  - Cost considerations of additional personnel in field
  - Contracting structures reasonably insulating industry from risk and promoting quality

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AM Ecosystem | Security | Liability & Quality | Cost & Profitability

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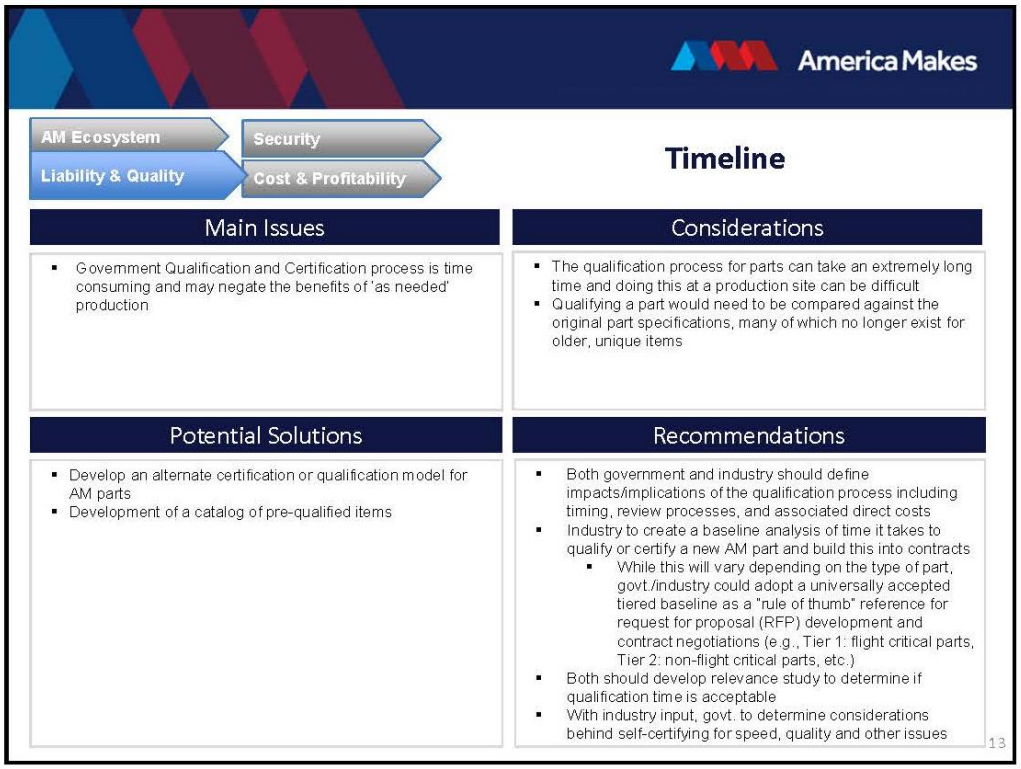
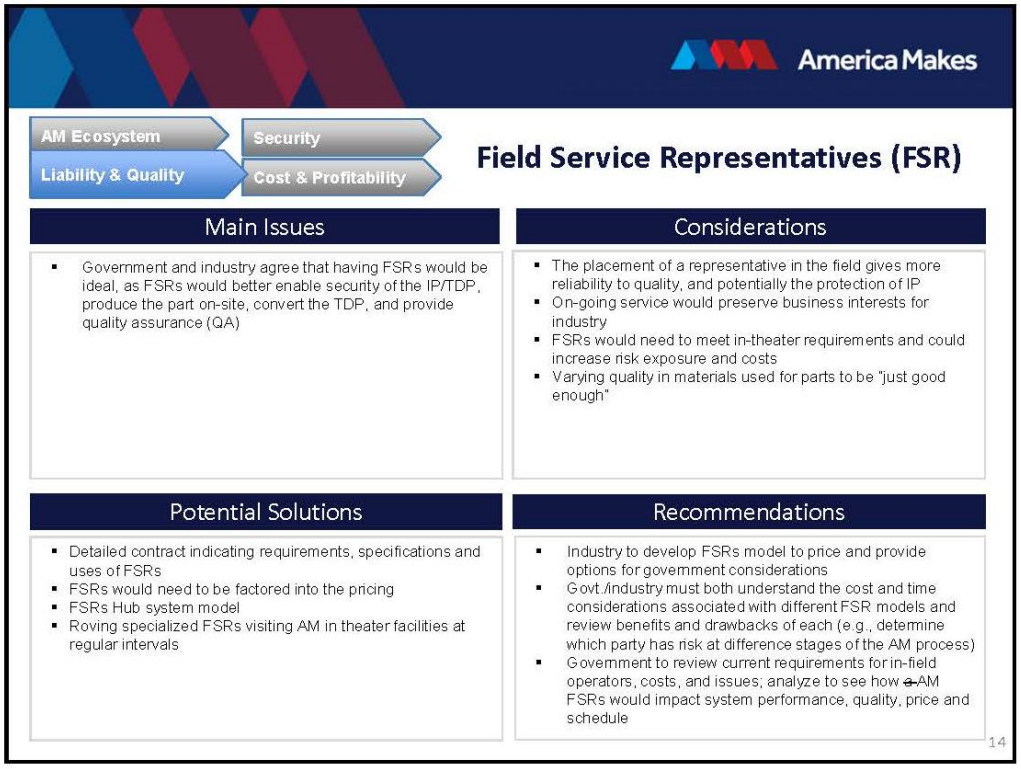

America Makes
AM Ecosystem
Security
Liability & Quality
Cost & Profitability
Timeline
Main Issues
Government Qualification and Certification process is time consuming and may negate the benefits of 'as needed' production
Considerations
The qualification process for parts can take an extremely long time and doing this at a production site can be difficult
Qualifying a part would need to be compared against the original part specifications, many of which no longer exist for older, unique items
Potential Solutions
Develop an alternate certification or qualification model for AM parts
Development of a catalog of pre-qualified items
Recommendations
Both government and industry should define impacts/implications of the qualification process including timing, review processes, and associated direct costs
Industry to create a baseline analysis of time it takes to qualify or certify a new AM part and build this into contracts
While this will vary depending on the type of part, govt./industry could adopt a universally accepted tiered baseline as a "rule of thumb" reference for request for proposal (RFP) development and contract negotiations (e.g., Tier 1: flight critical parts, Tier 2: non-flight critical parts, etc.)
Both should develop relevance study to determine if qualification time is acceptable
With industry input, govt. to determine considerations behind self-certifying for speed, quality and other issues
13


America Makes
AM Ecosystem
Security
Liability & Quality
Cost & Profitability
Field Service Representatives (FSR)
Main Issues
Government and industry agree that having FSRs would be ideal, as FSRs would better enable security of the IP/TDP, produce the part on-site, convert the TDP, and provide quality assurance (QA)
Considerations
The placement of a representative in the field gives more reliability to quality, and potentially the protection of IP
On-going service would preserve business interests for industry
FSRs would need to meet in-theater requirements and could increase risk exposure and costs
Varying quality in materials used for parts to be "just good enough"
Potential Solutions
Detailed contract indicating requirements, specifications and uses of FSRs
FSRs would need to be factored into the pricing
FSRs Hub system model
Roving specialized FSRs visiting AM in theater facilities at regular intervals
Recommendations
Industry to develop FSRs model to price and provide options for government considerations
Govt./industry must both understand the cost and time considerations associated with different FSR models and review benefits and drawbacks of each (e.g., determine which party has risk at difference stages of the AM process)
Government to review current requirements for in-field operators, costs, and issues; analyze to see how ~~a~~ AM FSRs would impact system performance, quality, price and schedule
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America Makes
AM Ecosystem
Security
Liability & Quality
Cost & Profitability
Brand and Reputation
Main Issue
Industry concerned about brand/reputation and it's impact on future revenue should the AM parts fail
Considerations
When industry loses control of production, the brand can be misrepresented by poor 3rd party or government production
For industry, this is a change and move to IP sales rather than part production/sales possibly reducing confidence in customers/government and therefore sales, since the company's brand is tied to traditional manufacturing
How will industry manage security issues specific to government IP sales?
Potential Solutions
Solicitation must clearly spell out the limitations of risk to the OEM and how the TDP will be used (one-time, multi, indefinite)
Develop brand preserving method for clearly identifying parts as govt. manufactured from a particular company's design or AM specific design
Recommendations
Industry to quantify full cost of brand in AM to understand it as a core business aspect
Determine and review short-term and long-term universal brand considerations
Government should clearly identify parts as government produced along with developing the option to conceal brand for industry or standardized remediation process in the event of failed production and potential brand loss (this would likely require FAR revisions)
As a pilot program, industry could consider developing a separate brand for select AM items to determine brand impact
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America Makes
AM Ecosystem
Security
Liability & Quality
Cost & Profitability
Revenue Stability and Predictability
Main Issues
Primary concern of industry is revenue loss from AM vs. traditional manufacturing
Stability and predictability are critical to industry to maintain affordable rates, maintain cash flow, control staffing levels, plan operations, and establish physical footprint, etc.
Considerations
Development of pricing models with industry to help the business plan revenue streams
Which contract types provide industry with sufficient revenue, while protecting govt.'s interests with pricing, value, and technical acceptability?
Potential Solutions
Perform frequent periodic forecasts using historical data for urgent or customized parts that may require AM
Based on a revised pricing model, industry must evaluate operational efficiencies and supply chain, along with minimizing costs to maximize profit
Government to offer multi-year contracts with option years so pricing and business models can be reviewed and adjusted at regular intervals as needed
Recommendations
Government needs to analyze items that are the most likely candidates for AM, estimate demand forecast, and publish a~~n~~ Request for Information (RFI) to begin pricing efforts
Industry, as soon as possible, must determine what revenue/profit losses and changes in business model are sustainable for AM to mature
Government and industry should partner to more quickly resolve any differences in demand and supply forecasts and to determine how to align operational models with business models
Consider a war game piloting parts from existing inventory with actual financials;
Confidentiality would clearly be a concern for this option, but has the potential to yield invaluable information regarding business models
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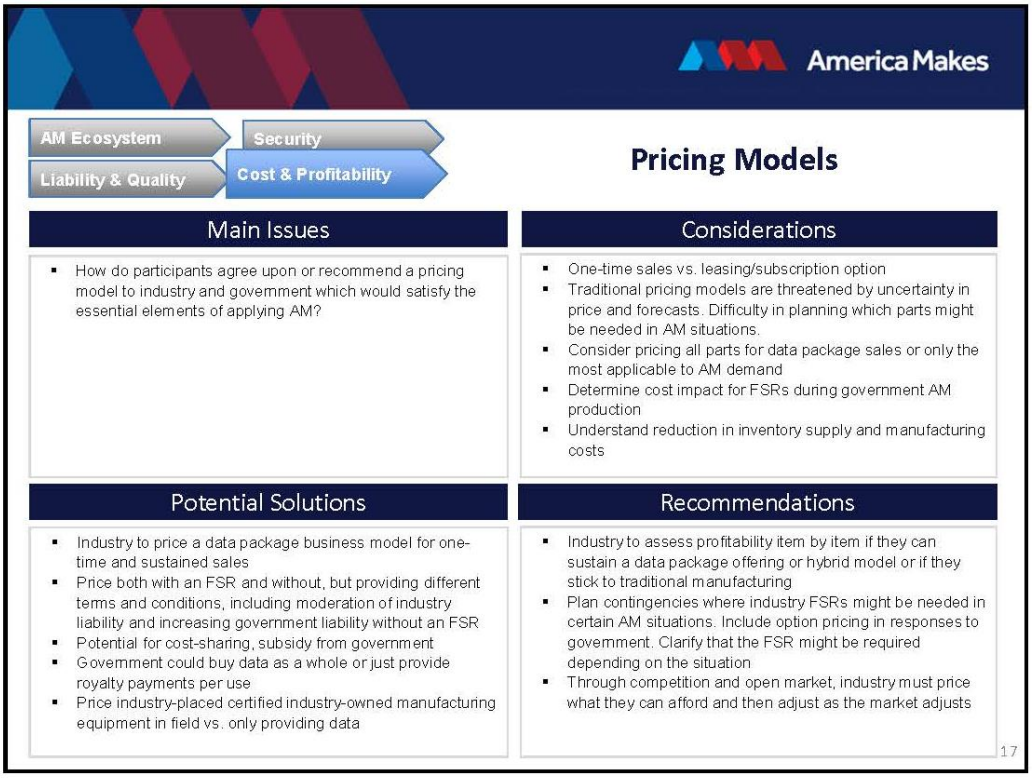
America Makes
AM Ecosystem
Security
Liability & Quality
Cost & Profitability
Pricing Models
Main Issues
How do participants agree upon or recommend a pricing model to industry and government which would satisfy the essential elements of applying AM?
Considerations
One-time sales vs. leasing/subscription option
Traditional pricing models are threatened by uncertainty in price and forecasts. Difficulty in planning which parts might be needed in AM situations.
Consider pricing all parts for data package sales or only the most applicable to AM demand
Determine cost impact for FSRs during government AM production
Understand reduction in inventory supply and manufacturing costs
Potential Solutions
Industry to price a data package business model for one-time and sustained sales
Price both with an FSR and without, but providing different terms and conditions, including moderation of industry liability and increasing government liability without an FSR
Potential for cost-sharing, subsidy from government
Government could buy data as a whole or just provide royalty payments per use
Price industry-placed certified industry-owned manufacturing equipment in field vs. only providing data
Recommendations
Industry to assess profitability item by item if they can sustain a data package offering or hybrid model or if they stick to traditional manufacturing
Plan contingencies where industry FSRs might be needed in certain AM situations. Include option pricing in responses to government. Clarify that the FSR might be required depending on the situation
Through competition and open market, industry must price what they can afford and then adjust as the market adjusts
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America Makes
AM Ecosystem
Security
Liability & Quality
Cost & Profitability
Fair Price and Profitability
Main Issues
Understanding by both parties that industry must be profitable and government must receive a fair price
Pricing to recover true cost of part and desired profit over time for the following: one-time data package vs. multi-use data packages for AM parts
Considerations
Industry needs to be compensated for their products to stay in business
Government needs to pay fair pricing to support quick-turn operations
Both pricing and government requirements must be balanced to realize the advantages of this new technology
Potential Solutions
Through competition and govt./industry partnership, find a fair price including subsidy for R&D that benefits both parties for parts most applicable to AM
Recommendations
Explore potential flexibility in pricing models and contract types during an existing contract AM demands and technology changes (e.g., demand and technology have the potential to change rapidly within a single option year)
Establish regularly schedule govt./industry meetings (e.g., quarterly) and leverage industry AM associations to form strategic universally accepted policy and guidelines to advance the technology and business processes
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Final Government-Industry Presentations

During the final move of the game (Move 5), government and industry teamed to develop their top 3-5 takeaways and lessons learned. The three government and industry presentations revealed that there were commonalities across all government-industry paired teams. Each set of teams also had slightly different experiences highlighting how organizations can approach the same scenario in different ways, experience different challenges, and have varying prioritization of issues. The table below depicts, at a high level, the commonalities and differences across the three government-industry teams and the entity that raised the issue.

	Government	Industry
COMMONALITIES	▪ Wanted to share quality liability through FSR or 24-hour support ▪ Built case based on some faulty assumptions about industry models ▪ Need additional learning sessions to understand industry's model for AM	▪ Believed long-term relationships for quality preserve long term revenue ▪ Built case based on some faulty assumptions about government abilities/needs ▪ Identified a need to advance AM within government contracting circles
DIFFERENCES	▪ Wanted "Open Books"—actual cost data to understand lifecycle costs ▪ Wanted STL file to move across production platforms ▪ Preferred to work within current business and contracting models	▪ Determined that production costs for AM dismiss significance of related overhead costs ▪ Believed it was important to limit production of parts to certain conditions (for quality) ▪ Desired annual sustainment charges or long-term relationships critical for AM

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Recommended Next Steps

- Gauge participant interest/availability for follow-on activity (i.e., identifying "how" to address the issues identified herein)
- Discuss and agree to the top 3-5 issues for follow-on exploratory activities (e.g., wargames, working groups, etc.)
- Establish an AM Working Group charter
- Brief at America Makes program review in September 2016

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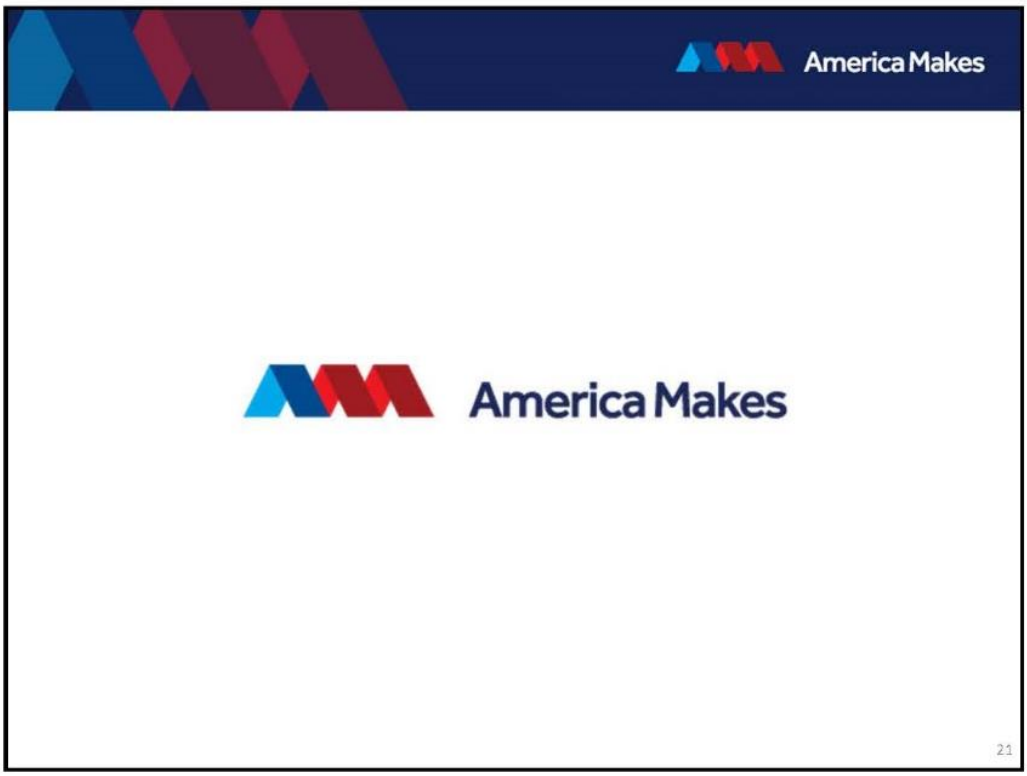
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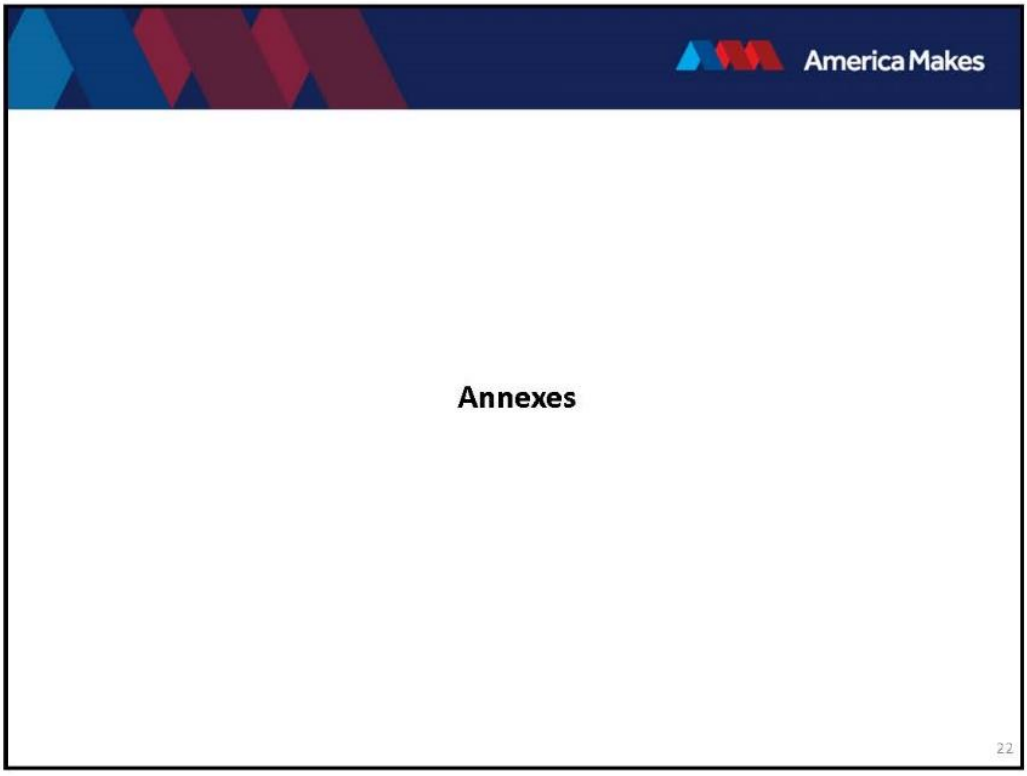
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Annexes
22

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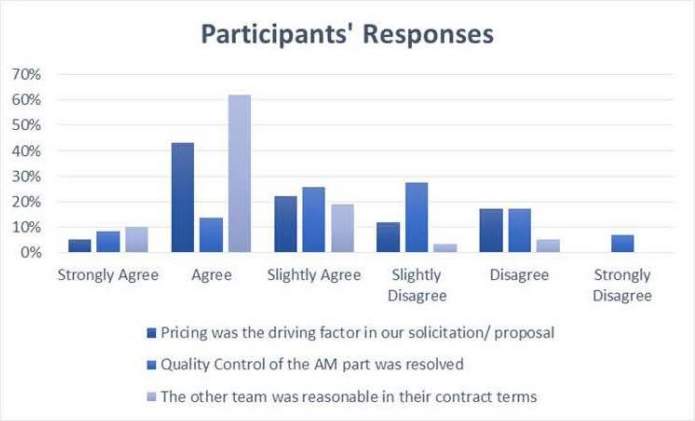
Survey Results



- Pricing was *the* driving factor in the business transaction
- QC of the AM part was NOT resolved
- Over 70% believed the other team was reasonable

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Survey Results

The AM Top 10 Outstanding Issues*

Rank	Issue	%
1	Business Model	15.6%
2	IP	11.8%
3	Contracting Vehicles/agility/speed/Ts & Cs	10.8%
4	Warranty/Liability	10.2%
5	Quality - QC/QA/Technical requirements/Qualification/Certification	9.7%
6,7,8 (tie)	Need for collaboration	5.4%
6,7,8 (tie)	Pricing	5.4%
6,7,8 (tie)	TDP	5.4%
9	Process/Training	4.8%
10	Leasing/Subscription - How this data will be shared, used and refreshed	3.8%

"May require a business model adjustment to engineering/software provider vs. manufacturer"

"OEMs need to have engineering agility to handle AM requests"

"There is a need for collaboration – a balance of profit and readiness"

OPEN RESPONSES

"FAR and contract language revisions are necessary to support AM"

"There is still a lack of understanding of AM capabilities and constraints"

"Would like to explore subscription options in the future"

*Based on open response survey questions

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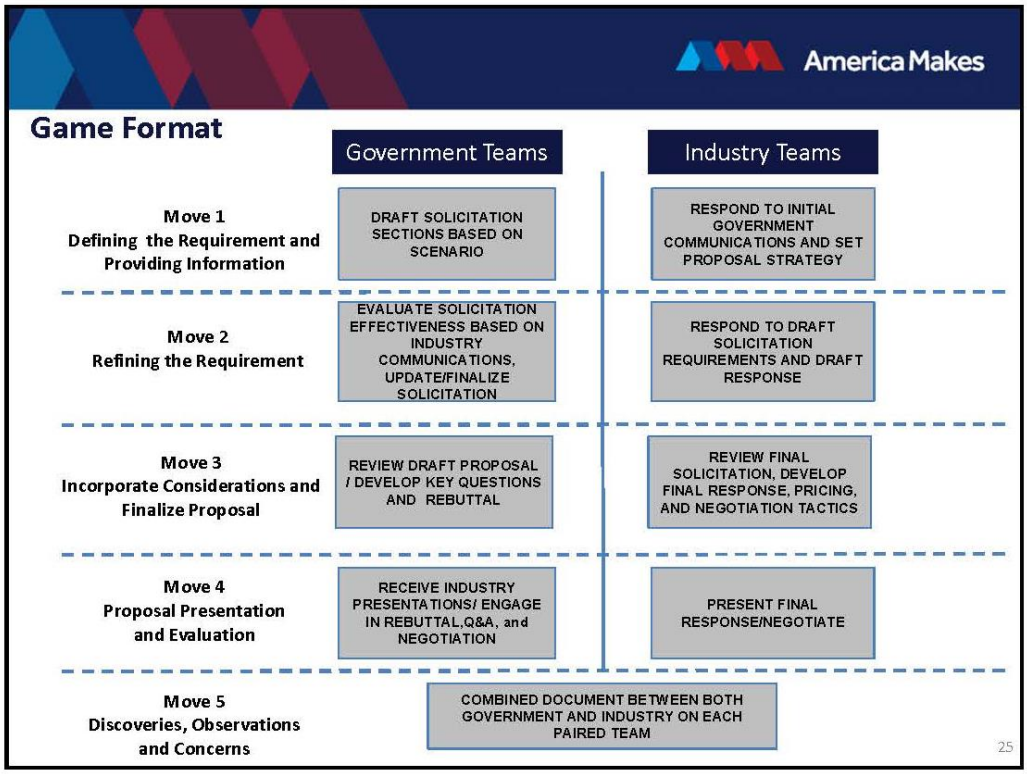
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Game Format
Government Teams
Industry Teams
Move 1
Defining the Requirement and Providing Information
DRAFT SOLICITATION SECTIONS BASED ON SCENARIO
RESPOND TO INITIAL GOVERNMENT COMMUNICATIONS AND SET PROPOSAL STRATEGY
Move 2
Refining the Requirement
EVALUATE SOLICITATION EFFECTIVENESS BASED ON INDUSTRY COMMUNICATIONS, UPDATE/FINALIZE SOLICITATION
RESPOND TO DRAFT SOLICITATION REQUIREMENTS AND DRAFT RESPONSE
Move 3
Incorporate Considerations and Finalize Proposal
REVIEW DRAFT PROPOSAL / DEVELOP KEY QUESTIONS AND REBUTTAL
REVIEW FINAL SOLICITATION, DEVELOP FINAL RESPONSE, PRICING, AND NEGOTIATION TACTICS
Move 4
Proposal Presentation and Evaluation
RECEIVE INDUSTRY PRESENTATIONS/ ENGAGE IN REBUTTAL,Q&A, and NEGOTIATION
PRESENT FINAL RESPONSE/NEGOTIATE
Move 5
Discoveries, Observations and Concerns
COMBINED DOCUMENT BETWEEN BOTH GOVERNMENT AND INDUSTRY ON EACH PAIRED TEAM
25


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Artifacts
Discoveries, Observations and Concerns
Team 1
Team 2
Team 3
Top Issues
Top Issues
26

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Government/Industry Team 1

Business Transaction Discoveries, Observations, and Concerns

10 May 2016

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Discoveries, Concerns, Observations

Government

- "Open books" concept – Government would like **actual cost data** to execute should-cost analysis for sustainment strategy, including an AM arrangement.
- Data access and security – does data travel through secure channels or reside on the machine? What about a **data insecure or data denied environment?**
- **Trained personnel in AM** – software acquisition and contracting are important for coming to the right AM arrangement.

Industry

- **Contract type** must be mutually agreeable and support the AM business model. Industry prefers a FFP, with a per part TDP usage and maintenance fee.
- Understand Government's **post-processing** intentions and capabilities
- Shifting from a commodity provider to a **software-as-service**, subscription model.
- Although per part price is greater (for one part) for AM, the overall cost to the Government in the **bigger picture is more beneficial** to Government, including:
  - ability to print part on demand
  - no inventory costs
  - no transportation costs
  - increased readiness and availability

Mutual

- **Level of support vs risk mitigation** (how do you determine what level of support you need to execute quality price with palatable risk
- **Shared assumptions** are needed to execute mutually agreeable arrangement
  - Translating designs from obsolete parts (or aging parts) and obtaining the proper ESA certifications in a challenge that must be properly understood by Government

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Government/Industry Team 2

Business Transaction Discoveries, Observations, and Concerns

10 May 2016

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Discoveries, Concerns, Observations

Government

- Pricing Considerations - moving from parts to data procurement
  - Short vs. Long Term – "just good enough" vs. fully operational part
  - CLIN for AM parts
- Cost Benefit Analysis necessary to understand what cost is reasonable
- Planning best approach for production location and strategy

Industry

- Concern about the ability of the person/machine printing
- Varying quality/variety in materials in part to be "just good enough"
- Field Service Rep – close loop production
- Data Spillage risk
- Technology refresh rate (Subscription)
- Difficult for industry to price longer term offering - Decisions need to be made how to spread NRE cost
- Mix of business model in providing both data and parts

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Discoveries, Concerns, Observations

Mutual

- Public/Private Partnership possibility to mutually agree on shared data/common standards and longer term contracts for future AM situations
- Technology isn't always better/faster/cheaper. Needs to be looked at for specific items
- Future Standards for Certification (ISO)
- Economic impact of giving the government the potential to manufacture on demand
- Limited post-processing/production/QA

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Government/Industry Team #3

Business Transaction Discoveries, Observations, and Concerns

10 May 2016

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Discoveries, Concerns, Observations

Government

- Government and Industry will need to partner
- Gov't needs to figure out how to encourage / drive industry to move to digital manufacturing / digital supply chain and industry responsiveness.
- May need to redefine Performance Based Logistics.
- How do we break paradigm of printing a part within hours/days and requiring weeks/months to negotiate a contract/agreement?
- Allocation of IP rights in TDP is still a concern.
- How do we incorporate Just In Time delivery?

- >> Reliable/known revenue stream

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Discoveries, Concerns, Observations

Industry

- AM is a bridge/hybrid manufacturing method (today)
- Protection/use of IP is a significant concern
- Stability and Predictability are critical
- Redefining the supply chain (sub-tier suppliers)
- Definition of deliverables (TDP + FSR)
- Where the warranty resides with AM
- Feedback

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Discoveries, Concerns, Observations

Mutual

- Create a mutually beneficial set of business model
  - There is no silver bullet model
  - Model(s) will change over time as tech matures
- Contracting as we understand it today has to change.
- Concern over capital equipment improvement over time
- Revenue stream
- Common understanding of requirements

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Weekly AM Working Group Call
"Top AM Issues" Discussion

June 30, 2016

America Makes

Contents

- Common Denominators
- Summary of Biggest Challenges
- Discussion: AM Working Group "Top Issues"
  - Development of AM Business Model
  - Intellectual Property (IP)/Legal/Security Aspects of AM
  - Contract Terms and Conditions/Contract Vehicles for AM
  - Industry's Warranty and Liability
  - Quality and Regulation Standardization

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Additive Manufacturing (AM) War Game

Common Denominators

Issues Affecting Industry and Government with the Emergence of AM

1) Business Model
2) Intellectual Property (IP)/Legal Aspects/Security
3) Terms & Conditions (Ts & Cs)/Contracting Vehicles
4) Warranty/Liability
5) Quality: Control (QC)/Assurance (QA)/Technical Requirements, Qualification & Certification
6) Need for Collaboration/Partnerships
7) Pricing/Value – "Rent vs. Buy", Variable pricing depending on demand
8) Technical Data Package (TDP)
9) Process/Training

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Additive Manufacturing War Game

Potential Showstoppers if not Addressed

Issues that must be solved to make AM successful

- IP and Legal
  - Uncertainty on who owns the IP and when transfer occurs. There needs to be an accepted framework to avoid delays and accommodate both "one-time emergency" fabrication and "permanent transfer" of IP
  - Risks posed by IP issues impede the quick adoption across the military
- Qualification and Certification
  - Parts must be safe to use and government and industry need to ensure specifications
  - Development of a "digital thread" including Technical Data Package (TDP) to create consistency and standards for AM applicable parts
- Warranty and Liability
  - Identify what liability and warranty for production is shared or transferred with IP
- Federal Acquisitions Regulation (FAR)
  - The FAR is not adapted for AM which slows the acquisition process and needs to be adjusted for long-term viability
- Cyber Security
  - TDP sharing needs to be secured to prevent tampering and protect industry from unauthorized disclosures

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Working Group "Top Issues" Input

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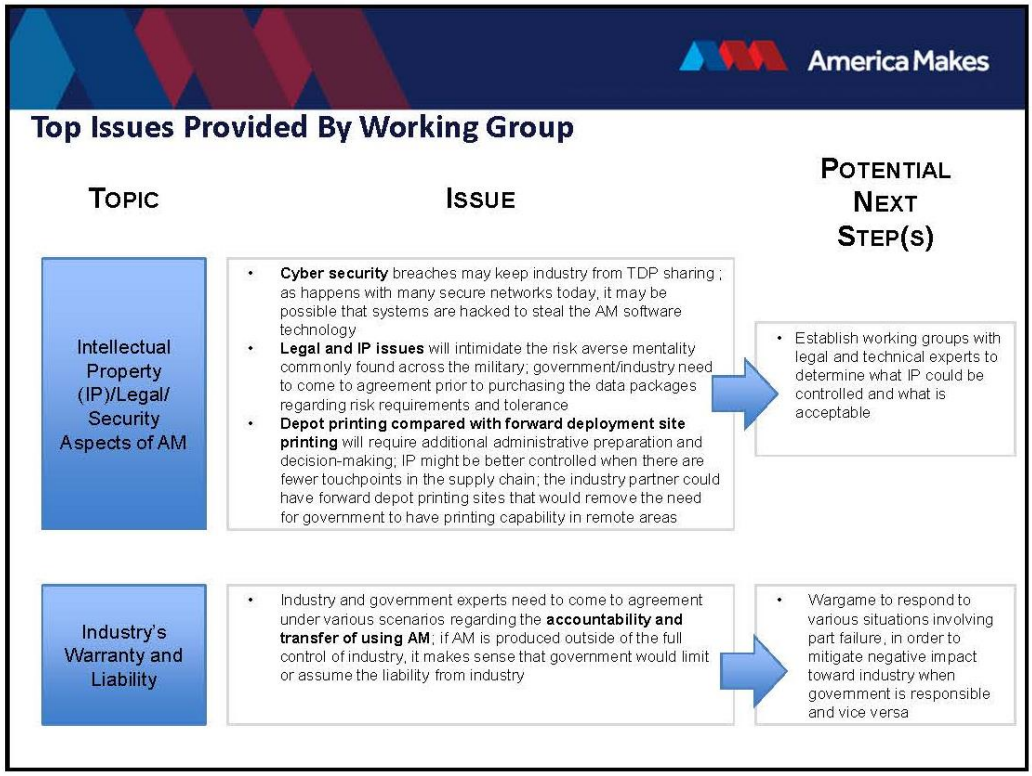
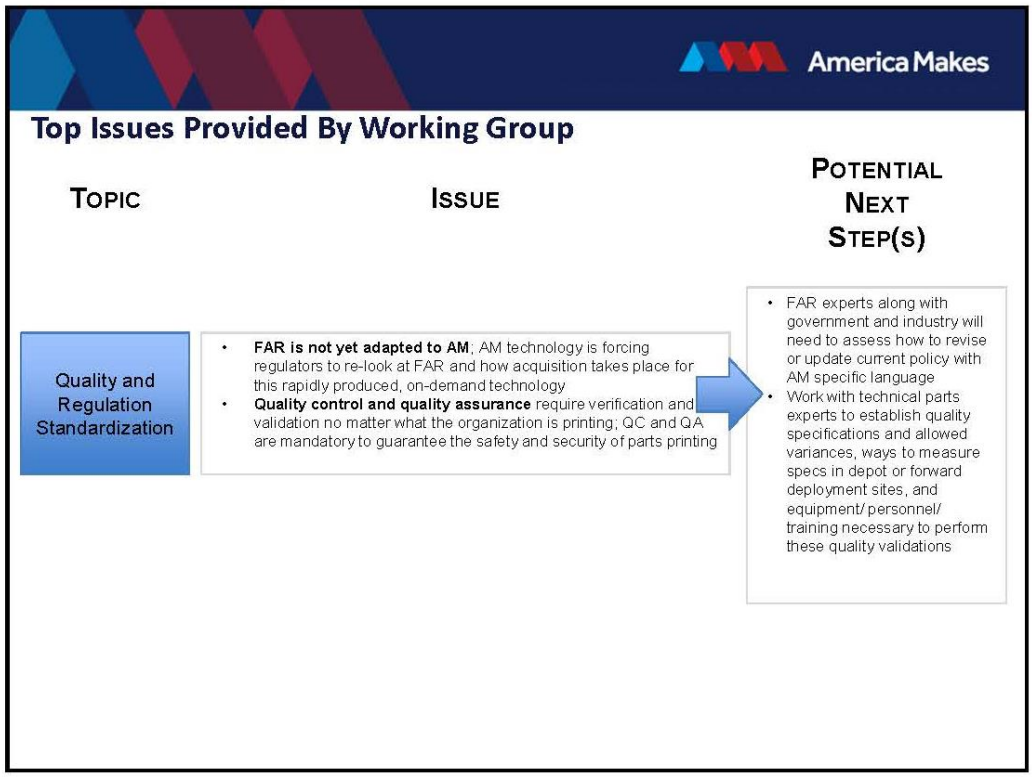
Top Issues Provided By Working Group

TOPIC	ISSUE	POTENTIAL NEXT STEP(S)
Development of the AM Business Model	• **Workforce issues** hampering the DoD from employing AM; current or new workforce must be trained in AM technology • **Evaluate CONUS/Depot remote printing scenario vs. direct printing** at the deployment site; consider operational availability, cost, and supply chain engagement as equally valued while using AM in indirect application for rapid tooling is part of the solution set • **Resources needed and supply chain support** including training for enabling direct printing at the forward deployment site; Does forward deployment site printing save time and cost vs. setting up depot sites with more capability, but slightly slower response time? • **Industry and government partnering**; How to do it, who participates, what is the desired outcome?	• A war game would be an appropriate next step followed by a working group or groups. There is a natural path for the latter (working with) America Makes • Suggested work groups and wargame to follow to review the topics of forward deployment vs. regional depots, field service representatives use, and pricing associated
Contract Terms and Conditions/ Contract Vehicles for AM	• Pricing related to Manufacturing Readiness Level and Technology Readiness Level maturation; Pricing – MRL and TRL might only slow the types and numbers of parts that can be produced, but wouldn't necessarily affect pricing • Rent vs. Buy; pricing must be established by industry for various offerings	• Through partnering between industry and government, pricing could be established for various contracting scenarios. Partnering might provide subsidized possibilities


America Makes
Top Issues Provided By Working Group
TOPIC
ISSUE
POTENTIAL NEXT STEP(S)
Intellectual Property (IP)/Legal/ Security Aspects of AM
• Cyber security breaches may keep industry from TDP sharing ; as happens with many secure networks today, it may be possible that systems are hacked to steal the AM software technology
• Legal and IP issues will intimidate the risk averse mentality commonly found across the military; government/industry need to come to agreement prior to purchasing the data packages regarding risk requirements and tolerance
• Depot printing compared with forward deployment site printing will require additional administrative preparation and decision-making; IP might be better controlled when there are fewer touchpoints in the supply chain; the industry partner could have forward depot printing sites that would remove the need for government to have printing capability in remote areas
• Establish working groups with legal and technical experts to determine what IP could be controlled and what is acceptable
Industry's Warranty and Liability
• Industry and government experts need to come to agreement under various scenarios regarding the accountability and transfer of using AM; if AM is produced outside of the full control of industry, it makes sense that government would limit or assume the liability from industry
• Wargame to respond to various situations involving part failure, in order to mitigate negative impact toward industry when government is responsible and vice versa


America Makes
Top Issues Provided By Working Group
TOPIC
ISSUE
POTENTIAL NEXT STEP(S)
Quality and Regulation Standardization
• FAR is not yet adapted to AM; AM technology is forcing regulators to re-look at FAR and how acquisition takes place for this rapidly produced, on-demand technology
• Quality control and quality assurance require verification and validation no matter what the organization is printing; QC and QA are mandatory to guarantee the safety and security of parts printing
• FAR experts along with government and industry will need to assess how to revise or update current policy with AM specific language
• Work with technical parts experts to establish quality specifications and allowed variances, ways to measure specs in depot or forward deployment sites, and equipment/ personnel/ training necessary to perform these quality validations

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- ❑ Agreement on #1 (#2?, #3?) top issue(s) to address?
- ❑ Agreement on venue format (e.g., war game, sub-working group think tank, etc.)?

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NCMS

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Appendix B. AM Wargame II Scenario

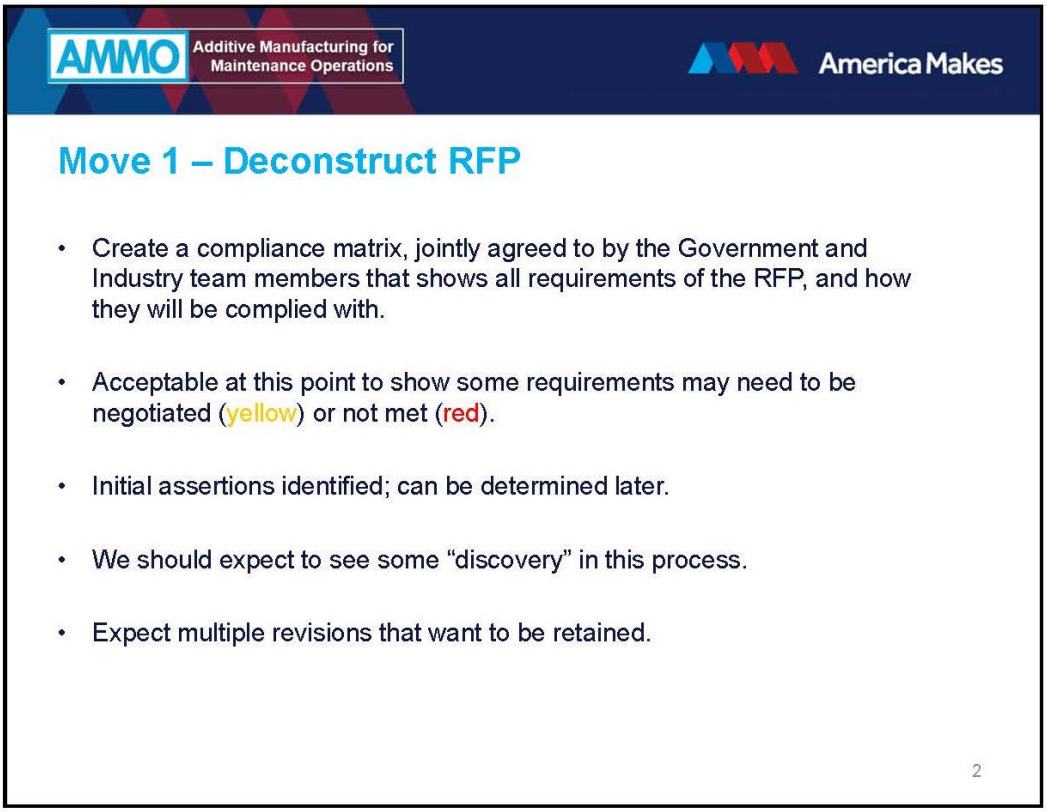
2017 Additive Manufacturing Business Model Wargame II Scenario

The Department of Defense (DoD) issued a request for proposal (RFP) to develop and acquire a reconnaissance light-weight (RLW) drone capable of being deployed by a two-person team in austere environments. The timeline defined by DoD is aggressive. DoD requires the awardee to produce a prototype within six months and the first production unit within a year after contract award. Most of the performance capabilities required by DoD can be performed by commercially available systems, but some of the reconnaissance features will have to be developed jointly by the Government/Industry team and some of the capabilities will be provided by the Government team, which cannot share the base technology with the drone manufacturer.

After a thorough evaluation of proposals, the DoD selected ACME, Inc., an original equipment manufacturer (OEM), as the drone manufacturer and awarded a contract to deliver 1000 RLW drones. The contract specifies that the first prototype will be delivered within six months after contract award and will be used as technical demonstration evaluation, qualification, and certification for production acceptance. Test and evaluation will be performed jointly with the DoD at a Patuxent River Test Center. The contract also stipulates that initial sustainment will be performed by ACME for the three years in which they are delivering RLW drones to DoD; both at their commercial facility for depot level maintenance and at selected field locations around the world, including shipboard. After ACME has delivered its 1000th RLW, DoD will be providing organic sustainment; including additively manufacturing configuration items originally produced that way by ACME under contract, which is a significant portion of the RLW parts. In fact, all the parts identified as potential sustainment items required for 6-month deployments of the RLW are required to be Additive Manufacturing (AM) parts by contract. This will give DoD the ability to self-sustain operations in locations where reach-back logistics chains may not be available.

Because of the aggressive timelines and AM requirements stipulated in the RFP and ensuing contract, ACME will base the RLW drone configuration largely off a commercially available design, which has recently received Federal Aviation Administration approval for supporting news reporting, and police operations over population centers. This means that ACME owns the intellectual property (IP) for most of the vehicle components. The configuration items that require joint development by DoD and ACME, namely the parts necessary to integrate the DoD reconnaissance technology to the air vehicle, will be owned by the DoD with unlimited data rights. As mentioned in the RFP, ACME will only be provided as much information regarding the Government owned reconnaissance technology to ensure its proper integration and performance to the air vehicle.

Appendix C. Templates



AMMO Additive Manufacturing for Maintenance Operations

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Move 1: Compliance Matrix

	Government and Industry	Industry	Government	Government and Industry
No.	Requirement	How compliance achieved	How well	Comments

Stoplight
(red, yellow, green)

3

AMMO Additive Manufacturing for Maintenance Operations

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Move 2: Strategy

- Develop technical approach, schedule, and statement of work assuming that there are no technology related constraints.
- Determine content of a Technical Data Package (or packages).
- Establish assertions and restrictions.
- Possible that there might be several TDP's that vary over the term or phase of the contract

4

AMMO Additive Manufacturing for Maintenance Operations

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Move 2: Technical Approach

5

AMMO Additive Manufacturing for Maintenance Operations

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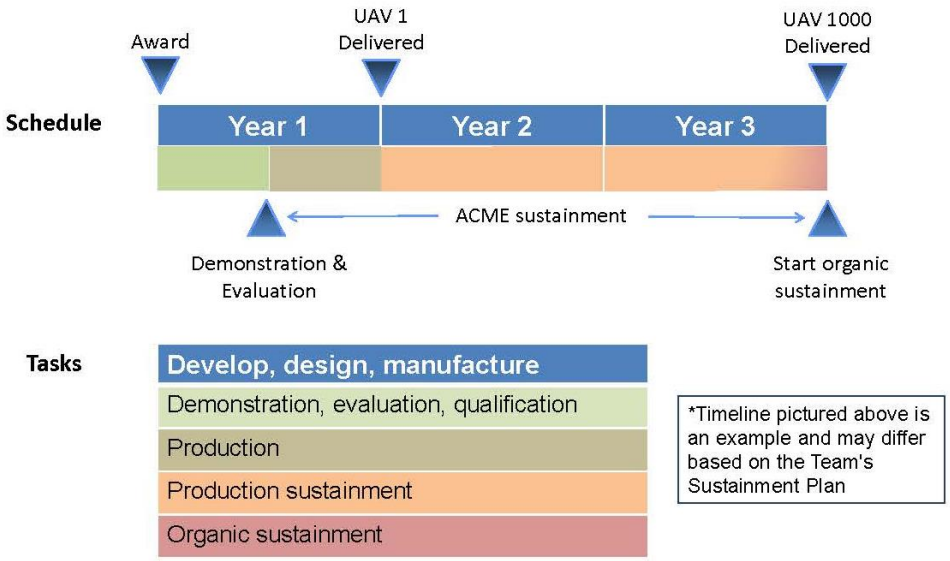
Move 2: Timeline



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AMMO Additive Manufacturing for Maintenance Operations

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Move 2: Statement of Work

7

AMMO Additive Manufacturing for Maintenance Operations

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Move 2: Technical Data Package

Requirement No.	Technical Data Description	Type of media	Source	Restrictions
	CAD Models/Drawings			
	Associated Lists			
	Specifications			
	Standards			
	Performance Requirements			
	Quality Assurance (QA) Provisions			
	Software Documentation			
	Packaging Details			

8

AMMO Additive Manufacturing for Maintenance Operations

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Move 2: TDP Discussion Points

1) Where will the technical data be stored?

2) How will the TDP be transported and secured?

3) How will updates and configuration management be handled?

4) What guidelines will be imposed on use?

5) Will the TDP be available to the Government?

6) If so, under what conditions:
   a) Government already purchased access
   b) Government will need to purchase access
   c) Government can "lease" temporary access
   d) Government will not have access.

9

AMMO Additive Manufacturing for Maintenance Operations

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Move 3: Complete Revenue Model

- Populate with data and values from prior moves as required:
  - Value proposition
  - Schedule
  - Resources
- Establish cost and revenue approaches/structures (menu selections).
- Identify partners, customer relationships, segments and channels.
- You may add or subtract questions from the canvas, as needed for time purposes.

10

AMMO Additive Manufacturing for Maintenance Operations

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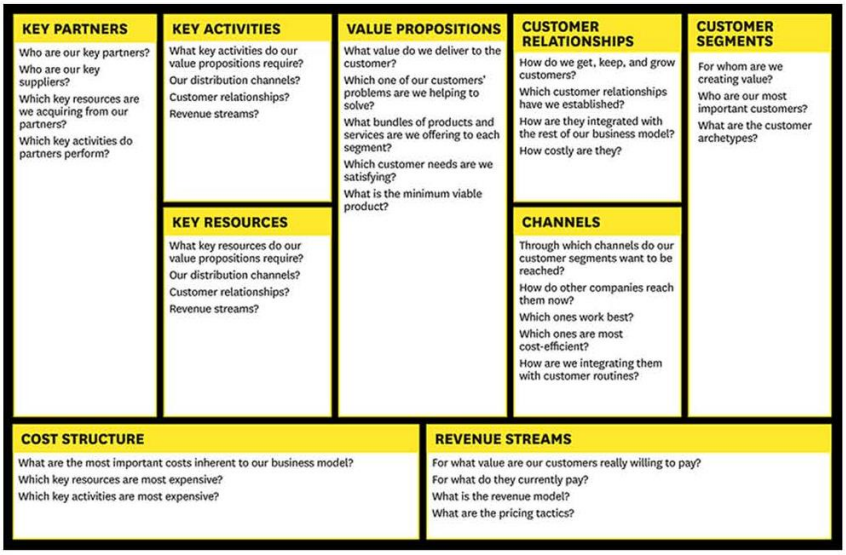
Move 3: Business Model Guide



AMMO Additive Manufacturing for Maintenance Operations

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Move 4: Assess to Value Proposition

- Have the prior moves met government and industry needs?
- Negotiate any open items on the compliance matrix.
- We should expect that there may be an impasse that can't be overcome because of the value proposition.


AMMO
Additive Manufacturing for Maintenance Operations
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Move 4: Contract Administration
Technical Approach
Terms and Conditions
Assertions
Warranty
Liability
13

Appendix D. Team Deliverables

Business Case / Model

(#1) Team Buy-out: Traditional government acquisition

#1A - Gov't purchases unlimited data rights from Acme

#2A - Gov't purchases government purpose data rights

3

BUY-OUT TEAM

Name	Organization	Discipline
Tom Naguy	Air Force	Engineering
Hannah Dumey	Boeing	Contracts
Bob Appleton	Troika	Logistics
Ashley Mitchell	LMI	Logistics
Luis Miguel (Mike) Acosta	Marine Corps Systems Command	Intellectual Property
Majid Babai	NASA / MSFC	Engineering
Regina Gebka	NAVSUP WSS	Enterprise IT
Brennan Grignon	OSD	Program Management
Karen Hazzah	Army AMCOM	Intellectual Property
Rick Jarman	NCMS	Program Management
Eric Kirchner	DLA	Logistics
Mike Minter	Lockheed Martin	Legal
Bernd Peters	Boeing	Engineering
Bill Peterson	NAVSUP WSS	Logistics
Chris Seier	NAVSUP HQ	Contracts
Dave Siddle	NCDMM	Program Management
Brice Toth	Penn State ARL	Enterprise IT
Alex Viana	NAVFAC HQ	Engineering
Mark Vitale	Deloitte	Logistics
Mike Schneider	Air Force	Engineering

4

Team Assumptions

- Team assumes primary focus for exercise was on field vs. depot.
- Buy the technology vs. leasing the technology.
- Buy same printers that ACME uses for commercial production.
- Assume the same sustainment package for field and depot (real world would be different).
- Specially negotiated rights rather than unlimited rights.
- Make and replace vs. repair.
- Training infrastructure plan is in place.
- Assertions & restriction should be determined pre-contract award
- Should be addressed in the pre-Milestone A activities

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Move 1: Compliance Matrix

	Government and Industry	Industry	Government	
No	Requirement	How compliance achieved	How well	Comments
1	TDP will include design intent; build file; material and process specifications; testing plan; machine parameters; parts requirements; field vs depot; how to sustain in field vs depot	Industry proposes a special negotiated data rights for the five additive manufacturing parts, Gov. accepting the use limitation for only the 5 Additive Manufacturing parts		Negotiate the rights of the parts based on the printing capabilities
2	TDP will include design intent; build file; material and process specifications; testing plan; machine parameters; parts requirements; field vs depot; how to sustain in field vs depot	Government buys unlimited / gov. purpose rights for AM parts		
3	Everything needed for manufacturing fit into a maximum of 2, 8x50 conex box (field)	Industry/Gov. completes a site survey to determine appropriate number of boxes for operating areas		
4	Training requirement to ensure that organic fabrication is enabled in the field; training transition will take place via a CLS contract	Industry will be responsible for initial training (USG pays for initial training); cross-training will take place with government personnel to expedite certification/qualification of operators needed for sustainment; Industry will oversee all training: how to operate the machine & how to build the parts; Industry will provide training manuals		
5	Assume we have technical qualification/certification for production parts	Industry pays for non-recurring for the 5 AMed part		To be discussed during Cost & Pricing – how much is this NRE worth?

Move 1: Compliance Matrix Cont'd

5	Repair or replace: To repair a part, we replace the AM parts in depot, repair the non-AM components; print a new AM part in the field	Industry proposes completing repairs for the drones; Gov to handle all field repairs (Make / Buy decision)		Complying with the 50/50 rule; Industry would like OEM repair capability due to COTS items
7	IUID for all AM parts	Industry proposes IUID of initial parts over $5,000		These are provisions to combat counterfeiting
8	Contractor will provide Contractor Logistics Services (to include printers) for three years at the depots; Government will provide an Interface Technical Package	Industry/Gov comply; No field work will be a part of the scope of CLS (Gov. personnel executing repairs will be trained by Industry)		Discussion need around TO's; need to discuss Industry's access to data
9	Government assumes liability in accordance with the FAR	Industry complies		
10	Printer manufacturer FSRs to facilitate S/W & H/W updates on the printers & requalify the printers for manufacturer driven changes; government will pay for any over & above printer capabilities;	Industry proposes Gov. pays for the FSRs; During CLS, Industry handles all printer modifications (first 3 years); Post CLS, gov. will take over printer modifications		printer updates S/W & H/W will affect TDP's; will need a transition plan for Post CLS; includes options for business models – buying vs. leasing
11	Sole source of AM procurement machines	Post CLS situation; Gov. desires		Justification & Approval; Gov. must prove that procurement should not be open competition
12	Government needs to manage the configuration control of the AM Parts; Gov. approval will be required for Class I ECP changes	Industry proposes Class II / III ECPs do not require Gov. approval		

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Move 2: Strategy

- Develop **technical approach, schedule**, and **statement of work** assuming that there are no technology related constraints.
- Determine content of a **Technical Data Package** (or packages).
- Possible that there might be several TDP's that vary over the term or phase of the contract
- Establish assertions and restrictions.
- Determine content of an **Acquisition Strategy and Life Cycle Sustainment Plan.**

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Move 2: Technical Approach (AM Specific)

To satisfy the requirements outlined in the Compliance Matrix, ACME agrees to:

- Perform all systems activities necessary to integrate the Government ISR capabilities on the drone
- To the maximum extent possible, integration components are to be additively manufactured
- Validate & verify the requirements are met for field manufacturing
- **Complete a site survey** to determine appropriate number of conex boxes for operating areas, including a facilities infrastructure assessment (depot & forward)
- Provide three year Contractor Logistics Support (CLS), of which ACME will handle all logistics including, but not limited to, printer maintenance
- **Facilitate initial training & provide all relevant training / operational manuals for the printers**; provide training for government personnel to achieve operator certification; training to calibrate the printers (set-up & follow-on); printer maintenance & repair training
- Manage transition plan for Post CLS organic operations
- **Complete all COTS repairs at industry facilities; complete surge repairs for 5 AM parts**
- Implement Class II/III Engineering Change Proposal (ECPs)

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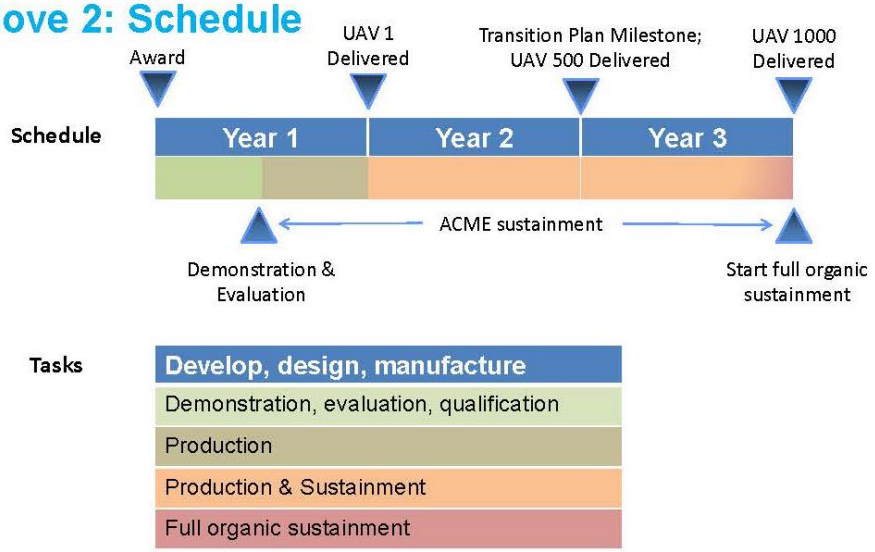
Move 2: Schedule



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Move 2: Technical Data Package

Deliverables adequate TDP for:

1. Four (4) polymer parts, TDP adequate to support polymer AM in field;
2. For aluminum parts, TDP adequate to support metal AM at depot

TDP will include:

- **design intent**
- build file
- material and process specifications'
- testing plan
- machine parameters
- parts requirements
- **field (polymer) vs. depot (metal)**
- how to sustain in field vs depot

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Move 2: TDP Discussion Points

1. Where will the technical data be stored?

- Digital Files will be stored in a native format
- Data Files will be provided in AM capable rich formats (ACME can provide, gov. can convert)
- During the CLS period, contractor will host data in contractor managed database (files will be transferred to the gov. customer)

2. How will the TDP be transmitted and secured?

- Updates will be delivered downstream to ensure seamless transition
- Data files can be transferred via CD-ROMs or data files can be transmitted via a network

3. How will updates and configuration management be handled?

- Government needs to manage the configuration control of the AM Parts
- Gov. approval will be required for Class I ECP changes
- Gov. responsible for formulating configuration management plan
- Acquisition Strategy defines configuration control through de-militarization

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TDP Discussion Points Cont'd

4) What guidelines will be imposed on use?

- Under the specially negotiated license data rights, ACME implements data permission restrictions
- See Intellectual Property Strategy for negotiated rights
- COTS items are not part of the scope of this discussion, but would otherwise be managed

5) Will the TDP be available to the Government?

- Yes

6) If so, under what conditions:

- Acquire sufficient Data Rights to allow field support of five (5) additively manufactured, essential sustainment parts. Options to be considered, primarily as to price, are:
  a) Unlimited Rights
  b) Government Purpose Rights
  c) Specially Negotiated License Rights in which the government accepts limitation to use Technical Data Package (TDP) for the five (5) additively manufactured, essential sustainment part only

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Move 2: Acquisition Strategy

A. BUSINESS MODEL

- Assessed in Move 3

B. RISK MANAGEMENT (risk cube is not necessary)

- Risk Management Plan:
  - Printers/Printer Obsolescence
  - S/W associated with printers
  - Raw materials (powders)
  - Life Time Buy & Storage
  - End Item generated from printing
- Technology Maturation (process completed with the prime OEM, responsible Engineer builds part matrix for support, needed Tech Data, COTS items, identify unique requirements that drive the program to accept risk)
- Printer variability – promoting consistency for part performance & qualification
- Cybersecurity associated with the S/W and Digital Technical Data Packages
- S/W Obsolescence
- Capacity
- Workforce training & maintenance Shortage

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Acquisition Strategy Cont'd – Part 2

C. INTELLECTUAL PROPERTY

Acquire sufficient Data Rights to allow field support of five (5) additively manufactured, essential sustainment parts. Options to be considered, primarily as to price, are:

A. Unlimited Rights
B. Government Purpose Rights
C. Specially Negotiated License Rights in which the government accepts limitation to use Technical Data Package (TDP) for the five (5) additively manufactured, essential sustainment part only

D. REQUIRED TEST ACTIVITIES

- Repeatability / Performance Qualification
- Printer Certification/Recertification (PMIL)
- Operator Certification/Qualification
- Witness Samples
- First Article Inspection
- Sampling Lots

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Move 2: Life Cycle Sustainment Plan

1. Obsolescence Management:

- Technical Data Package (design intent included)
- Data Rights: Government reserve the option to acquire additional levels of rights
- CDRLs: OEM provides Obsolescence Management Plan
- AM Technology Obsolescence Plan (Printer, Req. for Raw Material Stock; Shelf Management)
- Risk Mitigation Plan (high risk items, rapid COTS changes.

2. Competition in Sustainment

- During interim CLS, contractor will be sole provider (no competition)
- If competition sustainment is primary concern, government must procure no less than gov. purpose rights

3. Property Management

- GFI/GFE
- GoCo Agreement
- Facilities: Gov. provides facility; ACME utilizes
- Printers: Gov. buys the printers
- Conex Box: Site Survey

4. Cybersecurity

- Management of S/W Updates (CAD Packages)
- Compliance with DFARS Cybersecurity (Covered Defense Info; written in contract; original manufacturer site, point of manufacturing)
- Quality Assurance Plan (controls at ACME facility)
- Government System Integration & Access Plan

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Life Cycle Sustainment Plan Cont'd

5. Other Sustainment Considerations

- Component Improvement Plan
- Initial Sparing
- R&M Program
- Training

6. How will facilities and infrastructure be brought up to a sufficient level to meet program requirements?

- Environmental Health & Safety: contractor to provide plans / training; hazmat storage
- Power Requirements
- Program Environmental Health & Safety Evaluation ("PEHSE")
- Raw material storage – stocking, quality of the material, clean rooms
- Specialized infrastructure to support large machines (flooring, vibration control)
- Space allocation/footprint
- System engineering/integration plan (risk identification, TRL assessments)
- Distribution channels & secure transportation (hazmat materials, i.e. powder titanium)
- Work load estimates
- Facility sustainment plan (a piece of the lifecycle sustainment plan)

7. Where will obsolescence be an issue, and how can it be mitigated?

- See Obsolescence Plan in Acquisition Strategy

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Move 3: Business Model (Specially Negotiated)

KEY PARTNERS

- USG (ISR); customer
- ACME (drones, TDP); prime
- Printer Manufacturers; sub or partner to ACME
- Material suppliers; sub or partner to ACME

KEY ACTIVITIES

- Integration of ISR
- Established Tech. Capability for AM
- Data rights negotiations
- Cybersecurity
- Data permission / controls

KEY RESOURCES

- Facilities (manufacturing)
- Sales force
- Engineering expertise
- Training capability
- Certified materials/printers
- Printer/material supplier relationships
- Working capital
- Capacity

VALUE PROPOSITIONS

- Enables organic sustainment
- Improves operational readiness
- Reducing production lead times
- Continuous improvement, innovation advancement
- Reducing the logistics supply chain, inventory
- Providing new capability solutions

****

- Drone & TDP
- Contractor Logistics Services:
- Training (train the trainer)
- Data Management

****

- Minimum Viable: meeting the basic reqs. of the RFP

CUSTOMER RELATIONSHIPS

- Quality
- Continued process improvement
- Cost savings
- Technology improvements
- Technology demonstrations
- Joint Service Partnerships
- Multi-national coalitions

CHANNELS

- Traditional acquisition for USG (B2G)
- Direct Commercial Sales with sovereign data (B2G); (assume no export controlled items)
- Commercial marketplace

CUSTOMER SEGMENTS

- USG
- Foreign Military Sales
- Commercial segments (police & fire, oil & gas, Amazon, etc.)

COST STRUCTURE

- Capital requirements (manufacturing facilities, AM printers)
- Workforce capacity: trained engineering (design for AM)

REVENUE STREAMS

- License the data rights for AM parts
- Accelerated Timeline
- Willing to pay: Contractor Logistics Support (Improved Op. Readiness)
- Pricing premium for shortened lead time (Reduced production lead time)

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Move 4: Contract Administration

Problem: The Gov. needs IP to organically sustain the 5 AM parts
Solution: Industry will not agree to Unlimited / Gov. Purpose rights; Industry proposes a Specially Negotiated Licensing Agreement
The terms included are:

Technical Approach	T&Cs	Assertions	Warranty	Liability	Cost
ACME & the USG agree up-front to a specially negotiated license that covers 3 years CLS and the sustainment period post-CLS	• Non-compete clause • Production for USG only • Specified parts • Industry reserve right to sell improvements to international markets (barring export considerations) • Component Improvement Program • Cybersecurity reporting	As appropriate, validate funding representations that underlie the restrictions ACME will be the sole provider	Gov. desires product warranty offered to commercial customers at no additional cost, if ACME offered certification No warranty desired at additional cost	Patent Indemnification (COTS items) If gov. pays for certification through ACME, then ACME assumes liability	Four Payments; Annual Milestones Explore profit sharing opportunities achieved through Supply Chain efficiencies

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Challenges

- Attempting to negotiate after award
- **Focus of future wargames should be on pre-contract award**
- Examining the lift & the space impacts (maintainers, equipment, capacity, footprint, etc.)
- **Successful negotiate of valuing the contractor's yielding of a sole source premium for the limited rights tech data ("OEMs selling the secret sauce")**
- Peeling back the layers of the Lifecycle Sustainment Plan
- Technology product will be obsolete in five years
- How do you capture and/or continue product / technology improvement post-contract (component improvement program)
- Depot support—time did not allow full depot considerations and explorations (repair, training, manufacturing, etc.)
- Government challenge is the expectations
- Cost-benefit analysis – how do we effectively do that and place a value
- What improvements are the customers expecting based on your cost
- If the intent is industry to not certify the government then how do we place liability?

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Challenges Cont'd

- Financial metrics used to evaluate opportunities—warranty, liability
- Scenario missing major components of RFP
- Gov. lacking cost models
- Lack of LCSP to include equipment maintenance, printer, parts-- it drives what gov asks from industry.
- Data security -- cybersecurity
- Part provenance—counterfeit parts
- Future workforce considerations – machinists & talent to design for AM
- Lack of data around long term viability for AMed parts
- Product Lifecycle Management (PLM) with the ability to store data
- Mediums/tools that enables gov. can work across the supply base (data interoperability)
- Culture/mindset to adapt to new processes & procedures

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Final Thoughts

- Improved upon the first wargame through collaborative environment
- Deep dive into cost & pricing consideration, taking into account data rights
- Divide out scenario to applicable subject matter expert functions
- Additional time to work through the scenario
- Mock competition: Gov. engaging with Industry A & B teams
- Structure wargame 3 differently (phases over a few months)
- Utilize existing RFP/resources to design next scenario
- Need for more cross government services coordination & sharing
- Four different variations of solving the problem (richer body of knowledge)

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Additive Manufacturing Business Model Wargame II LOANER Out-brief

17 May 2017

Content

- Business Case / Model
- Team Composition
- Team Assumptions
- Deliverables and Results
  - Move 1: Compliance Matrix
  - Move 2: Statement of Work, Schedule, Technical Approach, Technical Data Package, Acquisition Strategy & LCSP
  - Move 3: Business Model Canvas
  - Move 4: Contract Administration
- Challenges
- Final Thoughts

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Business Case / Model

(#2) Team Loaner: Lease 1000 LWR drones from Acme

- Government completes all integration of reconnaissance capabilities
- Acme provides government purpose data rights to commercial IP
- Government organically sustains LWR drone thru life

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Team Composition

Name	Organization	Discipline
Howie Marotto	USMC	Logistics
Teresa Clement	Raytheon	PM
Mike Yukish	Penn State University APL	PM
Jim Pluta	US Navy	PM
Lisa Baker	USMC	Contracts
Jason Bridges	US Navy	Logistics
Tony Delgado	DLA	Logistics
Wayne Dudding	Dept of Energy	PM
Pobbie Griggs	Lockheed Martin	Engineering
Joe Inkenbrandt	Identify 3D	Engineering
Prakash Kolli	Blue Point Materials Research, LLC	Engineering
Hay-Kyung Lanteigne	US Army Aviation and Missile Command	Legal
Ousmane Lungu	Boeing	Enterprise IT
Kevin Malloy	US Navy	PM
John Merenich	Penn State University APL	Legal
Bob Murphy	Lockheed Martin	Engineering
Jeremy Pinson	US Army	Logistics
James Wilcox	Lockheed Martin	Contracts
Aaron Frank (Chan)	ASA(ALT)	PM

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Team Assumptions page 1

- Government leases 1000 reconnaissance lightweight drones that will be deployed by two-person teams
- Government completes all integration of reconnaissance capabilities
- Acme provides license rights for the five parts that can be additively manufactured for the life of the lease
- The five parts are commercial items
- All the parts identified as potential sustainment items required for 6-month deployments of the PLW are required to be Additive Manufacturing (AM) parts by contract.
- Government organically sustains each drone after first 3 years
- Government is NOT additively manufacturing motors, electronics, batteries
- Provide a TDPs that are compatible/translatable (COB/COG considerations…)
- DOD-produced parts may not be made with same material, process, etc.
- Government will lease drones for 5 years
- Life expectancy of drones is 10 years
- Drone must be at least partial mission capable (PMC) at 5-year mark
  - Need to define PMC
- Any government-manufactured parts on drone will be property of the lessor (ACME) upon return except those related to ISR package
- We will not allow ACME to have real-time, condition-based maintenance utilizing on-board sensors
- Drone will have a black box type monitoring system to enable feedback to OEM
- If drone crashes catastrophically during 5-year lease period, lessor is not responsible to replace it
- 20% of drones will not be returned to OEM
- Initial training for in-field printing of components will be included in cost of lease
- ACME is a wholly commercial company
- ACME will lease build file / tool path / array file (if applicable) for a set of defined printers but not ubiquitous capability
- CAD file…not so much;
- TDP is warranted

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Other Considerations

- Appeal of lease concept to industry given DOD's ability to manufacture parts for application to ACME's drone
- What is an acceptable profit margin to industry for leasing?
- What is minimal market value of leasing?
- Multi-year, no-color funds essential to acquiring innovative rapidly changing capabilities; Congress and/or OSD for action
- Base lease with options?
- Even with licenses, current laws do not allow businesses to operate as they normally do with non-government clients.
- Cost savings are possible at scale/across contracts (DLA)
- **If we were to fully explore this scenario, we would consider the modifications for ISR to be significant enough to re-characterize the drone into a non-commercial item**
- For upgrades during lease period (e.g. software, hardware/printers, file format, part improvements, etc.), there is currently no way under FAR and DFAR to rapidly acquire upgrades
- Leasing works if we assume shorter life cycles; FAR does not accommodate this.
- Incentivize industry to develop drone manufacturing capability using recycled materials
- Does the DOD want to become another manufacturer? Does DOD become a competitor? Could have market impacts.
- AM Lease Model can have impacts on both the DOD and Industry workforce structur

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Move 1: Compliance Matrix

No.	Requirement	How compliance achieved	How well	Comments
1	DOD able to print in-field w/ printers that are equivalent (material, process, resolution) to that used by OEM	Industry licenses TDP to government		No concerns about being able to get there
2	DOD able to print in-field w/ non-OEM approved printer	Government and industry must work out the parameters		-May be non-starter -Worth looking at
3	Government protects IP for the life of the lease	-Government deletes all information related to TDP upon expiration of lease -Government is responsible if IP is compromised -Vendor is responsible to protect IP as well		-Need license terms that need to be negotiated
4	ACME provides sustainment for first 3 years	-Ao = 80%		
5	Government provides some level of usage and employment data to OEM	-Feedback on a regular basis (frequency TBD)		-Includes part replacements related to performance

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Move 2: Strategy

- Develop **technical approach, schedule**, and **statement of work** assuming that there are no technology related constraints.
- Determine content of a **Technical Data Package** (or packages).
- Possible that there might be several TDP's that vary over the term or phase of the contract
- Establish assertions and restrictions.
- Determine content of an **Acquisition Strategy and Life Cycle Sustainment Plan.**

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Move 2: Statement of Work / Tech Approach

Statement of objectives:

"DOD is seeking a loan of 1000 drones for use by two-person teams in a tactical environment. Drones must be able to be augmented with DOD-provided ISR package. DOD will maintain drones out of deployable, climate-controlled containers and operate in Asian Pacific climates for a period of up to five (5) years. DOD will need access to and license for IP required to additively manufacture the following five (5) parts: propeller blades, drive trains, boom arms, strong boxes and shrouds.

Technical Approach:

ACME will provide lease of 1000 drones (per schedule provided) for government use by two-person teams in tactical, austere locales and environments. Drone may operate in harsh environments, but AM sustainment will be in mobile, containerized, climate-controlled facilities in FOBs, bases, shipboard, ACME facilities, ACME-approved service providers. Other leased services are also proposed: Co-design of the integration of GFE ISR; digital library/database; training; quality control services

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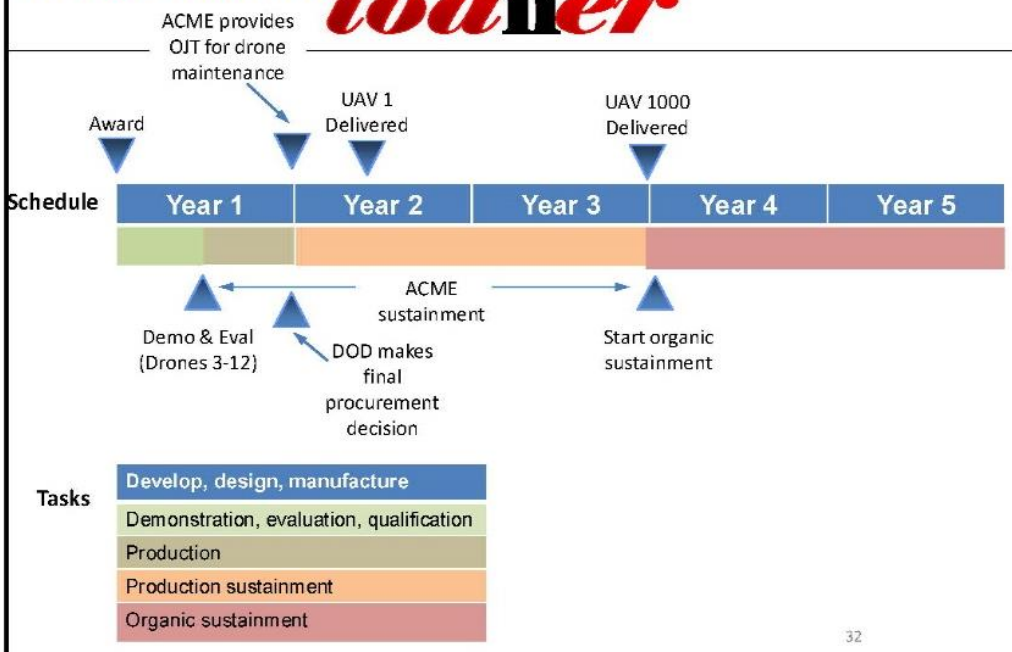
Move 2: Timeline



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Move 2: Statement of Work (Industry term) / Performance Work Statement (Gov't term)

Develop, design, and manufacture: A COTS drone capable of being integrated with a DOD-provided reconnaissance package

Demonstration, evaluation, and qualification: ACME will co-develop with government, manufacture and install ISR interface; government will integrate ISR capability and conduct flight test

Production: ACME will deliver two prototypes at 6 months ACA and after one year will be capable of producing 50 drones per month for the life of the lease. All drones will be manufactured in the United States.

Production sustainment: AMCE will provide three years of production sustainment beginning with delivery of first prototype.

Organic sustainment: ACME will provide a TDP for the five (5) AM components to DOD at one year with delivery of the first production unit.

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Move 2: Technical Data Package for AM parts

Req No.	Technical Data Description	Type of media	Source	Restrictions
1	~~CAD Models~~	N/A	None	Too expensive
2	Surface geometry and build files	Electronic	ACME	Levels of information assurance
3	List of authorized printers and materials	Electronic	ACME	No warranty
4	Specifications (COTS)	Per OEM	ACME	None
5	Standards (material, machine, operator training, process)	Electronic and in person	ACME	No current industry-wide standard for AM
6	Performance Requirements	Per OEM	ACME	None
7	Quality Assurance (QA) Provisions	Per OEM	ACME	Once government prints, government is responsible for Q/A -Visual inspection? -Weight verification?
8	~~Software Documentation~~	N/A		Not required b/c no CAD files
9	~~Packaging~~ Delivery Details	Electronic	ACME	Need to incorporate tech refresh clause into contract if DOD wishes to upgrade
10	Performance feedback	Electronic	DOD/ ACME	Black-box/data; no real-time sensor feedback

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Move 2: TDP Discussion Points

1) Where will the technical data be stored once transmitted to the DOD?
Current procedures in place with consideration for data repository (Marine/Joint); data rights management (DRM) system

2) How will the TDP be transported and secured?
DOD-grade encryption

3) How will updates and configuration management be handled?
IAW the terms of the contract.

4) What guidelines will be imposed on use?
Government use only. To be covered in license agreement. Specific printers and materials only. Training standards for all operators.

5) Will the TDP be available to the Government?
Yes for five (5) AM parts only.

6) If so, under what conditions:
Government already purchased access
Government will need to purchase access
Government can "lease" temporary access
Government will not have access.

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Move 2: Acquisition Strategy

A. BUSINESS MODEL: Lease Model

B. RISK MANAGEMENT:

1. Risk to Industry:

- Risk of receiving drones back in unacceptable condition
- Risk of forward/field locations changing
- Risk of lease termination due to dissatisfaction on DOD's part
- Does not perform as desired once GFE is installed
- Readiness levels degraded past accepted threshold
- Model is not profitable due to challenges making estimates
- Brand risk with drone failure due to DOD action
- Lessor unable to anticipate field demand
- IP risk and cybersecurity risk
- Unauthorized modifications and reverse engineering / version control

2. Risk to government:

- Not holding title exposes DOD to legal complications (e.g., bankruptcy situation)
- Drones become obsolete before lease expires; less risk impact than under "buy" scenario
- Does not perform as desired once GFE is installed
- Early termination of mission
- Difficult based on current lease-related regulations
- Lessor unable to anticipate field demand
- Higher upfront costs

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Acquisition Strategy Cont'd – Part 2

C. INTELLECTUAL PROPERTY

1. IP Cybersecurity
2. IP management (in-field)
3. IP infringement (insider and outsider threats)
4. IP cost (new model for industry and DOD)

D. REQUIRED TEST ACTIVITIES

1. Joint AM and flight tests
2. Digital security test for sharing TDP-related data
3. 3D printing in forward facilities and validating printed products
4. File transmission under bandwidth-constrained scenario?

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Acquisition Strategy Cont'd – Part 3

C. INCENTIVE OPPORTUNITIES

1. Lease renewal clause option similar to iPhone model; upgraded drone at less than $1.2M per drone at end of lease; option must be "priced" in initial lease; prevents need to recompete
2. Early delivery incentive ($)
3. Bonus for ability to design additional high-failure / increased performance parts on drone via AM
4. Bonus for ACME providing increased printer options
5. Bonus for ACME to design app for in-field use (design, iteration, innovation, maybe print command)
6. Federal incentives for manufacturers to use AM (e.g. tax breaks)
7. Enable data (printer performance, material performance, etc.) availability to industry post-deployment
8. Industry to Gov – Reduced cost for latest version
9. Industry to Gov – AM as bargaining chip (GOV choosing to NOT reverse engineer)

D. COMPETITION

1. Depots and Labs could compete for production of parts (requires legal authority)
2. Licensing agreement can specify if third party can print AM IP (might require higher license fee)
3. More competition in design than in production

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Move 2: Life Cycle Sustainment Plan

PRODUCT SUPPORT STRATEGY

I. Sustainment Strategy Considerations

1. **Obsolescence Management –**
   a) Done through options; short lease periods with gov't incentives to upgrade
   b) Decreased administrative lead times
2. **Competition in Sustainment**
   a) Modify laws/regulations to incentivize leasing through mutually beneficial contracting terms (i.e., boilerplating)
3. **Property Management (Physical, not IP)**
   a) Not an issue for the government until contractor sustainment ends
   b) Puts onus on industry rather than government
   c) Only an issue for years 3.5-5 (i.e., benefit of lease model)
4. **Cybersecurity**
   a) See previous discussion on slides 21-22
5. **Other Sustainment Considerations**
   a) Contractor will stock/provide all parts (AM and conventional, organic, third-party supplier) at all drone use locations for years 1-3
   b) After 3 years, materiel acquisition/storage will need to be addressed (gov't must procure, store, transport material)

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Life Cycle Sustainment Plan Cont'd

Cover items such as your basic sustainment support strategy, the short and long term plan to support the drone through life, including repair, consumables, and improvements for ALL aspects of this acquisition program. Consider all phases of the drone's Concept of Employment.

– How will facilities/infrastructure be brought up to a sufficient level to meet program reqts?
  - DOD needs to ensure we stock the AM printer feedstock
  - New sustainment model req'd for DOD

– Where will obsolescence be an issue, and how can it be mitigated?
  1. 3D printer and software obsolescence >> Shorter lease terms; lease 3D printers
  2. Material availability >> stock-piling; recycling; R&D investment in new material development
  - Only an issue if technology advances faster than expected within lease construct (industry and adversary)
  - Less risky to DOD than other models from obsolescence point of view
  - Good for industry if upgrade option (priced versus unpriced) is executed by DOD

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Move 3: Business Model Canvas

KEY PARTNERS

- Industry deport w/ AM capabilities
- DOD microfactories w/ AM capabilities
  - AFBs
  - FOBs
  - Shipsboard
- AM 3rd party Service Bureaus
  - CONUS
  - OCONUS
  - DLA
- Materials providers (feedstock materials)
- Equipment providers (AM fab/post-processing)
- Test facilities
  - Pax river
  - AM part testing (verifying fabricators)
- Cybersecurity Firms
- Alternate payload suppliers (beyond ISR)
- Prime Contractor

KEY ACTIVITIES

- ACME-approved qual/cert of the AM fabrication in the facilities
- Protecting the digital thread (i.e., transmitting and securing containment of AM TDP and return/deletion of the TDP files after lease ends)

KEY RESOURCES

- Optimized TDP build files to fabricate qualified AM parts
- Share data/reliability data with the AM materials providers and AM equipment providers
- Secure transmission of digital
- Material s/equipment available and certified
- Key personnel available as a service (at build locations from ACME and partners)
- Contracting with partners

VALUE PROPOSITIONS

- Maintaining leased drones via multiple AM fabrication sources reduces logistics / O&M chain for customers
- Drone services provide a platform for the sensor systems
- AM IP being freely available through the terms of the lease enables rapid fabrication of replacement components without restriction
- Product updates are more quickly available to customers (performance improvements by product upgrades via AM)
- Returned data to ACME and key partners gives insight on product usage and reliability information on AM components; informs future improvements on the AM components

CUSTOMER RELATIONSHIPS

- Defense:
  - Highly regulated
  - Very forward-leaning AM consumer and user
  - Independent AM capabilities
  - Sometimes fabricate AM components in innovative ways to make mission (speed over quality)
- Note: Other customer relationships not considered here, but are viable alternate sources of revenue for this lease model

CHANNELS

- DOD Contracting
- Demand signal to the service provider (i.e., indicating the need for additional AM components)
- Approved AM materials and processes/equipment lists and TDP to maintain the leased drones
- Sales of services
- Ordering

CUSTOMER SEGMENTS

- Defense
- Agriculture
- Law Enforcement
- Disaster Management
- Mining / Oil Fields
- Entertainment
- News Agencies
- Fortune 500 Companies (Amazon, etc.)

- Note: We assume the bigger customers for ACME are commercial customers, NOT with the DOD. This may drive more attention to the future innovations in drones away from DOD-focused applications.

COST STRUCTURE

- Drones leased
  - Replacement of lost/damaged drones during lease period
  - Material & Equipment costs (most expensive if ACME owns these in first 3 years)
  - Engineering & Design / build file maintenance & optimization for 3D printing
  - 3-year phase - ACME fabricates components; partners fabricate communications
- Off-Lease
  - Evaluate return

REVENUE STREAMS

- Lease Services
  - DOD Contracting services (cost for ACME to come to DOD acquisition standards)
  - Sell anonymized data back to material/machine manufacturers (e.g., operating data, AM data (printers, print environments, etc.), materials & test results
- Lease drones
- Lease printers
- Lease support to fielded upgrades

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loaner

Move 4: Contract Administration

Technical Approach: ACME will provide lease of 1000 drones (per schedule provided) for government use by two-person teams in tactical, austere locales and environments. Drone may operate in harsh environments, but AM sustainment will be in mobile, containerized, climate-controlled facilities in FOBs, bases, shipboard, ACME facilities, ACME-approved service providers. Other leased services are also proposed: Co-design of the integration of GFE ISR; digital library/database; training; quality control services

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Challenges (List Specific Challenges by Discipline)

Program Management:
- Cost, schedule, and performance
- Asset management (different model b/c drone and IP are not owned by DOD)
  - IP; material and printers; drone
- DOD's compliance with lease terms IAW compliance matrix
  - Flight hours; condition upon return
  - Protection of IP

Legal:
- Specially negotiated license for use of IP
- Lease authorities are currently limited primarily by DOD
- Licensing is a comparable option to leases
- What happens if lessor goes bankrupt? >> Vulnerability of leased mission critical assets to outside legal control.
- Export control

Engineering:
- Rapidly evolving list of printer manufacturers, material types/manufacturers, etc.
- ISR integration (mostly government and specific challenge to lease model)

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Challenges Cont'd (List Specific Challenges by Discipline)

Logistics (Maintenance and Supply) :
- Export control
- Limited to defined number of printers and materials
- Access to materials (competing with COTS customers)

Enterprise IT:
- Securing Digital Thread (e.g., encryption of data)
- Bandwidth requirements for sharing TDPs
- Requirement for new IT ecosystem
- Data management

Contracts Administration:
- Leasing

Other:
- Leasing works well for large companies, but not small ones (small companies may need a broker, thus reducing margin)

Thoughts:
- AM as a service?
- Reconnaissance as a service?
- Performance Based Logistics
- Third party leasing is common in industry, but not in DOD/Gov't

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Assess to Value Proposition

- Maintaining leased drones via multiple AM fabrication sources reduces logistics / O&M chain for customers
- Drone services provide a platform for the sensor systems
- AM IP being freely available through the terms of the lease enables rapid fabrication of replacement components without restriction
- Product updates are more quickly available to customers (performance improvements by product upgrades via AM)
- Returned data to ACME and key partners gives insight on product usage and reliability information on AM components; informs future improvements on the AM components

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Pros:

GOVERNMENT

- Leasing can mitigate obsolescence issues in systems that have rapidly evolving technology
- Leasing over the life cycle of a system can save money and provide a better value (e.g., increased readiness)
- No disposal costs
- Incentivizes acceleration of innovation
- Spurs competition

INDUSTRY

- Potential for continuous revenue stream
- Opportunity to leverage AM profitably
- Alignment of payment with their own investment in AM technology and rapid evolution in technology (i.e., long-term business relationship and revenue stream)
  - Incentivizes acceleration of innovation

Cons:

GOVERNMENT

- Impediments exist to a full leasing capability in government
- Penalty for going beyond degradation percentage in leasing option may discourage operational use (e.g., operational forces are less likely to use expensive assets, leased or otherwise, due to fear of loss/damage to and potential repercussions)
- Cost models for government are for the most part unexplored and may be more expensive for government than industry

INDUSTRY

- If gov't does something inappropriate with system, there may be risk to brand.
- Spurs competition

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Final Thoughts

- Good, bad or ugly?

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Additive Manufacturing Business Model Wargame II CLS Out-brief

May 17, 2017

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Content

- Business Case / Model
- Team Composition
- Team Assumptions
- Deliverables and Results
  - Move 1: Compliance Matrix
  - Move 2: Statement of Work, Schedule, Technical Approach, Technical Data Package, Acquisition Strategy & LCSP
  - Move 3: Business Model Canvas
  - Move 4: Contract Administration
- Challenges
- Final Thoughts

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Business Case / Model

(#3) Team CLS: Government purchases 1000 LWR drones

- Government / Acme work together to integrate reconnaissance capabilities
- Acme provides commercial logistics support for drone thru life
  - Provides spare parts
  - Maintains and provides TDP
  - Training and publications
  - Govt. only prints spares in critical situations

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Team Composition

Name	Organization	Discipline
Sam Cooper	US Army HQDA G-4 LIA	Logistics
Bill Harris	Sikorsky	Engineering
John Kelly	Youngstown State University	PM
Stephanie Gaffney	Youngstown Business Incubator	PM
David Barrett	Navy	Logistics
Andres Diaz	DLA HQ	Logistics
Jan Harpole	Defense Logistics Agency	PM
Florian Luebeck	German Armed Forces	Logistics
Steve Martinez	Center for Joint and Strategic Logistics	Logistics
Elizabeth McMichael	NAVAIR	Enterprise IT
Erik Merk	OPNAV-NAVAIR	Logistics
Greg Pace	Marine Corps	Logistics
Brian Pontius	NAVSUP Subinses Systems Center	Enterprise IT
Arthur Samora	Navy	Legal
Steve Skiptunas	Lockheed Martin	Logistics
Gug Sresty	Applied Systems & Technology Transfer	PM
Gary Wiest	Penn State Applied Research Lab	Logistics
Rob Williams	Boeing Company	Contracts
Ian Wing	Deloitte Consulting, LLP	Engineering
Greg Yukish	Applied Research Laboratory	Engineering

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Team Assumptions

- Having Operational units print the parts is not the primary source
- Vendors are supplying material
- ACME need to supply qualification specs
- Need to work out the arrangement for printing commercial parts, including joint IP rights
- ISR box weighs the same or less than the cargo it replaces
- Digital Thread exists, secured against cyber hacking
- Measure performance of the contractor
- Each operational unit only has enough supplies to reproduce the largest part of each material
- Every AM Part can be printed by the same machine (print envelope)
- Operator can remove and replace parts, but govt. technician needed at the intermediate level for manufacturing
- IT will have reach back to OEM support and ESA (Engineering support Activity) if necessary
- **Need Consider other AM platforms in theater**
- FAA Certified: not subject to criticality requirements
- **Vendor will not warranty govt. manufactured parts unless field service rep on site**

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Move 1: Compliance Matrix

No.	Requirement	How compliance achieved	How well	Comments
1	Validation/Security of TDP	IT Solution		Assumes govt. get the TDP to the field with Digital thread
2	1000 Drones in 2 yr production cycle	OEM Manuf		Typical acquisition
3	First Drone in 6 months	OEM Manuf		Typical acquisition
4	First production model in 12 months (this includes demonstration validation)	OEM Manuf		Dependent on #3
5	**30 year sustainment strategy, 5 year options (tech refresh)**	**Contract language**		**With the right metrics (combined from #7)**
6	**IP sufficient for sustainment/re-procurement**	**Contract Language**		**Can get the IP but not getting full benefit of AM. High$$**
7	Tech refresh deliverable every 5 years	Contract Language		Combined with #5
8	Maintainer training must be provided, new build and repair with publications	Publications, web and classroom		Tailoring for the military, certification of existing skills
9	Contractor Field Service Rep	Contract language		Determine scope

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Compliance Matrix Cont'd

No.	Requirement	How compliance achieved	How well	Comments
10	Warranty agreement for (TDP, Process, IP, parts)	Contract Language		Complex negation item
11	**Access to historical data**	**Contract Language**		**Digital thread two way**
12	ACME provides CLS	Contract language		CLS scope to be defined
13	All sustainable parts must be designed and qualified for AM process	Contract Language and TDP		
14	**Design is reconfigurable to meet design compliance (DoD open architecture standards)**	**Contract language**		
15	Technical Manuals	Publications		

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Move 2: Strategy

- Develop **technical approach, schedule**, and **statement of work** assuming that there are no technology related constraints.
- Determine content of a **Technical Data Package** (or packages).
- Possible that there might be several TDP's that vary over the term or phase of the contract
- Establish assertions and restrictions.
- Determine content of an **Acquisition Strategy and Life Cycle Sustainment Plan.**

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Move 2: Technical Approach

The contractor must maintain compliance with the most current DoD IT standards. Contractor will integrate ISR package ICW government authorities and manufacture to standards. **Contractor shall provide a 30-year sustainment plan, which shall comprise an initial 5 year sustainment/tech refresh with 5 successive 5 year government options**. Government will provide ISR package at award, ACME will deliver the integrated drone in test ready condition in 6 months accordance with production schedule. **Government wants sufficient IP/data rights with the initial TDP and with each successive tech refresh to sustain the drones.** All sustainable parts must be designed and qualified for AM process.

Specific IP/data rights will be negotiated with vendor in accordance with commercial practices. Contactor will provide training and maintain training materials for government to sustain the drones. Contactor shall provide field support services to maintain field readiness. A one year warranty will be supported for the drone. **Contractor and the government will collect and share historical data to improve sustainability and the readiness of the drones.** Contractor shall deliver drones using an open architecture approach, with standard interfaces that allow for substitution of components on either side of the interface. Contractor will deliver technical manuals to government.

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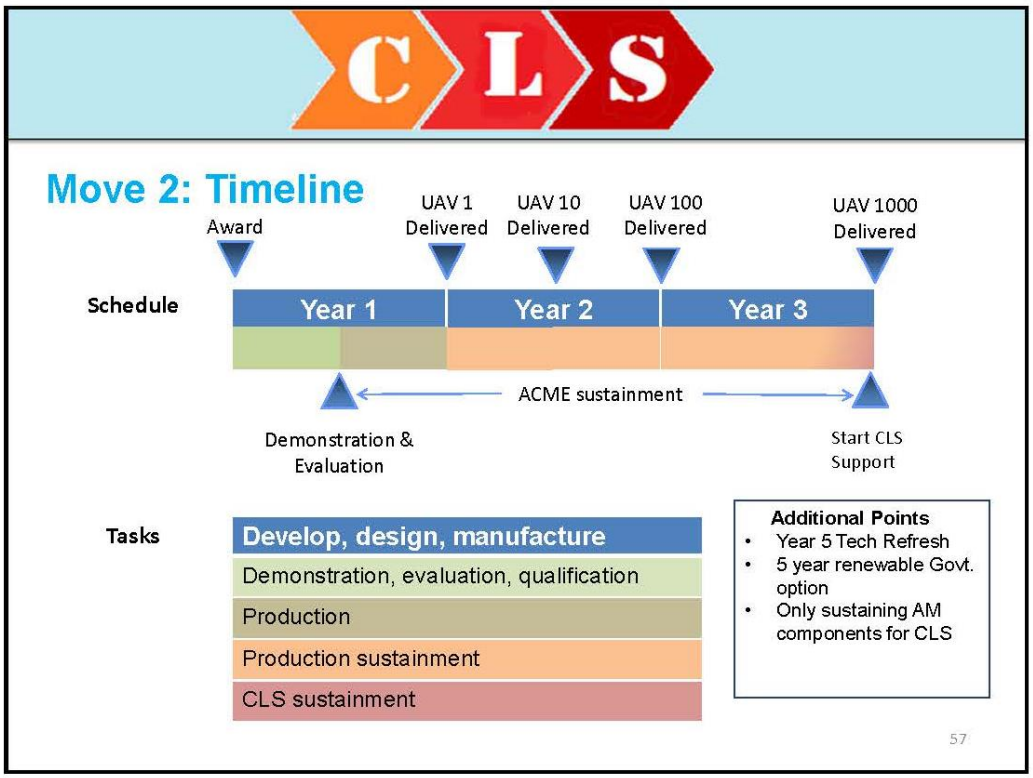
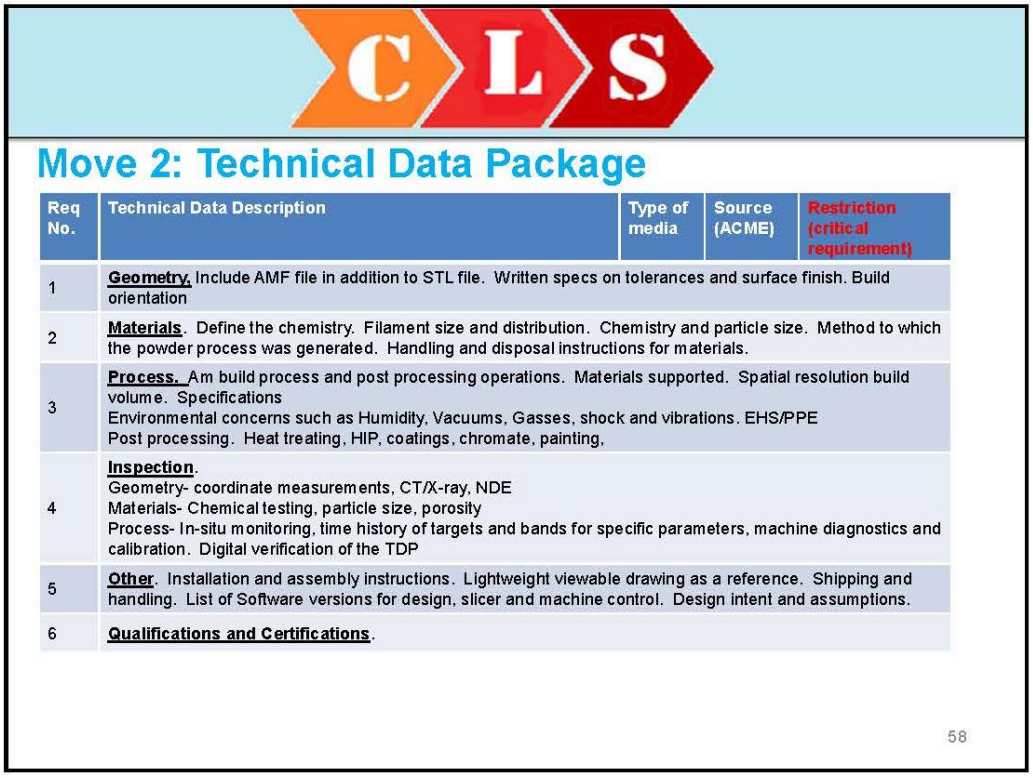

C L S
Move 2: Timeline
Award
UAV 1 Delivered
UAV 10 Delivered
UAV 100 Delivered
UAV 1000 Delivered
Schedule
Year 1
Year 2
Year 3
ACME sustainment
Demonstration & Evaluation
Start CLS Support
Tasks
Develop, design, manufacture
Demonstration, evaluation, qualification
Production
Production sustainment
CLS sustainment
Additional Points
• Year 5 Tech Refresh
• 5 year renewable Govt. option
• Only sustaining AM components for CLS
57


C L S
Move 2: Technical Data Package
Req No.
Technical Data Description
Type of media
Source (ACME)
Restriction (critical requirement)
1
Geometry. Include AMF file in addition to STL file. Written specs on tolerances and surface finish. Build orientation
2
Materials. Define the chemistry. Filament size and distribution. Chemistry and particle size. Method to which the powder process was generated. Handling and disposal instructions for materials.
3
Process. Am build process and post processing operations. Materials supported. Spatial resolution build volume. Specifications
Environmental concerns such as Humidity, Vacuums, Gasses, shock and vibrations. EHS/PPE
Post processing. Heat treating, HIP, coatings, chromate, painting,
4
Inspection.
Geometry- coordinate measurements, CT/X-ray, NDE
Materials- Chemical testing, particle size, porosity
Process- In-situ monitoring, time history of targets and bands for specific parameters, machine diagnostics and calibration. Digital verification of the TDP
5
Other. Installation and assembly instructions. Lightweight viewable drawing as a reference. Shipping and handling. List of Software versions for design, slicer and machine control. Design intent and assumptions.
6
Qualifications and Certifications.
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Move 2: TDP Discussion Points

1) Where will the technical data be stored?
- Data managed by ACME with access control to the government and can be downloaded.

2) How will the TDP be transported and secured?
- ACME, digital thread

3) How will updates and configuration management be handled?
- Updated to the master configuration on digital thread

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TDP Discussion Points Cont'd

4) What guidelines will be imposed on use?
- Rule/Role based information distributed via digital thread

5) Will the TDP be available to the Government?
- **Yes, for OMIT Operations, Maintenance, Installation and Training, not for competitive acquisitions.**
- **FFF form fit and functions is needed for the interface information**

6) If so, under what conditions:
- **a) Government already purchased access**
- b) Government will need to purchase access
- c) Government can "lease" temporary access
- d) Government will not have access.

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Move 2: Acquisition Strategy

A. BUSINESS MODEL

- **Cost plus vs. initial contract. Expectation to convert to firm fixed price after initial development**
- Tech refresh at 5 year window, minimizing sparing needs.
- OEM will be performing a PBL arrangements and has primary responsibility for parts replacement
- TDP maintained by OEM under PBL arrangement
- Demand based acquisition for wholesale pool and repair parts
- Government will print critical/unplanned/surge requirements
- Material supply management managed by PBL

B. RISK MANAGEMENT (risk cube is not necessary)

- Technical risks. Integration of electronics and GFE. Environmental conditions of drone.
  - Demval would mitigate risk in first 6 months
- **Ability of uniform personnel print the parts**
  - Demval would mitigate risk in first 6 months
- Programmatic risks. Cost and Schedule. Reliability of components
- **Need monthly historical use data provided by the government**

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Acquisition Strategy Cont'd – Part 2

C. INTELLECTUAL PROPERTY (only for AM parts)

- Contractor owns original design and any modifications.
- **Government has sufficient rights to the TDP for use in critical situations**

D. REQUIRED TEST ACTIVITIES

- Integration of electronics and ISR
- Flight and ground testing
- Specimen testing
- Communications testing
- **Maintainability/Manufacturer testing, in lab and in field by government**
- Final check test

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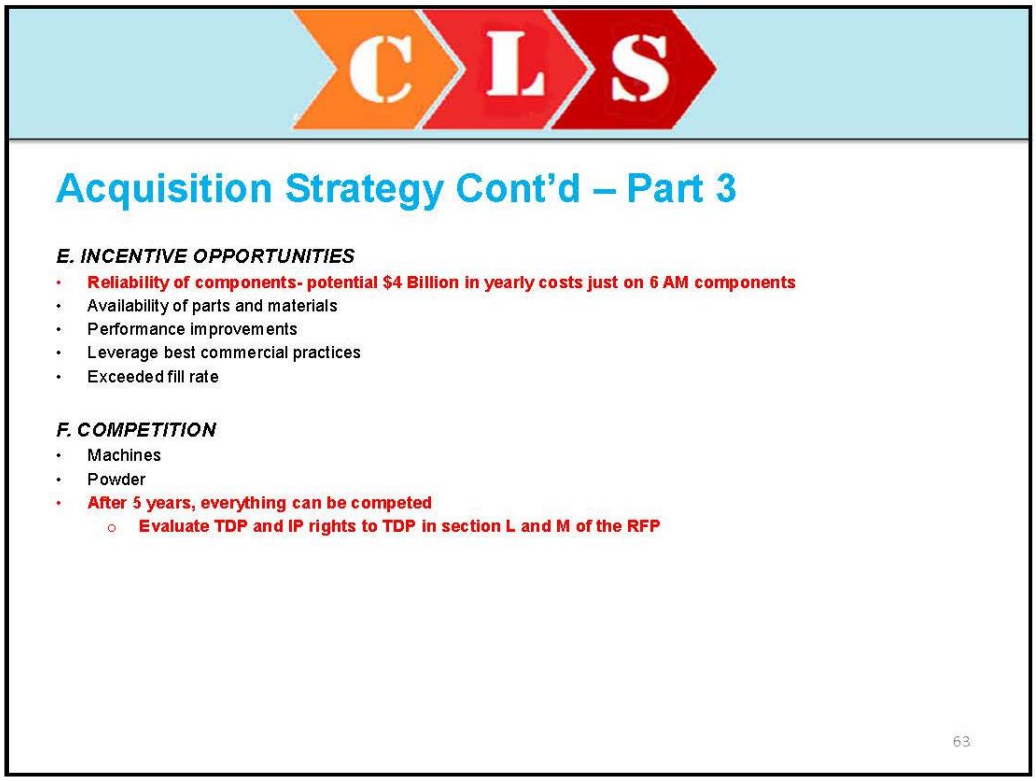
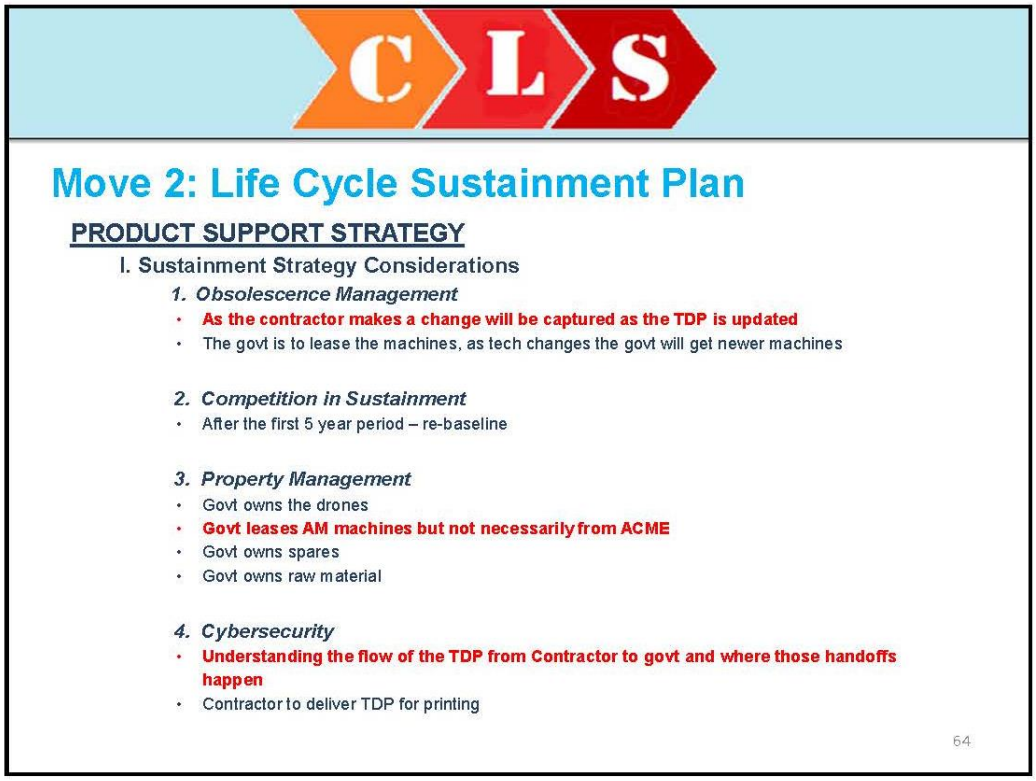
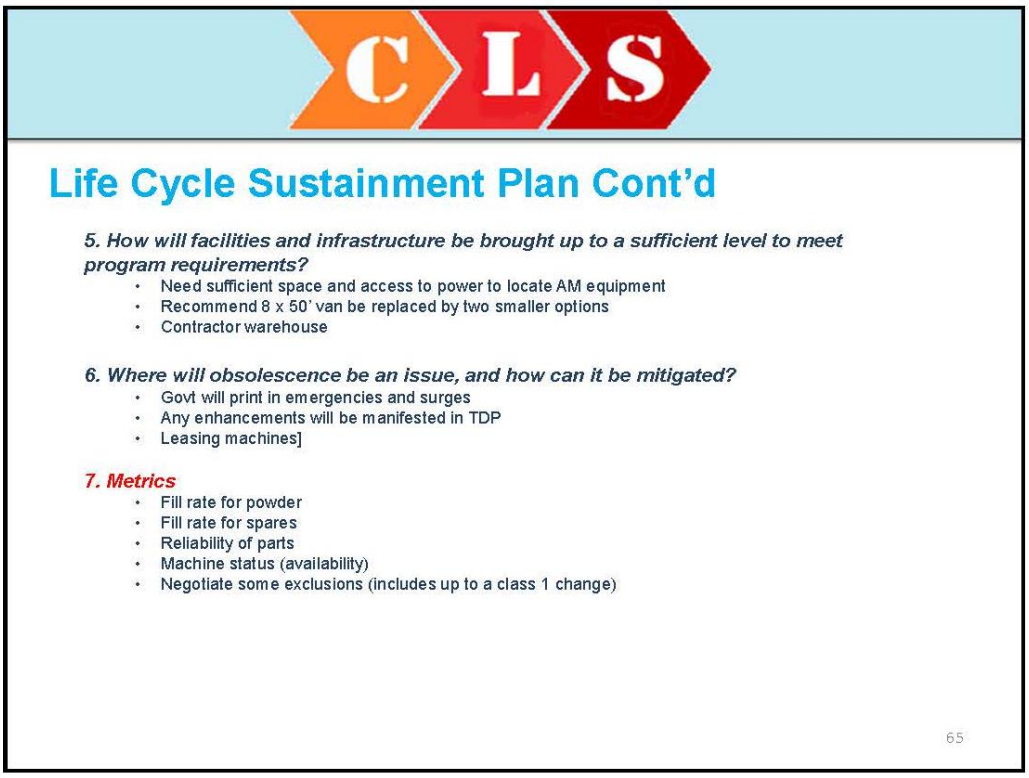
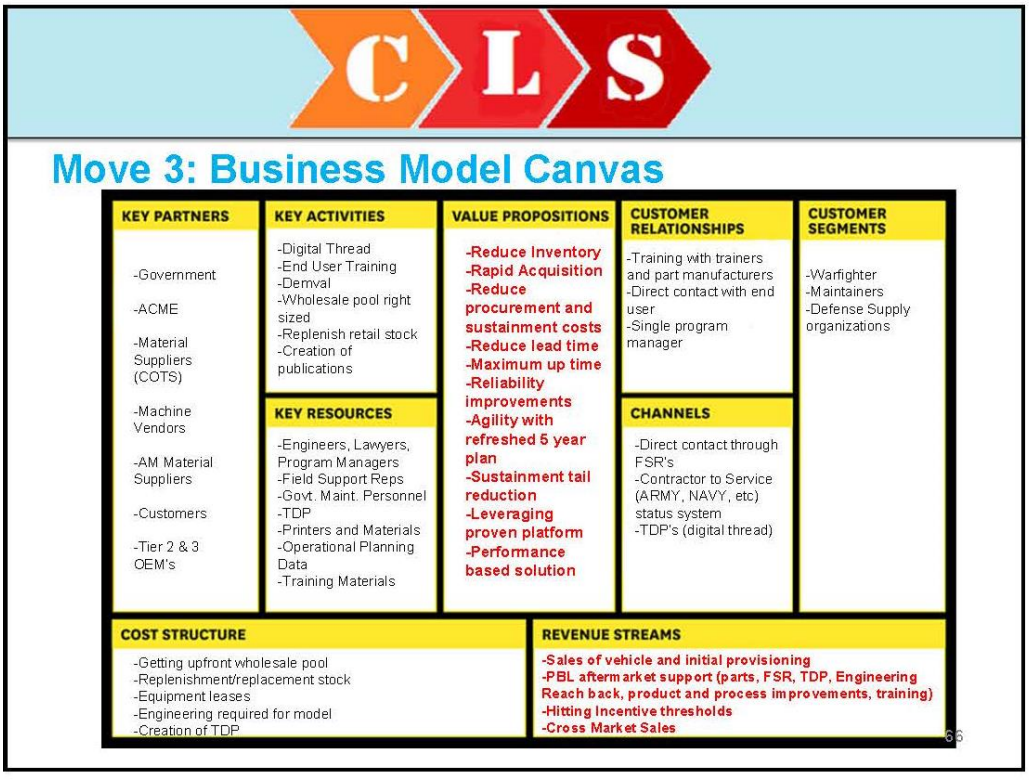

C L S
Acquisition Strategy Cont'd – Part 3
E. INCENTIVE OPPORTUNITIES
Reliability of components- potential $4 Billion in yearly costs just on 6 AM components
Availability of parts and materials
Performance improvements
Leverage best commercial practices
Exceeded fill rate
F. COMPETITION
Machines
Powder
After 5 years, everything can be competed
Evaluate TDP and IP rights to TDP in section L and M of the RFP
63


C L S
Move 2: Life Cycle Sustainment Plan
PRODUCT SUPPORT STRATEGY
I. Sustainment Strategy Considerations
1. Obsolescence Management
As the contractor makes a change will be captured as the TDP is updated
The govt is to lease the machines, as tech changes the govt will get newer machines
2. Competition in Sustainment
After the first 5 year period – re-baseline
3. Property Management
Govt owns the drones
Govt leases AM machines but not necessarily from ACME
Govt owns spares
Govt owns raw material
4. Cybersecurity
Understanding the flow of the TDP from Contractor to govt and where those handoffs happen
Contractor to deliver TDP for printing
64


C L S
Life Cycle Sustainment Plan Cont'd
5. How will facilities and infrastructure be brought up to a sufficient level to meet program requirements?
• Need sufficient space and access to power to locate AM equipment
• Recommend 8 x 50' van be replaced by two smaller options
• Contractor warehouse
6. Where will obsolescence be an issue, and how can it be mitigated?
• Govt will print in emergencies and surges
• Any enhancements will be manifested in TDP
• Leasing machines]
7. Metrics
• Fill rate for powder
• Fill rate for spares
• Reliability of parts
• Machine status (availability)
• Negotiate some exclusions (includes up to a class 1 change)
65


C L S
Move 3: Business Model Canvas
KEY PARTNERS
-Government
-ACME
-Material Suppliers (COTS)
-Machine Vendors
-AM Material Suppliers
-Customers
-Tier 2 & 3 OEM's
KEY ACTIVITIES
-Digital Thread
-End User Training
-Demval
-Wholesale pool right sized
-Replenish retail stock
-Creation of publications
KEY RESOURCES
-Engineers, Lawyers, Program Managers
-Field Support Reps
-Govt. Maint. Personnel
-TDP
-Printers and Materials
-Operational Planning Data
-Training Materials
VALUE PROPOSITIONS
-Reduce Inventory
-Rapid Acquisition
-Reduce procurement and sustainment costs
-Reduce lead time
-Maximum up time
-Reliability improvements
-Agility with refreshed 5 year plan
-Sustainment tail reduction
-Leveraging proven platform
-Performance based solution
CUSTOMER RELATIONSHIPS
-Training with trainers and part manufacturers
-Direct contact with end user
-Single program manager
CHANNELS
-Direct contact through FSR's
-Contractor to Service (ARMY, NAVY, etc) status system
-TDP's (digital thread)
CUSTOMER SEGMENTS
-Warfighter
-Maintainers
-Defense Supply organizations
COST STRUCTURE
-Getting upfront wholesale pool
-Replenishment/replacement stock
-Equipment leases
-Engineering required for model
-Creation of TDP
REVENUE STREAMS
-Sales of vehicle and initial provisioning
-PBL aftermarket support (parts, FSR, TDP, Engineering Reach back, product and process improvements, training)
-Hitting Incentive thresholds
-Cross Market Sales
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Move 4: Contract Administration

DELIVERABLE	COST TO GOVT.	COST TO BUSINESS	START	END STATE
30 year sustainment strategy, 5 year options (tech refresh)	Lower	Stable revenue, opportunity to increase overtime		
IP sufficient for sustainment/re-procurement	Cost Stability	Stable revenue stream, predictable		
Contractor Field Service Rep	Neutral	Neutral		
Warranty agreement for (TDP, Parts)	*Higher	Higher risk		
Access to historical data	Neutral	Slight increase in cost		
ACME provides spare parts	Lower	Stable revenue		
ACME provides publications	Lower	Stable revenue		
ACME provides training	Lower	Stable revenue		
All sustainable parts must be designed and qualified for AM process	Assumed	Assumed		
Design is reconfigurable to meet design compliance (DoD open architecture standards)	Increased cost dependent on complexity and performance	Dependent of complexity of integration of GFE		

*Does not include Government printed parts

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Challenges (List Specific Challenges by Discipline)

- Program Management:
  - New business Model
  - 5 Year tech refresh
  - Metrics
  - Configuration controls
  - Integration of COTS and GFE
- Legal:
  - Completeness and rights to TDP
  - **Commercial contract: add language to cover FAR gaps**
  - Define rights to open interface between GFE and COTS
  - Defining the rights to emergency prints for government printing
- Engineering:
  - Integration of sensors
  - Government printing (state of the technology)
  - **Creating the TDP (ACME)**
  - Long production time

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Challenges Cont'd (List Specific Challenges by Discipline)

- Logistics (Maintenance and Supply):
  - **Extremely high turn over of replacement parts**
  - Configuration Management
  - Operational maintenance data
  - Warehouse space (ACME)
  - Disruptive to traditional supply chains, different model
- Enterprise IT:
  - Secure storage and delivery of TDP
  - Establishing Digital Thread (distribution of data)
  - Interface between contractor and government information systems
- Contracts Administration:
  - Difficult OEM contracting with different services and agencies
  - Contract reconciliation for contractual performance metrics

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Final Thoughts

- AM streamlines incorporation of performance and reliability improvements and mitigates obsolescence
- Provides an alternative to reduce performance shortfalls
- AM is disruptive to commercial and DoD supply chains
- CLS is the way to go for a high level of operational availability, stable cost structure and product and process improvements
- **Low risk method for the government to enter the AM space**
- **CLS method has the greatest ability to offset high op-tempo needs**

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Additive Manufacturing Business Model Wargame II NET-FLIX Out-brief

Content

- Business Case / Model
- Team Composition
- Team Assumptions
- Deliverables and Results
  - Move 1: Compliance Matrix
  - Move 2: Statement of Work, Schedule, Technical Approach, Technical Data Package, Acquisition Strategy & LCSP
  - Move 3: Business Model Canvas
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- Challenges
- Final Thoughts

Business Case / Model

(#4) Team Net-Flix: Government purchases 1000 LWR drones from Acme

- Government and Acme setup Net-flix type of arrangement on "pay as you go" IP arrangement

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Team Composition

Name	Organization	Discipline
Capt. Armen Kurdian	U.S. Navy (Govt Co-Lead)	Program Management
Jim Regenor	Moog, Inc. (Industry Co-Lead)	Logistics (Mx and Supply)
Dana Ellis	NCMS (Facilitator)	Program Management
Debbie Lilu	NCMS (Coordinator)	Program Management
Jerrilee Degeus	USMC	Contracts Administration
Matt Brennan	Siemens	Enterprise IT
Todd Campbell	PricewaterhouseCoopers LLP	Program Management
Steven Dobesh	Joint Staff	Logistics (Mx and Supply)
Vincent Dothard	Lockheed Martin	Logistics (Mx and Supply)
Steven Dove	U.S. Navy OPNAV N4	Logistics (Mx and Supply)
Elizabeth Economou	ProMan Strategies	Logistics (Mx and Supply)
Barry Edelberg	Office of Naval research	Legal
Christopher Horny	NATO ACT Norfolk	Logistics (Mx and Supply)
Col. William McCauley	DLA Logistics Operations	Logistics (Mx and Supply
Stephen Michaluk	Department of Defense	Logistics (Mx and Supply)
Christian Norberg Dunn	FieldMade	Engineering
Wolfgang Petermann	PdM SKOT	Logistics (Mx and Supply)
Matthew Rigdon	Penn State Applied Research Lab	Engineering
Mark Rodriguez	Combined Arms Support Command, Fort Lee	Logistics (Mx and Supply)
Brandon Rubinc	NAVSUP Business Systems Center	Enterprise IT
Kenneth Sanders	Rock Island Arsenal	Program Management
Mark Shaw	GE Additive	Engineering
Tim Slabouz	USMC	Legal
Brandon Wegge	Boeing	Engineering
David Woessner	Local Motors	Program Management

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Team Assumptions

- Subscription Model
- Rights to anytime anywhere data
- End to end process. What it includes and what is being provided to the government
- Rapid advance of technology

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Move 1: Compliance Matrix

No.	Requirement	How compliance achieved	How well	Comments
1	Provide secure access for digital delivery	Acme provides access to controlled digital environment/portal through in-hand software/hardware (i.e. printing machine or laptop) containing library		(M) User access control, possible secure laptop, encrypted sharing portal, bi-directional communication to support demand signal, cyber security to verify/validate integrity of file.
2	Provide engineering support services	a) Stock design – Acme provides build requirements for library b) Engineering support for customized requirements		(M) Configuration management and traceability of the printed parts (serialization) and use of file. Timeliness with appropriate escalation scale.
3	Manufacturing as a Service (MaaS)	Acme provides process, training, equipment, software to achieve organic manufacturing: quality assurance		(S) Train the trainers, government manages training following initial cadre training. Need documented processes and tech manuals available, support equipment and machine maintenance and sustainment actions.
4	Capture of demand signal through full product lifecycle	Either access directly through equipment and software provided or electronic data interchange back to Acme.		(N) Where information is captured in supply system, ERPs, how Gov't communicates with Acme for product improvement, engineering changes, and lifecycle support; payment reconciliation.
5	Initial spare requirements	Initial provisioning based on mean time between failure (MTBF) historical data.		(N) Until government manufacturing capability is established.
6	Improve readiness by reducing post processing and manufacturing time and requirements.	Contractual terms to incentivize Acme.		(N) Material availability, Operational availability and materiel readiness

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Move 1: Compliance Matrix (cont.)

8	Incentivize ACME to reduce post processing time and manufacturing time (including reliability).	Incentivize ACME to reduce build time. Time to print NTE. Synchronization of the build.		(N) - Government will procure the post processing equipment. Year 1 - 3 ACME will provide field service representative and after year 3 100% government. Burden of ownership is on the government.
9	Subscription (# parts). If # parts are exceeded need to pay additional fee.	Availability of the package. Needs to be in all locations when needed. Accessible over the internet and accessible format. File size needs to be limited. Consideration - configuration management. Contract for capability or availability unlimited file access.		(M) - Consideration - reliability of the part. Determine how many parts will be printed. Different levels of subscription could be offered. Government would provide a monthly report for file access. Licensing arrangement needs to be negotiated.
10	Provide a suite of material and equipment. Manufacturing as a service.	ACME provides TDP for prevailing process and match government equipment (complete build file).		(M) - Need to make sure the powder is not corrupt at a FOB. ACME responsible for material handling of the powder. Measurement how often is there an unsuccessful build? Need to ensure software integrity.
11	Engineering sustainment – improve on requirement / capability on specific parts (high failure). Incentivize ACME (quality of parts).	Incentivize to increase the MBTF as well as performance envelope during the subscription period of performance.		(S) - Consideration - mission modification type of improvements.
12	Engineering services are required. Field service representative.	ACME will provide 24/7 technical support capability in addition to a field service representative. To include remote by ACME and diagnostics. ACME provides the diagnostics.		(M) - ACME will provide technical support when gov't is having difficulties printing a part (organic support).

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Move 2: Strategy

- Develop **technical approach, schedule**, and **statement of work** assuming that there are no technology related constraints.
- Determine content of a **Technical Data Package** (or packages).
- Possible that there might be several TDP's that vary over the term or phase of the contract
- Establish assertions and restrictions.
- Determine content of an **Acquisition Strategy and Life Cycle Sustainment Plan.**

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Move 2: Technical Approach

- Acme will identify, test and field an integrated data environment that will serve as the foundations for all configuration managed digital data associated with:
  - Asset Requirements
  - Engineering Data (models, reports, etc.)
  - Manufacturing Process information
- Acme will provide secure access to named individuals under a subscription service.
- The Acme IDE will serve as the portal for all subscribed and additional Engineering and Manufacturing support services as well as DoD field activity traceability.

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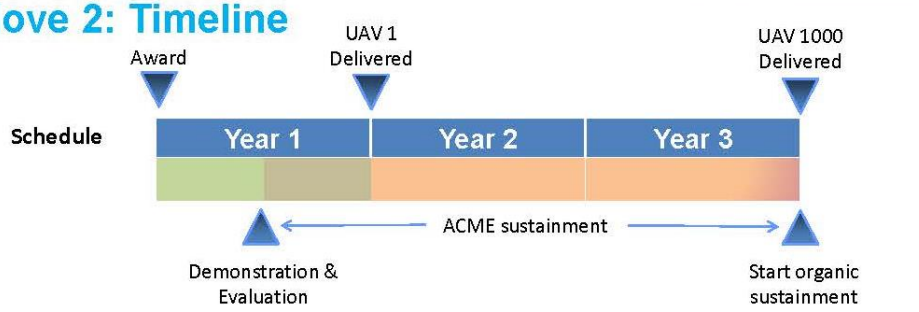
Move 2: Timeline



Tasks

- Develop, design, manufacture
- Demonstration, evaluation, qualification
- Production
- Production sustainment
- Organic sustainment

*Timeline pictured above is an example and may differ based on the Team's Sustainment Plan

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Move 2: Statement of Work

Starting with the list of major tasks below, provide the next of detail. The idea would be to associate cost with each of the tasks/subtasks.

Develop, design, manufacture	Acme Phase 1 is current commercial solution that's been proven and tested in the market.
Demonstration, evaluation, qualification	Total of $2,878,750 for acquisition. Demonstration entire aircraft for AM will include the requested five parts: propeller/blades, drive train, strong box, boom arms, and shroud. Qualify at customer site.
Production	Production is for 1,000 units over 3 years ($1.23B). Timeline is according to established 3 year delivery.
Production sustainment	Sustainment will provide spares in field. Cost is based on additional part requirements IAW the cost schedule.
Organic sustainment	Provision of entire TDP for independent government production after 3 years.

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Move 2: Technical Data Package

Requirement No.	Technical Data Description	Type of media	Source	Restrictions
1	CAD Models/Drawings	Any relevant format	Online access, restricted, secure Technical digital library	
2	Associated Lists	Any relevant format	Same as above	
3	Specifications	Any relevant format	Same as above	
4	Standards	Any relevant format	Same as above	
5	Performance Requirements	Any relevant format	Same as above	
6	Quality Assurance (QA) Provisions	Any relevant format	Same as above	
7	Software Documentation	Any relevant format	Same as above	
8	Packaging Details	Any relevant format	Same as above	

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Move 2: TDP Discussion Points

1) Where will the technical data be stored?

Type of Media
Online access restricted secure Technical digital library

Source
Acme plus alternate site for redundancy

Restrictions
Certified operators, restricted user access

2) How will the TDP be transported and secured?

Type of Media
Encrypted data at rest, file itself is encrypted

3) How will updates and configuration management be handled?

Type of Media
Available via secure online system

Restrictions
Government will approve engineering change

4) What guidelines will be imposed on use?

Type of Media
Delivered from online file

Source
Manufacturing in accordance design specifications for use/manufacture

Restrictions
Same guidelines as conventional manufacture; possible void of warranty if making changes contrary to guidelines

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TDP Discussion Points Cont'd

5) Will the TDP be available to the Government?

Source

Current list is required, but insufficient relative to additive manufacturing

Restrictions

Not in totality, but software will be delivered to build the product

6) If so, under what conditions:

a) Government already purchased access
b) Government will need to purchase access
c) Government can "lease" temporary access
d) Government will not have access.

a) Subscription service; fundamental tech data package defining req'ts; when in field Acme is providing a minimum production derivative
b) Government would purchase first run access; data/technology package outright for long-term takeover of production
c) Acme-provided equipment, materials
d) No specifications for flying aircraft

Manufacturing data "know-how" is most challenging to transfer.

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Move 2: Acquisition Strategy

A. BUSINESS MODEL

a. What is the value proposition for the Government? Doing it via AM.

i. Reduce inventory position & the benefits that come with that for going forward deployed. Increased readiness, eradicate or significantly reduce down time. Government buys what they need when they need it (less outlay). Develop just in time / on demand type of delivery whether from organic or vendor source. Reduce waste / less unused items. Reduce storage / inventory cost. Reduce logistics footprint.

ii. Risk reduction & eliminating or reducing variation in failure rates for parts. Having the certainty of how long a part will last.

iii. More flexibility for engineering changes (could be bad if not implemented right, don't want to lose control).

iv. Trained workforce in AM, for future efforts.

v. Higher A_o.

vi. Moving support to point of need.

vii. Success of this model could apply to larger efforts and future acquisitions.

b. What are the contracting strategies or contract types? What are issues that need to be address & how are you addressing them? (e.g., 'Liability' may be an issue, but don't just say "We will address 'Liability.'" What is your solution?)

i. Potential contract types. IDIQ for I.P. PBL-type with demand bands on how many times you print.

ii. Multiple contract line items with each CLIN having a different cost/price structure.

1. Fixed price for subscription & set allowance (one charge) plus over-use (second charge) or subscription for the data (one charge) and use beyond a certain amount…cost per print (second use).
2. Incentives – Govt incentive fee for high reliability (negotiated). Could be if government doesn't need to print too many, higher reliability on the drone. Feedback via demand or negotiated to ensure validity of demand and print. Restriction on the government to number of existing parts, failed parts need to be documented / returned something similar.
    a. The incentive could be inherent in the single price subscription that includes unlimited or some block amount of printing; if the vendor can improve reliability, that's less items government needs to print, and maybe less they would need to pay for follow-on subscription fee. Plus, vendor gets no benefit from the government paying for per-prints (i.e., would be a disincentive for vendor to increase reliability because they'd want to sell as may per-prints as possible).
3. Cost plus for engineering services to a ceiling
4. Fixed price for machines, feedstock, support equipment. Cost plus for setup, initial cadre training.

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Move 2: Acquisition Strategy (cont.)

A. BUSINESS MODEL (cont.)

c. What are the metrics against which the success or failure of the model will be evaluated?

i. Number of failed parts that need to be replaced, how many times is the customer printing the part—is the customer printing it right. If government keeps printing wrong, ACME not liable.

ii. Number of parts not available w/in a needed timeframe (defined in contract, could be 4 hours, 6 hours, etc.) Number of failed parts on build…how many parts has the government made that failed not due to government fault? Legal issue. Squishy. If process is documented wrong, who is liable? Build file needs to be verified and validated by the government.

iii. Have the machines been properly maintained & calibrated? How is that documented to demonstrate to the vendor?
Material properties of the powder / build material. That data may need to go back to ACME. ACME has provided process & controls, the government needs to take on that liability.
Where would the vendor be liable if a part failed…that may need to be further looked into.

iv. Machine performance monitoring. Might be automated…sent back to vendor w/o human interaction.

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Move 2: Acquisition Strategy

B. RISK MANAGEMENT (risk cube is not necessary)

a. *Technical risks*
   i. Part quality insufficient at forward deployed units
   ii. Corrupted data file
   iii. Cyber-risk
   iv. Machine failure (how long to repair by machine vendor)
   v. Material quality or availability
   vi. IT connectivity (printing feedback, demand capture, secure data transmission)

b. *Programmatic risks (cost & schedule)*
   i. Physical data loss
   ii. Training insufficient
   iii. Loss of expertise w/in Service
   iv. Depots aren't set up to receive machines, modifications to existing facility
   v. ACME goes out of business

c. *Address what your mitigation measures are, or contingencies*
   i. Monthly audit or feedback on prints. Build audit trail
   ii. Joint access to build reports & print metadata
   iii. Scaling of feedstock purchase…
   iv. Using only ACME provided feedstock (especially if developed standards don't exist yet)
   v. Develop feedstock & AM standards

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Acquisition Strategy Cont'd – Part 2

C. INTELLECTUAL PROPERTY

Break down how I.P. will be categorized, i.e., drawing, methods build files, etc.
- 3-D drawing package
- Parameter list
- Processes
- Manuals / ACME documentation
- Build instructions

How will the Government manage I.P.?
- Who will own it – ACME

What are the appropriate level of data rights
- Restricted rights in software & limited rights in technical data & documentation, i.e. user manuals, computer operations for machines.
- Would need copyright release for manuals
- Preferably, would want GPR, this is normal for non-commercial items. But vendor will not give those out of the gates.
- For commercial items, government could still ask under 252.227.7015 for better rights.
  - Require form fit function data for components, item or processes
- 7020 clause for rights in special works, make sure cited in your contract. Nevertheless those technical data rights clauses are still inherent in every contract.
- Schedule for licensing fees as appropriate as a solution for proprietary data. This is essentially the subscription model; the licensing fee could be one set fee for all items and unlimited printing, limited printing, or per print.
- If ACME goes out of business or decides no longer to support, TD would be held in escrow and turned over to government for GPR.
- Government reserves exigent rights in military purpose or urgent situation

Show a matrix or table of points in the acquisition cycle and what data rights and data packages the Government needs to have

- Production start to end. Prior to completion of 1,000th unit (FOC), government does not require any data rights. ACME providing sustainment.
- At FOC, government gets the restricted / limited rights specified above for the full up TDPs that would be used at the large depots or FRCs. (assumption is that from contract award to FOC, the initial cadre training and FRC/depot buildup is occurring).
- At some period following FOC (possibly 2 years), would need restricted / limited rights for TDPs to be made at remote locations, forward deployed depending on constraints provided by the government (i.e., constraints to power, storage, SWaP, etc.)
- After a longer period of time, possibly 10 years, government would negotiate for GPR or additional license rights to build new items or compete to other 3rd party vendor.

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Acquisition Strategy Cont'd – Part 2

D. REQUIRED TEST ACTIVITIES

a. *Should there be an Operational Test Period, and if yes, briefly discuss successful OT criteria. In your response only consider AM specific or related items, i.e., not the GFE.*

i. OT of the printer, material, capability of the people.
ii. OT of the logistics chain
iii. Val/ver of the manual & process to build parts by actual maintainers / fleet / service users.
iv. Test operational or field service rep support response
v. Logistics supportability / maintainability will be the key areas here with regard to AM
vi. Interoperability – allied partners. Standardization of data files.
vii. Can't guess at those details here. Field support. Consider this maybe for follow on wargames? Parking lot idea.
viii. Transportation / demonstration support area.
ix. Select one CONUS or unit co-located w/large depot & one field unit
x. TAT to make a part
xi. # of required machines
xii. Time to service machines
xiii. Ability of machines to make part as advertised by ACME
xiv. Does the documented process provided by vendor result in a 'good' part. i.e., meets spec, Q&C, serialized, providence.
xv. Does it fit in the aircraft & can I go fly the drone.

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Acquisition Strategy Cont'd – Part 3

E. INCENTIVE OPPORTUNITIES

a. *How can the vendor be incentivized? (could be incentive, graduated or straight up award fee)*
   i. Fee for high reliability
   ii. Fee for high OT scoring
   iii. W/in a certain time period (needs to be defined, but possibly first few years after deployment), fewer calls for support (i.e., less calls to a hotline), or minimal FSR support, or qualitative feedback on support/engineering services provided.
   iv. Less problems on the floor, less training issues.
b. *Where are opportunities for the government?* – this was the value proposition already laid out above.

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Acquisition Strategy Cont'd – Part 3

F. COMPETITION

a. *Understanding that ACME is contracted to build the drone, and any other activities they will perform per your model, are there opportunities for competition*
   i. Materials (feedstock)
   ii. Machines (remember ACME's machines are tied into their process, so there's added costs to changing machines)
   iii. Future drone competition, applying lessons learned from this effort

b. Production Contract: FP
c. Initial Sparing: FP
d. Engineering Services: CP
e. Subscription (everything): FP + maybe IF?
f. Metricize readiness, flight hours
g. Government incentivizes ACME to make strong parts that don't fail
h. Subscription + per print: FP
i. OEM incentivized for government to make as many parts as possible
j. Training: CP
k. DS Technical Assessment Task look it up. MAC IDIQ – supports w/s, liability, maintainability, interoperability, supportability, energetics, etc. You can quickly add tasks and money if it fits the profile of the overall effort.
l. Operating conditions should be specified
m. FSR may come in to say, government you are doing it wrong. Can't control the austere environment, but can you design the support structure to survive in that environment. i.e., sensors on the machine, environmental controls, proper sustainment of the machine.
n. Also, parts made in expeditionary environment may not last as long…that may be by design! The 'good enough' solution until a better one can be shipped in.

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Move 2: Life Cycle Sustainment Plan

PRODUCT SUPPORT STRATEGY

I. Sustainment Strategy Considerations

1. **Obsolescence Management - Consider manufacturing process obsolescence. View not on the part itself and focus on the process. Another option is to reverse engineer the part. If ACME decides that want to stop supporting.**

2. **Competition in Sustainment – If ACME decides not to support at the end of the subscription period the government has the option to procure from a different source.**

3. **Property Management – Assumption - Government owned contracted operated. At the end of the subscription the government has the ability to purchase the TDP per perpetuity. Assumption the drones are repurposed (de-mil).**

4. **Cybersecurity - The government should provide consideration for IP protection. Files should be transferred on a secure network (encryption based on integrity of the file). ACME should provide the file with counterfeit mitigation / cybersecurity considerations. Need to know if anywhere in the process has been compromised whether maliciously or inadvertently.**

5. **Other Sustainment Considerations – What is the repair level of the UAV? Where will the repair level take place? Assumption – printing new parts at point of use - operator level. Don't need special tools. Commercial reliability is the threshold. Government is final authority of the process and accept the part (determining authority for the viability of the part). When government initiates the subscription process, the government conducts a log demo and validates the process. Assumption the drone is disposable. ACME is responsible for mfg services and the integrated logistics support.**

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Life Cycle Sustainment Plan Cont'd

Cover items such as your basic sustainment support strategy, the short and long term plan to support the drone through life, including repair, consumables, and improvements for ALL aspects of this acquisition program. Consider all phases of the drone's Concept of Employment.

- **Short Term Plan – 0 – 3 years, year 1 100% CLS, year 2 30 – 40%, year 3 20%, year 4 100% organic. Year 1 mx and training, year 2 cut back on mx support by 50% and continue training same level as year 1, year 3 cut back mx support is converted to logistics LAR and QC gov't training only; year 4 – 100% organic.**
- **Long Term Plan – Organic and long term support. Individual licensing by component based on consumption.**
  - **How will facilities and infrastructure be brought up to a sufficient level to meet program requirements? Facilitate the use of and provide explosive proof and environmentally controlled shelters (minimum 2 (1 for storage and 1 for production (per fielded location) for part production. Manufacturing as a service – would establish infrastructure required for quality part production. Develop logistics footprint 8 x 50' (configurable in 3 (20') containers). Need to secure test equipment and special tools. ACME will supply tech diagnostic and prognostic equipment.**
  - **Where will obsolescence be an issue, and how can it be mitigated? Only consideration would be for process obsolescence due to the short duration of the contract.**
  - **Need to maintain an x% mission capable rate (need to ensure proper spares are maintained). ACME needs to meet the mission capable rate.**

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Move 3: Business Model Canvas

KEY PARTNERS
- Govt Program Office, Users, FAA: Reqts Dev/ Verification/ Testing
- Equip/Material Mfg (training) & Distro
- Software Vendors (digital thread)
- Data Storage Providers (Infrastructure)
- Commercial customers

KEY ACTIVITIES
- Production & Sustainment Process
- Development/Qualification
- Secure Data
  - Storage and Transfer
- Training
  - Validation/Verification/ Testing
  - Equipment distro and setup
  - User feedback
  - Total Asset Visibility
  - Product Updates
  - Initial Parts Provisioning

KEY RESOURCES
- Secure & stable IT infrastructure
- Human Capital (FSR, AM Artisans, Material Scientists, etc)
- Proven Cust Relationship Mgmt process
- Robust & stable supply chain
- 5 year sustainment plan for current & future business

VALUE PROPOSITIONS
- Technological enhancements
- drone availability
- 24/7 Subscription based service
- On demand part (JIT)
- Mitigate counterfeit parts
- Optimize delivery
- Reduce logistics /inventory footprint
- Transitioning to on demand consumption cycle (acquisition process)
- Elevate education and training govt workforce

CUSTOMER RELATIONSHIPS
- Direct relationship with govt.
- Expand beyond current Subscription
- Offer cost share on NRE and new design (value engineering)
- Establish trust
- Increase reliability
- Tradeshows
- Direct Engagement WG
- Equipment demonstration

CHANNELS
- Awards/contests/MIC
- Competing with the service bureau up front procurement govt could rev eng part, advertising – NDIA, tradeshows, direct eng. Wargames, equipment Join CTMA, PBL

CUSTOMER SEGMENTS
- Creating value for DoD
- Creating value For Customer,
- Shareholder and
- Constituents
- Better value
- Remove non-value added
- Portions.
- Result – higher Profitability and Lower cost to the DoD
- Gov't has infrastructure in place

COST STRUCTURE
- (Highest/Most important) Production & Sustainment
- Corporate investment in Non-recurring effort (NRE)
- Machines & Materials
- IP & IT data rights/infrastructure

REVENUE STREAMS
- Improve readiness (cost per day of availability),
- Subscription model, manufacturing as a service, mitigate counterfeit parts, end to end security on the network through production
- Continuous access to the parts catalog, turn key operations, reduce log footprint, increase agility. Provide redundant capability in theater.

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Move 4: Contract Administration

Technical Approach	Terms and Conditions	Assertions	Warranty	Liability	Cost
Initial Sparing and provisioning (Bridge)	**APPLIES TO ALL TECHNICAL APPROACH** 1. Data Right clauses a. Patent indemnity clause FAR 52.227-3(alt I or II) b. DFAR 252.227-7015 - Commercial Rights and Technical Data, c. DFAR 252.227-7017 - Identification and Assertion of use, release, disclosure restriction, d. FAR 52.227-1 - Authorization to consent clause	Transactional	Standard warranty for provisioning. Commercial equivalent.	Standard ACME Liability	5%
Buying of turn-key solution for DoD organic facility - providing TDP, training, and end-to-end process (does not include product updates). Includes printer, files, materials, etc.	Standard contract Ts and Cs for services	Transactional / Commercial licences, firmware, software, etc.	Standard commercial warranties on machines and support equipment. Extended warranty could be negotiated.	Liability extended to ACME if process was followed.	45%
Provide digital library	Transportable in a cyber secure environnent	TDP - DFAR 252.227-7015 - Commercial Rights and Technical Data,	Data warranty, cyber protection, data validation	ACME to ensure the build file is usable, current and accurate. If ACME does not comply with requirement, ACME is liable.	10%

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Move 4: Contract Administration (cont.)

Technical Approach	Terms and Conditions	Assertions	Warranty	Liability	Cost
a. Subscription (cloud) i. Blanket subscription unlimited use ii. Basic subscription b. CD/Laptops			Standard commercial warranty		10%
Engineering Services includes the config mgmt, product updates, product improvements, FSR support, SW/FW parameters, etc.	a. Agreed clause for commercial license for the printer b. Response time metric (variable) c. Standard contract Ts and Cs for services	Data rights can be negotiated on updates and/or modifications	Warranty applied to outcome	Negotiated liability between ACME and government	40%

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Challenges

- Leadership adoption of subscription business model
  - Lack of historical data for this business model
- Demonstrating value above traditional methods/processes
- Greater reliance on connectivity and the digital network
- Potential for new ground on liability issues (paradigm shift)
- Rules of acquisition need to be reexamined

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Final Thoughts

- ACME is optimizing the supply chain by providing services and capabilities based on a pay for service model to meet a specified level or capability. The subscription model can be tailored to meet demand
- Delivering just in time readiness by synchronizing supply and demand
- Reduce cost, increase performance and improve performance schedule
- Public / Private Partnership

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Appendix E. Abbreviations

AM	additive manufacturing
AMMO WG	Additive Manufacturing for Maintenance Operations Working Group
CLS	commercial logistics support
COTS	commercial off the shelf
DFARS	Defense Federal Acquisition Regulation Supplement
DoD	Department of Defense
FAR	Federal Acquisition Regulation
FSR	field service representative
IP	intellectual property
ISR	intelligence, surveillance, and reconnaissance
LCSP	life-cycle sustainment plan
OEM	original equipment manufacturer
PPP	public-private partnership
RFP	request for proposal
RLW	reconnaissance lightweight
TDP	technical data package
UAV	unmanned aerial vehicle