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<th>5f. WORK UNIT NUMBER</th>
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| 6. AUTHOR(S)             | Matt Harvazinski, Venke Sankaran, Doug Talley |
|--------------------------|

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<tr>
<td>Jamie Malak</td>
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0800 – 0815 Meet and Greet Social
0815 – 0845 Edwards Research Site Overview
0845 – 0900 Identification of Key AF Personnel
0900 – 0915 Business Information
0915 – 0930 Break
0930 – 1000 Technical Information
1000 – 1030 Q&A
1030 – 1100 Tour 1/Individual Q&A Sessions
1100 – 1200 Lunch
1200 – 1230 Tour 2/Individual Q&A Sessions
1230 – 1500 Individual Q&A Sessions (as needed)
Industry Day

- Aerospace Systems Technical Research Operations Services (ASTROS)

- Vision: Obtain affordable and responsive buildup / modification of rocket test stands and facility operations for demonstrating next generation rocket propulsion technologies

- Early Industry Involvement
  - Encourage competition
  - Feedback from industry

Distribution A: Approved for public release; unlimited distribution
GOVERNMENT TEAM
POC’s

• Procuring Contract Officer
  – Judy A Gayler, judy.gayler@us.af.mil  661-277-7748
  – Aimee Helm, aimee.helm@us.af.mil  661-277-2101

• Contract Specialists
  – Joshua Vasquez, joshua.vasquez.5@us.af.mil  661-277-8213
  – Nathan Hansing, nathan.hansing@us.af.mil  661-277-8454

• Acquisition Project Manager
  – Jamie Malak, jamie.malak@us.af.mil  661-275-5539

• Deputy Acquisition Project Manager
  – Robert Shah, robert.shah.2@us.af.mil  661-275-5915

Distribution A: Approved for public release; unlimited distribution
Edwards Research Site Overview
for ASTROS Industry Day

Mr. Michael Huggins
Chief, Rocket Propulsion Division

• Distribution A: Approved for public release; unlimited distribution
AFMC Mission Goals

- Continue to Strengthen AFMC’s Role in the Nuclear Enterprise
- Advance Today’s & Tomorrow’s Combat Capabilities through Leading-Edge Technology
- Acquire and Support War-Winning Capabilities
- Perform World-Class Test and Evaluation
- Sustain Air Force Capabilities through World-Class Depot Maintenance & Supply
AF S&T Workforce (AFRL)

<table>
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<th>Employees</th>
<th>Civilian *</th>
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*S&E Education*

- 20% PhD
- 33% M.S.
- 47% B.S.

*Does not include Students
*Data as of: 31 August 2013

*S&E Education* in S&T Workforce:

- 20% PhD
- 33% M.S.
- 47% B.S.

*Professional Tenure*

- Years of Federal Service:
  - 0 to 10
  - 10 to 20
  - 20 to 30
  - 30+

- # People:
  - 0 to 10
  - 10 to 20
  - 20 to 30
  - 30+
Where We Fit In

- Rocket Engines & Motors
- Satellite Propulsion
- Advanced Propulsion
- Fuels and Propellants
- System Analysis

- Air Vehicle Structures
- Controls
- Turbine Engines
- Ramjet Engines
- Hypersonic Engines
- Aircraft Power
- Thermal Management
- Fuels and Propellants
- System Analysis

RQ-West
(Edwards AFB CA)

RQ-East
(Wright Patterson AFB OH)
Edwards Site: Unique Capability

• **65 Square Mile Development Facility**
  – Air quality constraints do not inhibit research activities
  – Noise abatement not a problem
  – Wind/population corridor does not inhibit research
  – Environmental monitor/control systems in place
  – Flight Test Center relation/support ongoing

• **135 Major Lab/Engineering Facilities & Buildings**

• **30 Major Active Areas and Stands**
  – High Thrust Facilities
    • 19 Liquid Engine stands (up to 8M lbs thrust)
    • 13 Solid Rocket Motor pads (up to 10M lbs thrust)
  – Altitude Facilities (micro-newtons to 50K lbs thrust)

• **Unique geophysical set-up ($2.5B+ investment)**
Facilities

Bench-level Labs

High Thrust Facilities

- 19 Liquid Engine stands, up to 8,000,000 lbs thrust
- 13 Solid Rocket Motor pads, up to 10,000,000 lbs thrust

Altitude Facilities

- From micro-newtons to 50,000 lbs thrust

Distribution A: Approved for public release; unlimited distribution
History of the Rock

- AF Atlas ICBM/Launch Vehicle
  - Early 1960s on Test Stand 1-95

• Distribution A: Approved for public release; unlimited distribution
History of the Rock

- Titan I & II ICBM
  - Test Stand 1-3 in Early 1960s
- Titan IV solid rocket booster
  - 1980s – 1990s in Area 1-32 and Test Stand 1-B

Distribution A: Approved for public release; unlimited distribution
History of the Rock

- F-1 engine testing for the Saturn V Rocket that put Men on the Moon

**Distribution A**: Approved for public release; unlimited distribution
History of the Rock

- AF Minuteman I, II and III ICBMs

*Distribution A: Approved for public release; unlimited distribution*
Space and Missile R&D Building Block Process

6.1 EXPLORATORY RESEARCH
- Materials
- Turbomachinery
- Thrust Chambers & Nozzles
- Preburners

6.2 APPLIED RESEARCH
- Controls
- Electric Thrusters
- Cases/Tanks

6.3 ADVANCED DEVELOPMENT
- Reusable
- Expendable
- Spacecraft
- Space and Missile Integrated Rocket Demonstrators

TECHNOLOGY TRANSITION
- Strategic
- Tactical
- Space and Missile Component Technology Demonstrators
Rocket Propulsion Division (RQR)
Functional Layout

Safety

Finance

Experimental Demonstration (O)

Engines (E)
Motors (M)
Propellants (P)
Combustion (C)

In-Space Propulsion (S)

Integration and Operations

• Distribution A: Approved for public release; unlimited distribution
Branch Competencies/Expertise

• RQRC – Combustion Devices

• RQRP – Propellants

• RQRO – Experimental Demonstrations
  – World-Class Facilities & Testing Support For Rocket Propulsion Technologies and Systems. Solids, Liquids, In-Space at Atmospheric or Hi-Altitude (including temp control)

• RQRM – Motors
  – Exploratory and Advanced Development of Solid Propulsion Technologies

• RQRE – Engines
  – Exploratory and Advanced Development of Liquid Rocket Engine Technologies

• RQRS – In-Space Propulsion
  – Exploratory and Advanced Development of Spacecraft Propulsion Technologies

• Distribution A: Approved for public release; unlimited distribution
Programs of Interest
(it’s all about the paradigm shifts)

USET – Upper Stage Engine Technology
IMLM – Integrated Motor Life Management
MCAT – Missile Component Advanced Tech
HC Boost – Hydrocarbon Boost
AFM 315E – Green Propellant
EP – Electric Propulsion

Distribution A: Approved for Public Release; Distribution Unlimited
IMLM
(Integrated Motor Life Management)

Goals: Reduce predictive uncertainty of future state of a motor on an individual basis by 20%/50% (near/far term goals)

In-House:
- Validation of A&S modeling capability
- AFNWC funded supported for ANDES improvement (Automated NDE Data Evaluation System)

The WOWs
- Potential to provide millions in cost avoidance
- Provide accurate, near-real-time motor health condition (diagnostics)
- Provide individualized service life estimates (prognostics)
- Transition opportunity ~ 2018

• Distribution A: Approved for public release; unlimited distribution
What are we doing? Developing new solid rocket motor (SRM) components and M&S tools that decrease inert weight by 20%.

Customer why? High-speed penetrator weapons will enable attack of deeply-buried targets.

Tech Reason? New M&S tools may show possibility of higher efficiencies from SRM designs.

Transition? 3 of 6 FY12 task orders support an AFRL FCC. 1 of 6 FY12 task orders supports AFNWC.

In-House:
Experiments to validate new models

The WOWs
• The AFNWC propellant task is part of a plan that may save $2.1B in future acquisition costs.
• We are only gov’t lab doing solid rocket motor R&D for launch & strategic needs.

• Distribution A: Approved for public release; unlimited distribution
USET
(Upper Stage Engine Technology Program)

• Validating new suite of LOx/Hydrogen rocket engine M&S tools through heavily-instrumented 4,000 hp, 90,000 rpm turbopump

• Risk reduction work ups TRL of components allowing SMC/LR NGE program to enter post-milestone B, saving years on the schedule and $multi-M’s in cost

• Verify and Validate suite of tools to greatly reduce the amount of physical testing by conducting better M&S during design

• NGE with SMC/LR and tools used in current NGE risk reduction work, Hydrocarbon Boost, >45 M&S tool-specific transitions to industry, DOD, NASA

In-House:
• Test stand Buildup
  • Design of new facility hardware
  • Hardware Fabrication
  • Hardware Installation
• In-house tool validation and verification
• On-site rapid data reduction and analysis

The WOWs:
• SMC/LR requested TTP transition to NGE
• Key member of AUSEP (Affordable Upper Stage Engine Program) IPT
• Conducted Risk Reduction work on USET contract to support AUSEP TRL requirements
• Most highly instrumented, highest tip speed and suction of any turbopump ever tested

Program Completed, Report in Progress

SMC/LR AUSEP Vision Engine

Distribution A: Approved for Public Release; Distribution Unlimited
## HC Boost
*(Hydrocarbon Boost Program)*

### In-House:
- Building subscale test facility to mitigate combustion devices risk
- Critical combustion research using 219 funds
- Fuel thermal stability, nozzle cooling, injector design

### The WOWs:
- Design, build, test ORSC LOx/Kerosene Liquid Rocket Engine Tech Demonstrator
  - 250K-lbf with high Throttle Capability (SOTA is 2:1) – Enables mission flexibility
  - 100 Life Cycle with 50 cycle overhaul (SOTA is 20) – Exceeds requirement, provides margin
- ORSC is a higher performing engine resulting in a smaller launch vehicle or an increase in delivered payload

- Required to replace Russian RD-180 on EELV
- U.S.’s 1st reusable, high-perf HC engine
- Establishes Ox-rich staged combustion (ORSC) tech base for U.S.
- Sustain ailing U.S. rocket engine industry tech development base
- HCB strongly supports SMC/LR American Kerosene Engine project

*Distribution A: Approved for Public Release; Distribution Unlimited*
Electric Propulsion

What are we doing? Developing new technologies that enable less expensive, more maneuverable and more agile s/c

Customer Why? Reducing launch mass substantially reduces launch cost, increases payload fraction, and enables missions otherwise not possible (e.g. AEHF)

Tech Reason? Plasma propulsion increases Isp by 10x, reducing s/c propellant 10x, enabling lighter and/or more capable s/c

Transition?
• Tech demos: FalconSat-5—demonstrating low power propulsion and spacecraft impact
• Operational systems: AEHF—enabling high mass spacecraft directly supporting warfighter

In-House:
• Test facilities
  • 8 vacuum chambers
  • Thruster design
  • Diagnostics
  • Validation of M&S
• Mod/Sim Program
  • Advanced numerical methods

The WOWs:
• AEHF requested assistance with thruster performance verification; SV-2 onboard diagnostics package flying
• Developed propulsion module for FalconSat-5 tech demo, including spacecraft interaction diagnostics
• Cubesat EP propulsion module selected by 2 constellations for flight in 2014
• National M&S effort for EP coordinated by AFRL-RZSS

Distribution A: Approved for public release; unlimited distribution
AFRL Developed Advanced Monopropellants

What are we doing? *Providing advanced propellant with higher performance and much lower toxicity than hydrazine*

Customer why? *Faster operational response with reduced costs can be attained with greater mission capabilities*

Tech Reason? *Energetic ionic liquids provide low vapor toxicity and high energy density*

Transition? *Orbital flight experiment on TBD S/C-2014*

In-House:
- Fully characterized small scale safety & hazard properties
  - Passes all safety requirements
  - DOT approval for transport
- First successful thruster firings
- Pilot scale propellant production
  - *Advanced monopropellant cost = hydrazine cost*
  - Supplying transition programs
- Distribution A: Approved for public release; unlimited distribution

Small Spacecraft Benefits Trade Analysis

- NTO/MMH Bipropellant
- AFRL Advanced Monopropellant
- Hydrazine Monopropellant

Advanced monoprops can perform like bipropellant in small craft!
What Have We Done Lately?

Recent Technical Achievements

- Transitioned 200W Hall Thruster to TacSat-2
- Delivered 8 CubeSat thrusters to NRO (10x inc in performance)
- USET demo (liquid rocket engine turbopump), M&S transitions & tech transition to customer
- Hydrocarbon Boost subscale preburner on test stand (testing to begin CY14)
- Combustion Stability Test Rig/Facility passed last hurdled, testing to begin this quarter (219 funded)
- New energetic ingredient (furazan class) cleared for large batch (10 lb) scale-up
Questions?

Propulsion - the technology that enables the warfighter to reach out and touch anyone, anywhere in the world—and beyond.

The Air Force Research Laboratory’s Propulsion Directorate - the nation’s premier organization to create and transition technology for military propulsion and power systems since the dawn of powered flight.
ASTROS

ASTROS Project Manager

Jamie Malak

Distribution A: Approved for public release; unlimited distribution
Contract History

• Research Operation Support Services (ROSS I & II)
  – Combined three contracts
    • Operational Services Support (OSS)
    • Technical Services Support (TSS)
    • Facility Support Maintenance Services (FSMS)
  – 15 year history
    • ROSS I, $142M, PoP 1999 - 2011
    • ROSS II, $118M, PoP 2011 - 2016
  – Competitive source selections
  – CPAF

Distribution A: Approved for public release; unlimited distribution
Meeting Objectives

- Objectives of Industry Day
  - Present proposed program
    - Goals
    - Schedule
    - Seek input for acquisition strategy
  - Provide details on Request For Proposals (RFP)
  - Gain concurrence/feedback from industry on this plan.
  - Send feedback to email addresses listed at [www.fbo.gov](http://www.fbo.gov)
  - Q & A responses will be posted under FA9300-15-R-0001 in FBO NLT 27 July 2014

Distribution A: Approved for public release; unlimited distribution
Contracting Overview

- Current Contract
- Requirements to do Business with the Government
- Acquisition Background
- Contract Type
- Contract Structure
- Acquisition Conditions
- Oversights
- Deliverables
- Tentative Contracting Milestones
- Base Support/Government Furnished Services
- Organizational Conflict of Interest
- Source Selection

Distribution A: Approved for public release; unlimited distribution
Current Contract

- ROSS II, FA9300-11-C-0001
- Current Contractor: Jacobs Technology Inc.
- Contract Type: CPAF, FFP, CPFF
- Original Total Contract Value: $86M
- Current Contract Value: $118M
- NAICS Code: 541712 - Research and Development in the Physical, Engineering, and Life Sciences (Except Biotechnology)
  - SB size standard 1000 Employees

Distribution A: Approved for public release; unlimited distribution
Requirements to do Business with the Government

• **System for Award Management (SAM)** required in accordance with FAR 4.1102. Access at: [https://www.sam.gov/portal/SAM#1](https://www.sam.gov/portal/SAM#1)
  
  — Core Data (formerly Central Contractor Registration or “CCR”)
  
  — Representations & Certifications (formally Online Representations and Certifications or “ORCA”)

• **Wide Area Work Flow (WAWF):** Contractors will submit payment requests in accordance with the instructions contained in their specific contract. Reference DFARS 252.232-7003. Contact your particular DCMA office for training. Access at: [https://wawf.eb.mil/](https://wawf.eb.mil/)
Acquisition Background

• Project Name: ASTROS
• On Site Support – AFRL/RQ- West
• Anticipated Period of Performance, 10 years
  – 4 Year Basic
  – 2 Year Award Term
  – 2 Year Award Term
  – 2 Year Award Term

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Tentative Contract Type

- **Cost-Plus-Fixed-Fee + Performance Incentive + Award Term**
  - CPFF \((X\%)\) + PI \((X\%)\), request Industry input
  - **Possible Performance Incentive Criteria**
    - Management
    - Technical
    - Cost
    - Schedule
Anticipated Contract Structure

• Basic contract CLIN structure
  – CLIN 0001 Phase In (FFP)
  – CLIN 0002 ASTROS Labor (CPFF + PI)
  – CLIN 0003 Materials and Travel (Cost), government provided amount
  – CLIN 0004 CDRLs (NSP)

• Award Term Periods CLIN structure
  – CLIN X002 ASTROS Labor (CPFF + PI)
  – CLIN X003 Materials and Travel (Cost), government provided amount
  – CLIN X004 CDRLs (NSP)
Acquisition Conditions

- Security classification
- Base support
- Computer security requirements
- No foreign participation
- International Traffic in Arms Regulations (ITAR)
  - Public Law 98-94 (Export Control)
- Organizational Conflict of Interest (OCI)
- Non Disclosure Agreements (NDA)
- Associate Contractor Agreements (ACA)
- Unlimited data rights
- Environmental and safety requirements
  - Hazardous materials

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Potential Oversight

- Monthly Management In-House Reviews
- Regular updates to Government Program Manager and Work Plan Manager
- Compliance with Service Summaries
- Performance Incentive Reviews – fee
- Award Term Board – added years
Potential Deliverables

- Work Plan, as required
- Monthly Funds and Man-Hour Expenditure Report
- Property Control Plan
- State Environmental Health and Safety Plan
- Subcontracting Plan
- Quality Control Plan
- Instrumentation Controls Software/Programming

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Organizational Conflict of Interest

- Per Policy Memo 10-C-15 (15 Oct 2010) directed at AFFARS 5352.209-9000:
  - Prevents conflicting roles which may bias the contractor’s judgment of objectivity, or to preclude the contractor from obtaining an unfair competitive advantage in concurrent or future acquisitions.
  - Alt III – May not use other company’s proprietary information in any other way or purpose
  - Alt VI – Restrictions are binding to any subcontractors – prime must include in any subcontracts
  - Both Alts apply to this contract

- Policy Memo 10-C-15 can be found at

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<td>• Proposals due</td>
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<td>• Proposal evaluation</td>
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<tr>
<td>• Contract Award</td>
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<tr>
<td>• Phase-In (60 days)</td>
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<tr>
<td>• Full Performance</td>
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Distribution A: Approved for public release; unlimited distribution
Base Support

- Office space, furniture, telephones, computers
- Emergency medical transport
- Security police support
- Firefighter support
- Site specific training (i.e. Desert Tortoise)
- Custodial Service
- Use of government fuel supply

Distribution A: Approved for public release; unlimited distribution
Tentative Source Selection

• Award based on Best Value

• Evaluation factors
  • Factor 1: Mission Capability
    • Subfactor 1: Technical scenarios
    • Subfactor 2: Program management
    • Subfactor 3: Subcontract management
    • Subfactor 4: Personnel recruitment and retention plan
  • Factor 2: Past Performance
  • Factor 3: Cost/Price

• Factor 1 is most important. Factors 2 and 3 are equal in importance and of lesser importance than Factor 1.
  • Factor 1 > (Factor 2 = Factor 3)

Distribution A: Approved for public release; unlimited distribution
Tentative Source Selection

• Written & Electronic Proposals
  ➢ Electronic spreadsheets must include formulas

• Oral Presentations
  • 15 minutes company description/capabilities
  • 45 minutes evaluated
  • Factor 1, subfactors 2, 3 and 4

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Technical Overview

• Current Demographics
• Major Work Vectors
• Contract Management
• Security / ITAR Restrictions

Distribution A: Approved for public release; unlimited distribution
Current Technical Demographics

- Total number: 95

- Skill Sets Include
  - Scientists / Engineers (38)
  - Technicians (57)
    - Mechanics
    - Instrumentation and Controls
    - Machinists
    - Welders
    - Electricians

Distribution A: Approved for public release; unlimited distribution
Major Vectors

• Provide comprehensive program management responsible for overall program coordination and all individual tasks required to satisfy assigned mission on time and at or under agreed budget.

• Provide appropriate specialized skills related to rocket propulsion systems. Demonstrate flexibility to quickly respond to changing test stand build up requirements and priorities.

• Provide robust, timely and accurate standardized electronic billing and purchasing systems at the CLIN/ACRN/Task level, linking PO & invoice (with % Davis Bacon Act).

• Maintain required safety, security, quality, code/regulation/logistics compliance and sustainability levels.

• Maintain required configuration management such as drawings, SOPs, etc.

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Security

• Work site is in an access controlled area
  – Badges required
  – Military base requirements
  – Special requirements for visitor access

• Some classified information may be generated

• No POVs in test areas

• Comply with International Traffic in Arms Regulations (ITAR) and EAR (Export Administration Regulations) as such items are generated
• All documents must be reviewed and approved by the Scientific and Technical Information Office (STINFO) prior to release. A vast majority of documentation generated will have limited distribution

• Contractors have a responsibility to inform their subcontractors and commercial suppliers that they must also comply

• For further information, please reference:
  
  
Questions & Discussion
<table>
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<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>0800 – 0815</td>
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</tr>
<tr>
<td>1100 – 1200</td>
<td>Lunch</td>
</tr>
<tr>
<td>1200 – 1230</td>
<td>Tour 2/Individual Q&amp;A Sessions</td>
</tr>
<tr>
<td>1230 – 1500</td>
<td>Individual Q&amp;A Sessions (as needed)</td>
</tr>
</tbody>
</table>

Distribution A: Approved for public release; unlimited distribution