• Benefits of the Schedules Program
• GSA’s Strategic Vision for 3D Printing/Additive Manufacturing
• Keynote Speaker: Dr. Peter C. Liacouras, Walter Reed National Military Medical Center
• Break
• Industry Capabilities
• Lunch
• Keynote Speaker: Lester Hitch, United States Army, Aberdeen Proving Ground
• MAS Proposal Submission
• Promoting GSA to the Customers
• Federal Marketing Opportunities
• Closing Remarks
Benefits & Advantages of Using GSA’s Multiple Award Schedules (MAS)
Key Benefits

- Fast, flexible, cost-effective procurement solution
- Brings together thousands of federal customers and vendors.
- An agency receives the best value and knows the vendor has been vetted and are fair and reasonable.
- Contracts are fully negotiated.
- FAR 6.102(d)(3) – states use of MAS is a competitive procedure.
Benefits (Continued)

• Dedicated Team (unprecedented)
  • Contract Specialists & Officers dedicated to the success of this initiative.

• No need for a prospective contractor to research which Schedule or Special Item Number (SIN) they should propose under. We’ve done this for you.
Time Benefit MAS Contracts Provide

- Using the Multiple Award Schedule (MAS) Program significantly reduces acquisition time.
  - Orders can be awarded in days rather than months.
  - Competition is streamlined
  - Easy access to the right industry partners.
  - Streamlined Blanket Purchase Agreements (BPA) procedures.
Opportunities MAS

- A premier acquisition vehicle in government, with approximately $40 Billion a year in spending
- IWACenter averaged over $2.6 Billion annually between FY08 – FY15
General Service Administration
3D Printing/Additive Manufacturing
(3DP/AM)
Total Solution
3D Printing includes printers; ancillary equipment, technical services and supplies required to generate functional prototype images and printed objects. Equipment may include all classes and sizes of 3D Printers, laser imaging devices, post processing devices and ancillary accessories and software to produce functional items. Technical services include but are not limited to: 3D Printing and laser imaging to produce a digital file used to generate functional prototype images and printed objects. All types of consumables and other items related to this SIN are included.
- 3DP/AM Total Solution not captured.
- DoD estimated spend for FY17-FY19, $3.8 billion.
- Defense Appropriations FY15 Committee Report “Committee encourages the Secretary of Defense to research creative applications for AM technology.”

Source: Defense Systems Information Analysis Center
Strategic Vision for 3DP/AM

A comprehensive group of 3DP/AM products, and services that can equip a new or retrofit an existing 3DP/AM machining center that covers the manufacturing life-cycle from design concept-to rapid prototyping-to mission critical part.
Ten elements define our Total Solution approach.

1. Software
2. Metrology
3. Materials
4. Additive Processes
5. Post Processing
6. Additional Equipment and Systems
7. Accessories
8. Construction Services
9. Ancillary Services
10. Service Providers
Software Applications
“Digital Thread”
Metrology
“The Science of Measuring”
Materials
“The Usual Suspects and More”
Additive Processes
“The Elite Eight”

1. Directed Energy Deposition (DED)
2. Electron Beam Welding
3. Powder Bed Fusion (PBF)
4. Binder Jetting
5. Material Extrusion
6. Material Jetting
7. Lamination
8. Stereolithography (SLA)
Accessories, Additional Equipment, and Systems “As Required”

- Any product or system that ensures personnel and workplace safety while maintaining the design intent and integrity of the finished part and equipment.
Post Processing
“Finished Part”
Ancillary Services

- Equipment Training – Initial and On-Going
- On-Site Maintenance Response
Service Providers
“Reverse Engineering, Prototyping, Part Production”
Promote savings by leveraging the federal government's buying power.

Established relationships with industry partners.

Assisting federal agencies in meeting their operational mission requirements.

Development of subject matter experts within the 3DP/AM industry.

Effective use of the MAS program.

Expediting award of contracts.
GSA 3D Printing/Additive Manufacturing Solutions

Managed By:

GSA Region 3
Federal Acquisition Service
Integrated Workplace Acquisition Center

3D Printing Solutions
Schedule 36 SIN 51.400
Phillips / 3D Systems and On Demand Parts

Introductions:
Gary Bredael
Tim McClanahan

GSA Schedule
Contract: GS-03F-080CA
Full line of 3D Systems Printers, consumables, and Geomagics
A Little about Phillips Corporation
Phillips Corporation is a family run machine tool business founded in 1961. Originally named Phillips Machinery and Supply, we sold industrial supplies and light machine tools to local industry. Today, Phillips Corporation is an International leader in the manufacturing technology field.

Federal Division worked with the Federal Government exclusively for almost 60 years and has never defaulted on a contract.

Federal Division was the first machine tool dealer to secure a GSA Contract.

Federal Division partnered with the United States Army to provide mobile machine shop sets to overseas campaigns.

Federal Division has been a partner and GSA dealer for over 20 years.
3D Systems
3D Systems is the inventor of 3D Printing. 3D Systems provides the most advanced and comprehensive 3D digital design and fabrication solutions available today, including 3D printers, print materials and cloud-sourced custom parts.

“On Demand Parts”

manufacture the future now
The Perceptual Design Pie

- Scan
- Model
- Inspect
- Print
Idealized from Damaged

Make **Good Parts from CAD**

Make **Good Parts from BAD**

*Parts from imperfect Physical Examples*
With Verified fidelity
Additive Manufactured Projects

Honeywell T Hawk

Raytheon AQS – 20 Minesweeper

LOGOS – Kestral
Direct Metal Example

GE LEAP Engines
3D Printed Fuel Nozzle

25% Lighter
5 times more durable
More Fuel Efficient
PROFESSIONAL
Price: $20,000 - $325,000

PRODUCTION
Price: $300,000 - $975,000

Lower price points
High Performance
Question and Answer session

Thank you for your time and we look forward to serving you.

Gary Bredael, Tim McClanahan
Additive Manufacturing via Functional Parts Manufacturing.

GSA Additive Manufacturing Industry Day.

Bill Cowan
Sales Manager
EOS REP Mid Atlantic Region
December 2015
• Tuckahoe 35 years Machine Tool Distribution.
• Small Company Women owned representing:
  • EOS: GSA Contractor, and Representative Mid Atlantic States.
  • Additive manufacturing metal and plastic.
  • Functional Parts.
• GF Machining Solutions: GSA contract holder for:
  • Mikron High Speed Milling Machines.
  • Agie Charmilles EDM’s.
  • Laser Texturing.
3D Printing Machines and Powders on GSA-Advantage

The EOS products on GSA-Advantage are all of the current EOS metal and plastic machines. Also all of the EOS and ALM powders are on the schedule.

EOS Materials Plastics
ALM Materials Plastics
EOS Materials Metals

https://www.gsaadvantage.gov/advantage/s/search.do?q=24:STUCKAHOE+TRADING+INC&searchType=1&db=0
EOS: Technology and Market Leader for Design-Driven, Integrated e-Manufacturing Solutions

- **Family-owned**, founded in 1989,
- Headquartered in Krailling near Munich, Germany
- **Integrated solution provider for Additive Manufacturing**
- **Solution portfolio**: Additive Manufacturing (AM) systems, materials (plastics and metals), software and services
- **Complete end-to-end solutions**: from part design and data generation to part building and post-processing
- **EOS enables competitive advantages for a variety of industries**, such as medical, aerospace, tooling, industry, lifestyle products and automotive
- **EOS is committed to**: **Innovation – Quality – Sustainability**
EOS: Global Presence

EOS worldwide installed base

> 1,600 systems

- ⅔ Metal systems
- ⅓ Polymer systems
- 266 customers with more than 1 system

EOS global footprint

- Customers in 51 countries
- EOS Sales & Service offices in 11 countries, distribution partners in 22 countries
- More than 500 employees worldwide (74% Germany, 26% International)
- Strong patent portfolio: More than 700 active patents in nearly 100 patent families
- R&D spendings of approx. 15% of Sales

Source: EOS. Installed base (includes purchased and rented systems) as per 12/2013. Staff figures as per 09/2013.
GSA and Additive Manufacturing:

- Separate Schedule for 3D Printing Additive Manufacturing:
  - Schedule 36, Category 51 400

- Public Private Partnerships
  - America Makes
  - DARPA
  - DOD
  - FDA, NIST, FBI, LOS Alamos Labs etc.
Why should our government be interested in additive manufacturing?

1. Increase speed of development. Ex. NASA, DOD, National Labs, DARPA, FDA.

2. Increase Speed to manufacture critical parts. Ex. DOD


4. Manufacturing Drones.
Why is Additive Manufacturing (AM) a Game Changer?

<table>
<thead>
<tr>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Faster “Time-to-Market” combined with shorter lifecycle</td>
</tr>
<tr>
<td>- Customization of products</td>
</tr>
<tr>
<td>- Differentiation by customer value add</td>
</tr>
<tr>
<td>- Cost pressure</td>
</tr>
<tr>
<td>- Increased flexibility in production (&quot;factories around the corner&quot;)</td>
</tr>
<tr>
<td>- Increasing focus on sustainability</td>
</tr>
</tbody>
</table>

CJ Howard rock climbing in California with his DMLSTM customized rock climbing prosthesis grown in Ti64 material
Slovakian healthcare pioneer relies on EOS technology for patient-specific cranial implants

**Medical**

- **Challenge**
  Provision of technology and material for the production of precision implants for cranial, jaw and facial bones using Additive Manufacturing.

- **Solution**
  The manufacture of customized, patient-specific implants from biocompatible titanium alloy, using the EOSINT M 280.

- **Results**
  - Patient-specific: form precision leads to reduced side-effects
  - Efficient: lower error-rate during production and constant manufacturing costs with increased precision
  - Approved: implant registered by the Slovakian State Health Authority (SIDC)

Source: CEIT Biomedical Engineering, s.r.o.
What Phase Are We In?

"The Chasm"

Innovators
Early Adopters
Early Majority
Late Majority
Laggards

Technology Adoption Lifecycle

Area under the curve represents number of customers

Courtesy: Geoffrey A. Moore, “Crossing The Chasm”
What is DMLSTM®? Direct Metal Laser Sintering

Functional principle:
Parts are produced by layer-wise application of powder and exposure to a laser

Materials: plastic, metal, and sand
Machine In Action
Laser Sintering Benefits Major Industries

Aerospace

Automotive

Industry

Lifestyle

Medical

Tooling

Sources (upper, left to right): Morris Technologies; M. Kandler, Frauenhofer IPA; Festo; (bottom l. to r.): WITHIN Labs/EOS; EO
Our technology activities are seamlessly linked to our strategy resulting in various challenges

EOS: Strategy basis and resulting challenges

Balanced triangle

- Process
- Material
- System

- Part quality
- Process robustness
- Industrialization

Effects

In dependency to each other

Hurdles to overcome

- Process Robustness
  - Build platform
  - Several jobs
  - Several machines
  - Several suppliers

- Industrialization
  - Automation
  - Quality assurance
  - Easy-to-Service
  - Productivity

Part Quality
- Mechanical properties
- Dimensional accuracy
- Surface quality
- Density
The ParameterEditor Allows to Change Parameters for Process Development

EOS ParameterEditor

Package includes licenses for
- Baseline: parameter values for available layer thickness for respective material
- ExposureEditor: editing functionality
- Material: machine settings and controls (EOS ParameterSet(s))

Flexible and Open
1. Select from multiple exposure types for pre-exposure, skin, core, contour and supports
2. Edit multiple parameters per exposure type such as laser power, scan speed, hatch
3. Assign to entire job and/or each part

Over 240 editable parameters
What Can Be Edited?

Global modifications

- Global beam offset
- Focus/defocus: exposure per part or per layer
- Material (via PPP-Job)
- Gas flow (LAS 400N)
- Scaling in X,Y,Z
- Defocus (beam expander wheel)
- Powder feed
- ...

Parameter set consisting of

- Contour parameters upskin
- Contour parameters inskin
- Contour parameters downskin
- Hatching parameters skin
- Hatching parameters core
- Support parameters

For the areas above the parameters on the right can be varied

Parameters for every area

- Contour parameters
  - Number of contours
  - Laser power
  - Scanner speed
  - Beam offset
  - Pre-/postcontour

- Hatch
  - Laser power
  - Scanner speed
  - Line distance
  - Beam offset
  - Hatching strategy
  - Stripe width
  - Skywriting

- Thickness of skin and core
The modular EOS monitoring solution covers the key factors to ensure highest product quality

### System Monitoring
- Monitoring and controlling all system settings and process parameters
- Ensuring optimal machine and process conditions as a prerequisite for highest part quality

### Powder Bed
- Recoating quality
- Exposure quality
- Correlation to metallurgical and mechanical properties
- Dimensional conformance (part accuracy and detail resolution)

### Melt Pool
- Energy input
- Homogeneity of melt pool
- Temporal behavior of light (e.g., Nachglühen von Spratzern)

### Optical Tomography
- Energy input (Streckenergie)
- Direct correlation to metallurgical and mechanical properties
- Dimensional conformance (indirect)
In-Build QA/QC is an essential element for a holistic Quality Assurance System for DMLS
Value Add: Risk reduction

Risk reduction is a key aspect when moving DMLS towards production – together we can reduce it to a minimum.
Complex Metal Parts

Source: EOS GmbH
EOS Pursues a Platform-Based DMLSTM Strategy—From R&D to Production

**Large scale Production Platform**

- Semi-automated processes
- Modular concept
- Single field with 1kW laser
- Multi-field with 200/400W lasers
- XL build chamber (400x400x400mm)

**Focus on production**

**Focus on flexibility**

- Designed for flexible material exchanges
- 200 / 400 W laser
- Build chamber (250x250x325mm)

**R&D / small scale Production Platform**

- Develop & qualify applications
- Freeze system settings for production
- Produce small scale volumes

**Focus on application**

- Adapted system to match requirements of specific applications
- Dedicated materials and parameters (e.g. gold)

**Application specific**

- Scale up for production
- Adapt to application
# Materials for EOSINT M systems

<table>
<thead>
<tr>
<th>Name of material</th>
<th>Material type material</th>
<th>Typical applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOS MaragingSteel MS1</td>
<td>18 Mar 300 / 1.2709</td>
<td>Injection moulding series tooling; engineering parts</td>
</tr>
<tr>
<td>EOS StainlessSteel GP1</td>
<td>Stainless steel 17-4 / 1.4542</td>
<td>Functional prototypes and series parts; engineering and medical</td>
</tr>
<tr>
<td>EOS StainlessSteel PH1</td>
<td>Hardenable stainless 15-5 / 1.4540</td>
<td>Functional prototypes and series parts; engineering and medical</td>
</tr>
<tr>
<td>EOS NickelAlloy IN718</td>
<td>Inconel™ 718, UNS N07718, AMS 5662, W.Nr 2.4668 etc.</td>
<td>Functional prototypes and series parts; high temperature turbine parts etc.</td>
</tr>
<tr>
<td>EOS CobaltChrome MP1</td>
<td>CoCrMo superalloy</td>
<td>Functional prototypes and series parts; engineering, medical, dental</td>
</tr>
<tr>
<td>EOS CobaltChrome SP2</td>
<td>CoCrMo superalloy</td>
<td>Dental restorations (series production)</td>
</tr>
<tr>
<td>EOS Titanium Ti64</td>
<td>Ti6Al4V light alloy</td>
<td>Functional prototypes and series parts; aerospace, motor sport etc.</td>
</tr>
<tr>
<td>EOS Aluminium AlSi10Mg</td>
<td>AlSi10Mg light alloy</td>
<td>Functional prototypes and series parts; engineering, automotive etc.</td>
</tr>
<tr>
<td>DirectMetal 20</td>
<td>Bronze-based mixture</td>
<td>Injection moulding tooling; functional prototypes</td>
</tr>
</tbody>
</table>

Further materials are under development IN625, Hastalloy X, 316L....
EOS Systems for the Additive Manufacturing of Polymer Parts

**FORMIGA P 110:** Compact system for RP applications and small series

- Usable build size:
  - Width 200 mm
  - Depth 250 mm
  - Height 330 mm
  - Max. volume: 16.5l per build

- Main properties:
  - Highest detail resolution and final part accuracy
  - Production flexibility
  - Small machine footprint (1350x1040x2200 mm) for fit into every production environment

**EOS P 396:** Productive mid-volume polymer laser sintering system

- Usable build size:
  - Width 340 mm
  - Depth 340 mm
  - Height 600 mm
  - Max. volume: 69.4l per build

- Main properties:
  - The “workhorse” in the mid-volume segment
  - High mechanical homogeneity across full build volume thanks to EOSAME feature

**EOSINT P 760:** Largest build volume for polymer parts

- Usable build size:
  - Width 700 mm
  - Depth 380 mm
  - Height 580 mm
  - Max. volume: 154.3l per build

- Main properties:
  - High-volume production
  - Large part sizes
  - Double-laser system
  - Extensive portfolio of periphery for maximum system productivity (e.g. CoolDown Station)

**EOSINT P 800:** For high-performance polymer parts

- Usable build size:
  - Width 700 mm
  - Depth 380 mm
  - Height 560 mm
  - Max. volume: 149l per build

- Main properties:
  - First and only ultra-high-temperature material system (EOS PEEK HP3, melting point of 372°C)
  - Option to reduce build size enabling cost-effective production of fewer parts
IDT 2014 | Materials
Material Choice Navigator

PA 2201 – PA12
- Natural colour

PA 2202 black – PA12
- Anthracite-black colour

PrimePart FR – PA12
- Flame retardant
- Refreshable

PA 2210 FR – PA12
- Flame retardant
- Non-halogenated

PA 1101 – PA11
- High impact
- High elongation

PrimePart PLUS – PA12
- Low refresh
- Highly economical

PrimePart ST – TPE/PEBA
- Soft, rubber like material

PA 2105 – PA12
- Dental models

PrimeCast101-Polystyrene
- Patterns for investment casting

Alumide – PA12
- Aluminium-look
- Good post-processability

PA 3200 GF – PA12
- High stiffness
- Low warpage

CarbonMide – PA12
- Very high strength and stiffness

EOS PEEK HP3 – PAEK
- Highest mechanical and chemical performance

PA 2200
- White colour
- General purpose
Supporting Capabilities

Conventional Technologies
- Wire EDM
- CNC Machining
- Extrude Hone
- HIP Furnace

Connected Technologies
- Software Tools
- Organic Structures
- MMP
Post Processing
3D Printing Machines and Powders on GSA-Advantage

The EOS products on GSA-Advantage are all of the current EOS metal and plastic machines. Also all of the EOS and ALM powders are on the schedule.

EOS Materials Plastics
ALM Materials Plastics
EOS Materials Metals

https://www.gsaadvantage.gov/advantage/s/search.do?q=24:STUCKAHOE+TRADING+INC&searchType=1&db=0
Thank you for your attention!

www.eos.info
General Services Administration  
Region 3 Federal Acquisition Service  
IWA Center  
3D Printing/Additive Manufacturing Industry Day  
Presenter – Doug Hardina  

December 10, 2015
Agenda

- Who is GPI Manufacturing Inc.?
- How DMLM works
- DMLM Finishing
- Designing for Additive
- How to Achieve an Additive Program
About GPI Manufacturing Inc.

- Privately owned service bureau providing rapid prototyping and contract manufacturing through the use of additive technologies.
- One of the first DMLM service providers in the country!
- We have experience using the best metal printing technology available!
- We love what we do!
Equipment

EOS M270/280/290
3D Systems ProX

- Ideal for both Prototype & Production Parts
- Builds complete in Hours/Days
- Layer by Layer, Additive Manufacturing
- Produce Functional Parts With:
  - Complex Geometries
  - Excellent Mechanical Properties
  - High Hardness & Strength
DMLM Basics

- Metal parts of the most complex geometries are built layer-by-layer directly from 3D CAD data without tooling.
- Parts have excellent mechanical properties, able to be welded, tapped and machined.
- DMLM produces parts that can be built in a matter of hours or days rather than weeks.
- Accelerating design cycles and time-to-market while enabling multiple redesigns affordably.
- Parts can be functionally tested in the environment for which they were designed.
HOW DMLM Works

- The cad is sliced into 20-40µm layers and fed to the machines program.
- A layer of powder is brought over the build plate and the laser melts the powder to the build plate to start the build.
- Every part is built directly on to a build plate.
- The part is then built layer by layer until done.
- The part is then cut from the plate, support material removed and any post finishing that is requested by the customer completed.
DMLM Materials

- Cobalt Chrome
- Maraging Steel (MS1)
- Nickel Alloy IN 718 (Inconel)
- Stainless Steel 316L
- Stainless Steel (PH1)
- Stainless Steel (GP1)
- Titanium Alloy Ti-64
- Aluminum
DMLM Surface Roughness

- Raw DMLM parts are about 150-250 Ra directly off the machines (material dependent)
- Shot peen/blast improves the part to an average of 125 – 150 ra
- DMLM Parts can be finished up to 16 Ra hand polish or 1 Ra machine polished
Designing for Additive!
Internal Channels and Cavities

- Routing options for internal channels are almost infinite
  - Create ideal flow channels
  - Well defined distance from cavity walls
Conformal Cooling
Design Differently

Traditional Machining

Additive Manufacturing
How to Achieve an Additive Program

Here’s how we recently started a long term contract with GE

- **Capability Assessment: Part & Process**
  - GPI Manufacturing Inc. supplied the knowledge and labor base for process utilization involving EOS 290 equipment to successfully build the part
  - GPI was qualified to develop and implement the production process requirements required by the customer
How to Achieve an Additive Program

- **Process Definition**
  - Mutual agreement upon Frozen Process requirements were established. These include:
    - Destructive and non-destructive part qualification
    - Material Procurement (vendors, powder qualities)
    - Lot certifications
    - Secondary Processes (HIPing, Solution HT, post-machining)
    - Machine calibration schedule and qualification
    - OEM involvement (EOS technical support for maintenance)
    - Plant improvements (3 additional machines/power infrastructure)
    - FMEA identification and program documentation
How to Achieve an Additive Program

- Produce and Maintain
  - GPI has a dedicated engineer: oversee all aspects of contract manufacturing projects
  - GPI has the infrastructure: 9 DMLM machines, 25 DMLM employees, OEM and vendor relationships
  - GPI has skill maintaining the process to make sure the part genome is in place – serialization of components
  - GPI has the focus, experience and expertise to successfully execute your contract manufacturing program
Conclusion

- DMLM opens new frontiers
  - Prototyping and Additive Manufacturing functional parts.
  - Design freedom. Create what couldn’t be done before!
  - Quick lead times
  - High quality parts

- Ability to manufacturer parts faster!

- Low volume production without penalty of tooling costs!
GSA Schedule 36

GSA 3D Printing Industry Day
12/10/2015 Philadelphia
Presented by Digital Plaza
GS03F0055X, GS03F011DA
GSA Schedule
The Good (1)

1. $40 billion government opportunities
2. 80% of Schedule Holders are small business
3. Federal Government Agencies have incentive to use small-business set asides.
4. 5 Years/20 years contract opportunities
GSA Schedule

The Good (2)

5. Easy and fast ordering procedures for government agencies
6. Unlimited contract amount
7. Only 4% of Federal Government contractors have GSA, which provides market barriers and less competition
8. GSA brings credibility to small business.
GSA Schedule
The Bad
1. 60% of GSA Schedule Holders do $0 sales
2. Can be expensive and takes time to get a schedule
3. Limited/Negotiated margin
4. GSA must have “Most Favorable Customer” (MFC) status
GSA Schedule
The Ugly

1. Time, expense and effort to get a schedule
2. Annual or biannual auditing from GSA
3. Requires compliance with GSA rules and administrative procedures
4. Every change must be submitted for approval.
GSA Schedule 36
3D Printing Team

1. Very committed to the product line
2. Knowledgeable and supportive
3. Much quicker than other GSA schedules
Conclusions

1. Great opportunities if you are willing to make a complete and total commitment to the process

OR,

2. Use companies like us who spend 100% of our time in the marketplace
3D Print/Additive Manufacturing Industry Day

December 10, 2015
RDECOM’s Additive Manufacturing Vision

Lester Hitch
Production Manager
Rapid Technologies and Inspection Branch
Advance Design and Manufacturing Division
Edgewood Chemical Biological Center
U.S. Army RDECOM
December 10, 2015

DISTRIBUTION STATEMENT C. Distribution authorized to U.S. Government Agencies and their contractors (export controlled) (25 Nov 2014). Other requests for this document shall be referred to HQ RDECOM, APG, MD.
Additive Manufacturing (AM) technologies bring the promise of enhanced performance with the flexibility of point of need manufacturing, repair of DoD assets and the ability to reduce part requisition and fulfillment cycles.

RDECOM is working with academia, industry and across government organizations to mature AM in the following areas:

- **Material performance**: Capturing pedigreed material data to inform design and engineering of AM parts; Emphasis on materials not being addressed by industry (i.e. Steel alloys, Aluminum Chem-Bio resistant polymers, etc)

- **Machine performance**: Identifying, improving and documenting key process parameters to enable qualification and certification of AM for Army use

- **Digital Product Data**: Emphasis on establishing digital product data as the authoritative source for product data; Verification and validation of model quality and data elements prior to driving the manufacturing process

A methodical, phased approach to maturing AM technologies is key to realizing AM as a viable tool within the Army’s toolbox.
Case Study: Bradley Track Pad Pin/Nut

Bradley Track-pad Pin

Preliminary Findings/Lessons Learned:

- AM is a tool that should be used when engineering judgment, business case analysis and part performance warrant such a decision
- AM must often be combined with Subtractive Manufacturing to achieve the final part
- Digital product data is key to realizing the benefits of AM
Three 5-year progressive stages of adoption with four distinct pillars of investment:

<table>
<thead>
<tr>
<th>FY15–19</th>
<th>FY20–24</th>
<th>FY25–29+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Alternative</td>
<td>Process Alternative</td>
<td>Product Alternative</td>
</tr>
<tr>
<td>Tooling and Repair</td>
<td>Process Substitution</td>
<td>Novel Designs</td>
</tr>
<tr>
<td>Part Substitution</td>
<td>Primary manufacturing</td>
<td>Novel Materials</td>
</tr>
<tr>
<td>Rapid Fielding/Point of Use manufacturing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pillar 1: Material and process certification and qualification

Pillar 2: Army Additive Manufacturing Knowledge-base

Pillar 3: Machine Technology and Material Improvements

Pillar 4: Transfer technology to the industrial base and field

Level of complexity from low to high, evolving from part to system, and from early adopters to traditional acquisition
### Material Costs

<table>
<thead>
<tr>
<th>Material</th>
<th>Weight (g)</th>
<th>Process Waste (g)</th>
<th>Build Time (min)*</th>
<th>Cost**</th>
<th>COTS Price***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washer</td>
<td>1.95</td>
<td>0.20</td>
<td>&lt;2</td>
<td>$0.23</td>
<td>$0.13</td>
</tr>
<tr>
<td>Nut</td>
<td>5.32</td>
<td>0.53</td>
<td>5</td>
<td>$0.61</td>
<td>$0.53</td>
</tr>
<tr>
<td>Bolt</td>
<td>19.34</td>
<td>1.93</td>
<td>15</td>
<td>$2.23</td>
<td>$1.82</td>
</tr>
</tbody>
</table>

*Does not account for post-processing time  **Determined using 4340 at $105/kg  
**Catalogue price for MIL-SPEC Grade 8 hardware

- 4340 Alloy steel hardware printed using DMLS
- Demonstrated the ability to print functional parts at the point of need
- Established an initial business case for part substitution via AM

### Technology Challenges:

- Material limitations
- Process/machine limitations
- Post processing requirements
- Lack of standards
- Lack of digital product data
- Hype cycle and managing expectations

### Rapid Prototyping, Product Development and Fielding

- Repair and Point of Use manufacturing using LENS and Cold Spray processes
- Tooling
- Divot Repair Area HP-Aluminum Cold Spray Fill Surface Grind
- Step 1 Step 2 Step 3
Material Performance: Research into materials of interest to the Army (steel alloys, aluminum, etc) to better understand impacts of evolving microstructure, particle size and processing parameters on final part characteristics.

Machine Performance: Demonstration of smaller feature sizes; scaling up machine envelopes; experimenting with processing environments (temp, humidity, inert, etc); establishing ruggedized and portable AM capabilities; enabling multi-material/multi-functional machines to demonstrate integrated structural/electronic parts.

Digital Product Data: Establishing an enterprise-wide product data management (ePDM) system to archive digital product data; working with the REF and others to create and curate a digital parts library; championing the establishment of standards to elevate digital product data quality and status as the authoritative source for product data.
• **Primary objective:** Coordination of AM activities

• **Participants:** Primarily RDECOM organizations with invited or ex-officio participation by non-RDECOM organizations
  - Cross-Army participation (HQDA, Organic Industrial Base, PEO/PMs)
  - DoD and non-DoD organizations represented
    - Navy, Air Force, DARPA, DLA, SOCOM
    - NASA, Dept. of Energy, Industry

• **Three main focus areas**
  - Portfolio review
  - Joint Planning
  - Advocacy and Outreach
Additive Manufacturing is a major component of AMRDEC’s mission to plan, manage, conduct research, and provide one-stop life cycle engineering for manned/unmanned aviation weapon systems, missile weapon systems, and related or assigned weapons systems.

Additive Manufacturing Equipment

<table>
<thead>
<tr>
<th>MakerBots(4)</th>
<th>FDM - Polymers</th>
</tr>
</thead>
<tbody>
<tr>
<td>LulzBot TAZ ¾</td>
<td>FDM - Polymers</td>
</tr>
<tr>
<td>Formlabs Form 1</td>
<td>SLA - Photopolymers</td>
</tr>
<tr>
<td>Dimatix DMP-2831</td>
<td>Inkjet printer</td>
</tr>
<tr>
<td>Stratasys Objet 350 Connex 3</td>
<td>PolyJet – Photopolymers</td>
</tr>
<tr>
<td>Stratasys 400mc</td>
<td>FDM - Polymers</td>
</tr>
<tr>
<td>Stratasys 900 mc</td>
<td>FDM - Polymers</td>
</tr>
</tbody>
</table>

Current Programs

<table>
<thead>
<tr>
<th>FY14-16</th>
<th>Additive Manufacturing for Optimized Missile Components and Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY15-18</td>
<td>Direct Digital Manufacturing for Helicopter Engines</td>
</tr>
<tr>
<td>FY15-16</td>
<td>DMLS to Manufacture Combustion Liners with Shaped Film Cooling Holes</td>
</tr>
<tr>
<td>FY15-18</td>
<td>AM Used to Restore/Reclaim/Reutilize High Value Aviation Assets</td>
</tr>
<tr>
<td>FY16-18</td>
<td>Printable Materials with Embedded Electronics</td>
</tr>
<tr>
<td>FY16</td>
<td>Additive Manufacturing for Aerospace Gear Applications</td>
</tr>
</tbody>
</table>

POCs:

Katherine Olson, katherine.aolson6.civ@mail.mil, 256-313-6642
Keith Roberts, john.k.roberts48.civ@mail.mil, 256-842-8616

Applications

AMRDEC is investigating the following application areas:

- Missile components optimized for weight and frequency tailoring
- Repair of high value aviation components that cannot be repaired traditionally
- Small complex shaped effusion film cooling and non line of sight holes
- Aerospace gears
- Gearbox housings
- Printable materials with embedded electronics
- Tooling and molding
- Composites and composites tooling
- Rapid, low cost inspection of AM components

Benefit to the Warfighter

- Enhanced component designs optimized for performance, weight savings, reduced part count and cost
- Point of need part production
- Improved operational readiness
- Improved availability of spares
- Compressed supply chain

Future Focus

Establish an additive manufacturing facility that will allow the training of engineers in design, analysis, and fabrication of additively manufactured components and structures, enable research particular to AMRDEC’s mission, and assist in understanding the material – process - property relationship required for qualification and certification.
NSRDEC utilizes native AM capabilities to support the soldier-focused mission through rapid prototyping and model system fabrication. Primary focus areas for NSRDEC are experimentation support and soldier capability demonstrations in conjunction with requirements development.

### Additive Manufacturing Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Technology</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTM Sinterstation 2500 plus</td>
<td>SLS</td>
<td>Polymers</td>
</tr>
<tr>
<td>Stratasys Objet 500 Connex 3</td>
<td>PolyJet</td>
<td>Photopolymers</td>
</tr>
<tr>
<td>Objet30</td>
<td>PolyJet</td>
<td>Photopolymers</td>
</tr>
<tr>
<td>MakerBots(3)</td>
<td>FDM</td>
<td>Polymers</td>
</tr>
<tr>
<td>Z-Corp 450</td>
<td>Binder Jetting</td>
<td>Polymers</td>
</tr>
<tr>
<td>HyRel System 30M</td>
<td>Micropump/ink, paste</td>
<td></td>
</tr>
</tbody>
</table>

### Applications

AM equipment is used, in concert with manufacturing techniques, to enable quick turn solutions supporting 6.2-6.3 research focused in the following areas:
- Combat Feeding
- Soldier Clothing and Individual Equipment
- Aerial Delivery Systems
- Expeditionary Basing and Collective Protection

### Benefit to the Warfighter
- High iteration concept development for capability validation to inform requirements
- Tailored and Soldier specific solutions
- Ration components tailored to individual Warfighters’ nutritional requirements, operational scenarios, and preferences
- Reduced reliance on ration storage and long shelf life
- Reduced ration packaging and field trash
- Sustainment of high-tempo operations occurring at the outer edge of supply lines

### Current Programs

FY16-19; Tech Base 6.2-6.3; Concept Feasibility and Technology Demonstration; TRL0-3

### Future Focus
- Warfighters fitted with physiological status monitors that sense nutritional deficiencies/needs
- Biometric data transmitted to food printer
- Printer loaded with nutrient dense pre-mix
- AM of nutritionally tailored ration component
- Delivery to Warrior on or near the battlefield
- NSRDEC capability growth – higher capacity with broader materials availability. Expanding rapid prototyping capacity will enable greater support to the diverse portfolio of soldier-centric projects managed at NSRDEC.

### POCs:

**RP:**
- Gary Proulx, gary.n.proulx.civ@mail.mil, (508) 233-4418
- Matt Hurley, mtthew.j.hurley8.civ@mail.mil, (508) 233-5904

**Combat Feeding:**
- Mary Scerra, mary.e.scerra.civ@mail.mil, 508-233-5896
- Ann Barrett, ann.h.barrett.civ@mail.mil, 508-233-4516
ARL’s flagship AM facility is housed in the Weapon’s and Materials Research Directorate, APG, MD. The research focus for ARL is on materials synthesis and processing science for near net-shape and net-shape AM.

### Additive Manufacturing Systems

<table>
<thead>
<tr>
<th>Systems</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Systems ProX 300</td>
<td>DMLS/metal</td>
</tr>
<tr>
<td>3D Systems ProX 100</td>
<td>DMLS+/metal, polymer, ceramic</td>
</tr>
<tr>
<td>EOS P800</td>
<td>SLS/polymer</td>
</tr>
<tr>
<td>3D Systems ProJet 5500</td>
<td>PJP/polymer</td>
</tr>
<tr>
<td>3D Systems ProJet 6000</td>
<td>SL/polymer</td>
</tr>
<tr>
<td>3D Systems Viper Si2</td>
<td>SL/polymer</td>
</tr>
<tr>
<td>Envisiontec Ultra</td>
<td>SL/polymer</td>
</tr>
<tr>
<td>nScrypt Tabletop</td>
<td>micropump/ink, paste</td>
</tr>
<tr>
<td>nScrypt SuperScrypt</td>
<td>6-axis, multi-technology</td>
</tr>
<tr>
<td>Benchtop Printers (6)</td>
<td>SL and FDM/polymer</td>
</tr>
</tbody>
</table>

### Near Net-Shape Systems:

- Cold Spray Systems (3)          (CS/metals + subtractive + NDI)
- Fabrisonic SonicLayer 4000      (UAM/metals + subtractive)
- Rolls Royce Cranfield SMD       (WAAM/metals)

### Applications

AM equipment is used, in concert with other advanced manufacturing and characterization techniques, as research tools for the development of materials and technologies for the Army’s Future Expeditionary Force. 6.1-6.2 research focused on these current and future needs:

- Agile and point-of-use manufacturing
- Recycled and indigenous material feedstocks
- Materials for man-machine interface
- Multi-material processing systems
- Additive + Subtractive + Inspection in one box
- Design for volumetric optimization
- Flexible, conformable and adaptive protection systems
- Joining of 3D electronics and 3D structures
- Biocompatible materials and bio-surrogate materials
- Biomimetic materials and systems
- Depot level and in-field repair
- Boost US manufacturing industrial base

### Current Programs

- FY13-15; 5 Programs; Material Development; TRL0-3
- FY16-18; 9 Programs; Material Development, Matter-Energy Interaction, Processing Science, Topological Optimization; TRL0-2

### Future Focus

Process Optimization through process-property-structure excogitation, process feedback, and process modeling. Tailoring macro-structure by deliberate design and control of micro-structure.

### Benefit to the Warfighter

- Reduced logistical burden, BIG Army & locally
- Technology organic to the Soldier
- Soldier protection, individual and mission specific
- Signature management, vehicles and unmounted Soldiers
- Lightweightening, vehicles and Soldier systems

### POCs:

- L.J. Holmes, larry.r.holmes.civ@mail.mil, 410-306-0854
- Vic Champagne, victor.k.champagne.civ@mail.mil, 410-306-0822
ECBC’s flagship AM facility is integrated within Advanced Design and Manufacturing Division, APG-EA, MD. ADM is a Prototype Integration Facility within RDECOM rapidly developing products for the warfighter.

Additive Manufacturing Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOS M270 Dual</td>
<td>DMLS - metals</td>
</tr>
<tr>
<td>Stratasys Fortus 900mc</td>
<td>FDM - polymers</td>
</tr>
<tr>
<td>Stratasys Fortus 400</td>
<td>FDM - polymers</td>
</tr>
<tr>
<td>Stratasys Titan</td>
<td>FDM - polymers</td>
</tr>
<tr>
<td>MakerBot Style Benchtops (4)</td>
<td>FDM - polymers</td>
</tr>
<tr>
<td>3D Systems Sinterstation 2500</td>
<td>SLS - polymers</td>
</tr>
<tr>
<td>3D Systems Viper Si2</td>
<td>SL - polymers</td>
</tr>
<tr>
<td>3D Systems 3500</td>
<td>SL - polymers</td>
</tr>
<tr>
<td>3D Systems 7000</td>
<td>SL - polymers</td>
</tr>
<tr>
<td>FormLab +</td>
<td>SL - polymers</td>
</tr>
<tr>
<td>Stratasys Connex500</td>
<td>Polyjet – polymers</td>
</tr>
</tbody>
</table>

Molding/Casting Capabilities:

Digital Tooling for casting and composite layup.
Rapid Tooling for Injection Molding.

3D-data Capturing Systems:

Surphaser 2500HX, Faro Laser Scan Arm, Konica Minolta Range7, Konica Minolta 910. Scanning scale from a penny to a building.

Applications

AM equipment is used, in concert with other advanced manufacturing and engineering capabilities, as a means to produce and develop technologies for the Army’s warfighter and scientist:

- Components optimized for weight and strength.
- Part count reduction.
- Tooling and molding for injection molding, urethanes, silicones, and composites.
- Housing for unique components and electronics.
- Rapid development of concepts.
- Low-cost alternative for customized low-volume production.
- Rapid development and supply of unique theater-deployed components.
- Reduction of supply chain and backorder constraints.

Current Programs

<table>
<thead>
<tr>
<th>Year</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY15-FY16</td>
<td>Engineering and production support for Rapid Equipping Force Expeditionary Lab</td>
</tr>
<tr>
<td>FY13/14/15</td>
<td>Material and Application research with University of Delaware</td>
</tr>
<tr>
<td>FY15/16</td>
<td>R&amp;D a photo-initiated Polycarbonate polymer in partnership with ARL’s Additive Manufacturing Team</td>
</tr>
</tbody>
</table>

Future Focus

Leverage partnerships with other DoD agencies, Industry and Academia to develop new products for the warfighter.

Benefit to the Warfighter

- Enhanced component designs optimized for performance, weight savings, reduced part count and cost
- Point of need part production
- Improved operational readiness
- Improved availability of spares
- Compressed supply chain

POCs:

Rick Moore, richard.b.moore44.civ@mail.mil, 410-436-5517
Lester Hitch, lester.s.hitch.civ@mail.mil, 410-436-5787
Brad Ruprecht, bradley.r.Ruprecht.civ@mail.mil, 410-436-6655
The Army’s leading facility in Additive Manufacturing (AM) of Metals. Located within ARDEC’s Materials, Manufacturing & Prototyping Technology Division

**AM Systems**

**DMLS**
- EOS M270
- Materials: 4340, Stainless Steel, Titanium, Aluminum, Inconel, Cobalt Chrome
- Specs: 200W laser, .02-.06 layer thickness, 1mm minimum feature size, 9.5” x 9.5” x 7.5” build volume

**EBM**
- ARCAM A2X
- Materials: Ti, Ti6Al4V, Inconel, CoCr
- Specs: Capability currently being established

**Support & Testing Equipment**

- Powder Synthesis
- X-Ray Analysis
- Post Processing
- Hardness Testing
- Thermal Stress Relief
- Mechanical Testing
- EDM Equipment
- Scanning Electron Microscopy
- Oxygen Nitrogen Analysis
- Particle Size Analysis

**Future Focus**

- New materials systems (functionally graded materials, novel alloys, hybrid materials)
- Fielding of AM parts and AM systems for on-demand Battlefield manufacturing
- Wide range of qualification & certification of materials, processes and parts via additive manufacturing
- Advanced fabrication integration with sensors and electronics

**Applications**

Additive Manufacturing equipment is used to prototype, develop, and fabricate metal parts via a layer by layer powder bed laser sintering process. The process provides a wide range of design flexibility over traditional manufacturing methods, allowing for rapid prototyping, part weight reduction, novel part design, reduced time to product, and overall manufacturing flexibility.

**Benefit to the War Fighter**

- Reduced Logistics footprint and Time to Field for replacement parts
- Enabling options to reduce single point failures
- Increase force effectiveness and reduce operations, support, maintenance, and liability costs
- Enabling novel and improved part designs for reduced weight while meeting or exceeding performance requirements
- A qualified, certified, and sustainable process for providing parts on a reduced cost, rapid response, on demand basis

**POCs:**

Ryan Carpenter, ryan.r.carpenter6.civ@mail.mil 973-724-6907
James Zunino, james.l.zunino.civ@mail.mil 973-724-6773
Elias (Louie) Jelis, elias.jelis.civ@mail.mil 973-724-3922
The Army’s leading facility for to design, development, fabrication, testing, and integration of Printed Electronics for munitions and weapon systems. Located within ARDEC’s Materials, Manufacturing & Prototype Technology Division.

### Applications

PE equipment is used, in concert with other advanced manufacturing and characterization techniques to design, develop, fabricate, integrate & test flexible and hybrid electronics into existing and future munitions and weapon systems. Embedded sensing, prognostics & diagnostics, Fuzing, munitions monitoring, structural health monitoring, novel power sources, Hig-G electronics, and numerous other applications. Current Thrusts include:

- Nanomaterials Development / Novel Inks
- Manufacturing & Deposition Techniques
- Testing and Evaluation
- Qualification / Reliability / Survivability
- Flexible Hybrid Electronics
- Power Generation/Energy Harvesting/Power Storage
- Active Sensor Systems
- Device Miniaturization
- Homeland Defense / Homeland Security
- Munitions & Fuzing
- Components / Sub-Systems Integration
- Remote Weapon Systems

### Printed Electronics Systems

- **M3P 2000** (Multi-tool/multi-material)
- **nScrypt – SuperScrypt** (Multi-tool / multi-material)
- **Dimatix DMP 2800s** (Inkjet)
- **Sonoplot GXII** (Ultrasonic Deposition / Direct Write)
- **Harper Integrated R2R** (Flexo / Inkjet / Reel-to-Reel)
- **Novacentrix PulseForge 1300** (Photonic Curing)
- **Nano-Ink** (Dip-Pen)
- **PixDro / Epson** (Inkjet)
- **Voxel 8** (Multi-material FDM/DW)
- **LogoJet** (Inkjet / UV)
- **Screening Systems** (Screening / Coating)

### Integration & Testing Equipment

- **Sintering / Post Processing** Electronics Characterization
- **Grommet Interconnect** Profilometery
- **Embroidering** 2D/3D Scanning
- **Thermal Cycling** Accelerated Aging
- **Inspection / Microscopy** Ink Development

### Future Focus

Process Optimization and Scale-Up; Manufacturing Improvements for Novel Chaff; Integration of printed devices for power sources, antennas, and soldier systems. Integration of PE into 3D Structures.

### Benefit to the Warfighter

- Reduced logistical burden, BIG Army & locally
- Increased force effectiveness and reduce operations, support, maintenance, and liability costs
- Increase Army readiness by reducing equipment downtime
- Increase safety by providing ammunition assurance
- Improved Testing Capabilities
- Optimized R&D / Systems Engineering

### POCs:

- James Zunino, james.l.zunino.civ@mail.mil, 973-724-6773
- Dave Sabanosh, david.h.Sabanosh.civ@mail.mil, 973-724-3229
The Army’s leading facility in Additive Manufacturing (AM) of Polymers. Located within ARDEC’s Materials, Manufacturing & Prototyping Technology Division

**AM Systems**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FDM</strong></td>
<td>Stratasys uPrint (x2) (ABS)</td>
</tr>
<tr>
<td></td>
<td>Stratasys uPrint SE Plus (x2) (ABS)</td>
</tr>
<tr>
<td></td>
<td>Stratasys Dimension Elite (x3) (ABS)</td>
</tr>
<tr>
<td></td>
<td>Stratasys Dimension SST 1200 (ABS)</td>
</tr>
<tr>
<td></td>
<td>Stratasys Fortus 400MC (ABS, ULTEM)</td>
</tr>
<tr>
<td><strong>SLA</strong></td>
<td>3D Systems Viper Si2 (Photocure resin)</td>
</tr>
<tr>
<td></td>
<td>3D Systems SLA 3500 (Photocure resins)</td>
</tr>
<tr>
<td><strong>SLS</strong></td>
<td>EOSINT P395 (Powdered plastic and plastic/metal blends)</td>
</tr>
<tr>
<td><strong>Polyjet</strong></td>
<td>Stratasys Objet 260 Connex1 (Photocure resins)</td>
</tr>
<tr>
<td><strong>Multi-Tool / Multi-Material Systems</strong></td>
<td>Multi-Axis Multifunctional Manufacturing Platform M3P (Multiple tools)</td>
</tr>
<tr>
<td></td>
<td>nScrpt – SuperScrypt (multiple materials)</td>
</tr>
<tr>
<td><strong>Testing Systems</strong></td>
<td>Tensile/Flex/Compression/Impact tester</td>
</tr>
<tr>
<td></td>
<td>DMA (Dynamic viscoelastic data)</td>
</tr>
</tbody>
</table>

**Applications**

AM equipment is used to prototype, develop, fabricate parts for form, fit and function testing. AM allows for novel designs and prototyping which can drastically decrease time to end use product. Novel designs, with use of new materials will increase strength and/or decrease weight.

**Benefit to the War Fighter**

- Reduced Logistics burden, BIG Army and locally
- Increase force effectiveness and reduce operations, support, maintenance, and liability costs
- Improving testing capabilities
- Optimized R&D/Systems Engineering
- Lower weight, better quality of life

**Future Focus**

Certification and qualification of materials, processes and parts. Fielding of AM parts and AM systems for manufacturing on demand. A method for recycling of waste generated. Improved strength utilizing composites for higher loads and higher confidence in the field.

**POCs:**

Calvin Lim, calvin.lim.civ@mail.mil, 973-724-9768

James Zunino, james.l.zunino.civ@mail.mil, 973-724-6773
Additive Manufacturing (AM) technologies bring the promise of enhanced performance with the flexibility of point of need manufacturing, repair of DoD assets and the ability to reduce part requisition and fulfillment cycles – but are not a silver bullet

RDECOM is working with academia, industry and across government organizations to mature AM in the following areas:

– **Material performance**: Capturing pedigreed material data to inform design and engineering of AM parts; Emphasis on materials not being addressed by industry (i.e. Steel alloys, Aluminum, Chem-Bio resistant polymers, etc)

– **Machine performance**: Identifying, improving and documenting key process parameters to enable qualification and certification of AM for Army use

– **Digital Product Data**: Emphasis on establishing digital product data as the authoritative source for product data; Verification and validation of model quality and data elements prior to driving the manufacturing process

RDECOM is pursuing a methodical, phased approach to maturing AM technologies and the use of digital product data to enable AM as a viable tool within the Army’s toolbox
Questions/Discussion
RDECOM AM Focus Areas: M240L Example

|--------------------|---------------------|------------------------|------------------------|
| Description of Capability: M240L | After 5 years (FY19): M240L barrel can be made via AM, if the business case warrants it, but with no change to the part geometry
Individual titanium castings replaced with AM parts | After 10 years (FY24): M240L receiver can be additively printed as a subsystem, thus reducing part count and leveraging the benefits of AM
5 parts now one AM part | After 15 years (FY29+): At the design stage, M240L is determined to be produced via AM due to the ability to print the entire gun, along with coatings / sensors / electronics embedded
Entire M240L produced via AM |
MAS Proposal Process

• Initial steps of the offer process
• Visit www.eoffer.gsa.gov
  • Have you passed the Pathways to Success Training?
  • Did you get your DUNS number?
  • Have you registered with System Award Management (SAM)?
  • Have you applied for a digital certificate?
Additional Required Documents and Questions

- Business plan and Marketing plan
- Last two years of income statements and balance sheets
- Commercial price list
- GSA Proposed Pricing
- Terms & Conditions
eBuy

A Tool for Federal Business
Objectives

• What is eBuy?
• What’s In It For You?
• Who Uses eBuy?
• How Does It Work?
• Tips and Best Practices
• How Do I Get Access?
**What is eBuy?**

eBuy is designed to facilitate the request for submission of quotations for commercial products and services between Buyers and MAS Schedule Holders.
Where Buyers Connect With You…

- Products and Services
- Quantity (*Volume discounts)
- High dollar purchases (*Above small purchase threshold)
- Purchases with complex requirements
- Determining Sources of Supply (Request For Information)
- State and Local Government (*Disaster Recovery)
What’s In It For You?

- Exclusive to MAS Schedule Holders
- Access to RFI/RFQs
- Request for Quote
- Save time with quick access and responses to RFI/RFQ
- Transparency of purchasing patterns
- Increase customer communication
- Automatic notifications for RFQs
### Who Uses eBuy?

<table>
<thead>
<tr>
<th>Top Ten Agencies</th>
<th>Number of FY 15 RFQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of the Air Force</td>
<td>12,882</td>
</tr>
<tr>
<td>Department of the Navy</td>
<td>11,304</td>
</tr>
<tr>
<td>Department of Veterans Affairs</td>
<td>10,377</td>
</tr>
<tr>
<td>Department of the Army</td>
<td>8,124</td>
</tr>
<tr>
<td>Department of Health and Human Services</td>
<td>4,328</td>
</tr>
<tr>
<td>Department of Defense (Office of the Secretary of Defense)</td>
<td>4,227</td>
</tr>
<tr>
<td>Department of Homeland Security</td>
<td>3,540</td>
</tr>
<tr>
<td>Department of the Interior</td>
<td>2,940</td>
</tr>
<tr>
<td>General Services Administration</td>
<td>2,595</td>
</tr>
<tr>
<td>Department of Agriculture</td>
<td>2,122</td>
</tr>
</tbody>
</table>
How many RFQs came through this office?

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Schedule Description</th>
<th>Number of FY15 RFQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>THE OFFICE, IMAGING AND DOCUMENT SOLUTION</td>
<td>2,450</td>
</tr>
<tr>
<td>71</td>
<td>FURNITURE</td>
<td>8,433</td>
</tr>
<tr>
<td>72</td>
<td>FURNISHING AND FLOOR COVERINGS</td>
<td>670</td>
</tr>
<tr>
<td>78</td>
<td>SPORTS, PROMOTIONAL, OUTDOOR, RECREATION, TROPHIES</td>
<td>2,978</td>
</tr>
<tr>
<td>58 I</td>
<td>PROFESSIONAL AUDIO/VIDEO, TELECOMMUNICATIONS</td>
<td>1,666</td>
</tr>
<tr>
<td>71 II K</td>
<td>COMPREHENSIVE FURNITURE MANAGEMENT SERVICES</td>
<td>297</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>16,494</strong></td>
</tr>
</tbody>
</table>
How Does This Work?

1. Buyer submits Request For Quote (RFQ)
   a) Buyer identifies vendors to be notified
2. E-mail notification sent to identified Vendors
3. Vendors view RFQ in their account
   a) Vendors respond to RFQ
4. RFQ Closes
5. Buyer reviews process of all quotes submitted
6. Award is made
Tips and Best Practices

• Check eBuy daily for new Request For Quotes (RFQ)
• Contact Buyer with questions or clarifications
• Submit quotes before the RFQ closes
• Provide detailed information for Buyer’s RFQ
How Do You Get Access to eBuy?

Get on Schedule!
Promoting GSA to the Customer

Sherrie Taylor
Customer Service Director
GSA/FAS
12/10/2015
GSA Customer Accounts and Research Division (CAR)

- Outreach division of the Federal Acquisition Service
- Provides government customers support in acquisition services and solutions helping them select the best value solution for their needs.
What Does CAR Do?

• Supports the Government Customer by providing training and assistance on how to access and obtain goods and services to meet their critical mission requirements.

• Provide direct consultation and assistance on the advantages and benefits of using GSA

• Conducts customized training in how to utilize GSA acquisition vehicles and GSA's eTools
What does this mean to you?

- Vendors need to be educated on how Government Customers make purchasing decisions.
- Most decisions are made after conducting market research.
Welcome! GSA eLibrary is your one source for the latest GSA contract award information. GSA offers unparalleled acquisition solutions to meet today's acquisition challenges. GSA's key goal is to deliver excellent acquisition services that provide best value, in terms of cost, quality and service, for federal agencies and taxpayers.

GSA offers a wide range of acquisition services and solutions utilizing a variety of tools, contract vehicles, and services to meet the customer's specific needs including Multiple Award Schedules, Governmentwide Acquisition Contracts, Technology Contracts, and Assisted Acquisition Services. For more information on what GSA has to offer, visit GSA.gov.

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**Category Guide**

- Winter Supplies & Services
- Disaster Relief
- Hospitality, Cleaning, & Chemicals
- Laboratory, Scientific, & Medical
- Office Solutions
- Security Solutions
- Tools, Hardware, & Machinery
- Vehicles & Watercraft
- Building & Industrial
- Furniture & Furnishings
- IT Solutions & Electronics
- Law Enforcement, Fire, & Security
- Recreation & Apparel
- Services
- Travel & Transportation Solutions
- Wildland Fire & Equipment

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**News**

Introducing the PROFESSIONAL SERVICES SCHEDULE (PSS) Effective September 30, 2015, the MOBIS (874), AIMS (541), FABS (520), Language (738II), Logworld (874V), PES (871) and Environmental (899) schedules will no longer be available as individual MAS programs. All of the services covered under these schedules, and all of the existing contractors will be available under the new PROFESSIONAL SERVICES SCHEDULE (PSS), effective October 1, 2015. Additional information pertaining to the Professional Services Schedule (PSS) program can be found on the [Interact - Professional Services Category Community](#) and from the [GSA Professional Services Schedule page](#).

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**Additional Information**

**Customers**
- Training Opportunities
- FRDS-NG
- EPLS
- GSA Strategic Sourcing EPla

**Contractors**
- FedBizOps
- Schedule Sales Query
- Vendor Support (VSC)

---

GSA eBusiness (eBuys) is an easy-to-use electronic Request for Quotation (RFQ) system designed to facilitate the request for submission of quotations. With eBuys, getting quotes is just a click away!

---

Quick Search

Go to | schedule - ▼ | Go

Schedule Contracts

- View schedule contracts
- GSA schedules info
- VA schedules info
- NAICS schedule/SIN crosswalk
- FSC schedule/SIN crosswalk

Technology Contracts

- View technology contracts
- GSA technology contracts info

State and Local Governments

- Cooperative Purchasing
- Purchase IT products, services, and support equipment from Federal Supply Schedules.
- View participating vendors
- Cooperative Purchase FAQ

Disaster Recovery Purchasing
- Purchase products and services to facilitate recovery from a major disaster.
- View participating vendors
- Disaster Recovery Purchasing FAQ
**Search Results Summary**

Search Criteria: **3-D printers**
Did you mean **3d printers**?

**Instructions:** Click the source number to view a list of categories. Click the category number (i.e. SIN) to view a list of contractors.

### Description matches

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>36</td>
<td>**3D Printing Solutions - 3D Printing** includes <strong>printers</strong>; ancillary equipment, technical services and supplies required to generate functional prototype images and printed objects. Equipment may include all classes and sizes of <strong>3D Printers</strong>, laser imaging devices, post processing devices and ancillary accessories and software to produce functional items. Technical services include but are not limited to: <strong>3D Printing and laser imaging</strong> to produce a digital file used to generate functional prototype images and printed objects. All types of consumables and other items related to this <strong>SIN</strong> are included.</td>
</tr>
<tr>
<td>51 400</td>
<td><strong>THE OFFICE, IMAGING AND DOCUMENT SOLUTION</strong></td>
</tr>
</tbody>
</table>
**Contractor Listing**

For general questions, contact:
National Customer Service Center
Phone: 1-800-480-3111
E-mail: mashelpdesk@gsa.gov

36  **THE OFFICE, IMAGING AND DOCUMENT SOLUTION**

<table>
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<th>Description</th>
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5 contractors

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<th>City, State</th>
<th>Socio-Economic</th>
<th>Contractor T&amp;Cs/Pricelist</th>
<th>View Catalog</th>
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<td>AMBLER, PA</td>
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<td>GALLOWAY PLASTICS, INC.</td>
<td>GS-03F-095CA</td>
<td>847-615-8900</td>
<td>LAKE BLUFF, IL</td>
<td>s</td>
<td>GSA Advantage</td>
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<tr>
<td>PHILLIPS CORPORATION</td>
<td>GS-03F-080CA</td>
<td>410-564-2808</td>
<td>HANOVER, MD</td>
<td>s</td>
<td>GSA Advantage</td>
<td></td>
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<tr>
<td>TUCKAHOE TRADING INC</td>
<td>GS-03F-015CA</td>
<td>215-353-0785</td>
<td>DOYLESTOWN, PA</td>
<td>s/w/v/v</td>
<td>GSA Advantage</td>
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Questions?
Office of Small Business Utilization

Our Mission
To promote increased access to GSA’s nationwide procurement opportunities

- OSBU is an advocate for Small Businesses
- OSBU connects small businesses with people who can help them, and programs that can grow their skills.
- OSBU’s nationwide staff of trained professionals has a deep background in contracting and acquisition.
- We also help the small business community reach key contracting experts to help navigate the procurement process.
# GSA's FY 2016 Subcontracting Goals

<table>
<thead>
<tr>
<th>GOALING CATEGORY</th>
<th>GOAL</th>
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<tbody>
<tr>
<td>Small Business</td>
<td>36.50%</td>
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<tr>
<td>Small Disadvantaged Business (SDB)</td>
<td>5.00%</td>
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<tr>
<td>Women-owned Small Business</td>
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<tr>
<td>HUBZone Small Business</td>
<td>3.00%</td>
</tr>
<tr>
<td>Service-Disabled Veteran-owned Small Business</td>
<td>3.00%</td>
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</table>
The Five Small Business Contracting Programs are:

- Small Business (FAR 19.5)
- 8(a) (FAR 19.8)
- HUBZone (FAR 19.13)
- Service-Disabled Veteran-Owned Small Business (SDVOSB) (FAR 19.14)
- Women-Owned Small Business (WOSB) (FAR 19.15)

• Award may be set aside for WOSBs for specific NAICS codes where SBA has designated that WOSBs are substantially underrepresented.
• WOSBs must register with SAM, and with SBA’s WOSB Program Repository to participate in the WOSB program. Click on www.sba.gov/wosb for details.

There is **parity among the 8(a), HUBZone, SDVOSB, and WOSB programs** (FAR 19.203, effective as of March 16, 2011.). For these four programs, there is no order of precedence.

- 8(a)s are by definition small disadvantaged businesses (SDB), the 8(a) Program can be used to meet the agency’s SDB goals
Office of Small Business Utilization

FY 2016 GSA Forecast
(www.gsa.gov/smallbizforecast)
Office of Small Business Utilization

FY 2016 GSA Forecast
(www.gsa.gov/smallbizforecast)

GSA FY 2016 Agency-wide Forecast
(downloadable Excel form, 255K)

Review the Forecast Map for opportunities in your region

FORECAST DISCLAIMER - All projected procurements are subject to revision or cancellation. Final decisions on the extent of competition, small business participation, estimated value, or any aspect of the procurement action will not be made until each procurement is posted to Federal Business Opportunities (FEDBIZOPPS). Forecast data is for planning purposes only and is not a commitment by the government to purchase the described products and services.

GSA is comprised of both the Federal Acquisition Service (FAS) and the Public Buildings Service (PBS). FAS oversees the commercial acquisition part of GSA including acquisition of supplies and services, engineering, facilities and utilities, maintenance, real estate and interior design. FAS develops procurement programs for products, services, and technology. PBS develops procurement programs for construction, architecture, real estate and interior design.

In addition, GSA staff offices fulfill a wide range of missions within GSA, including financial policy leadership, IT services and solutions, and internal and external communications.
# Website Shortcuts

<table>
<thead>
<tr>
<th>GSA.gov</th>
<th>SHORTCUTS</th>
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<tbody>
<tr>
<td>Office of Small Business Utilization</td>
<td><a href="http://www.gsa.gov/smallbusiness">www.gsa.gov/smallbusiness</a></td>
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<td></td>
<td><a href="http://www.gsa.gov/sbu">www.gsa.gov/sbu</a></td>
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<td>Contacts for Small Business Support</td>
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</table>
Charles Aycock
Small Business Specialist
202-257-1513
charles.aycock@gsa.gov

Mid-Atlantic Region
Dow Building
100 S Independence Mall W
Philadelphia, PA  19106
Thank You