AFLCMC/RO

# RAPID SUSTAINMENT OFFICE

Annual Report
2021


RSO

Approved for public release: AFLCMC-2022-0048

# CONTENTS

# 2021

2021 saw the continuation of challenges brought forth by the COVID-19 pandemic. The Air Force Rapid Sustainment Office (RSO), like many others, found new, agile ways for teams to work together and advance its mission, and emerged with a renewed sense of resilience in the face of rapidly changing circumstances. In this Annual Report, the RSO showcases its enduring commitment to innovative sustainment technologies that keep the Air Force fleet prepared and ready.

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# OVERVIEW

The RSO was established with a sustainment-centric focus to leverage mature, new, emerging, and disruptive technologies to dramatically improve Air Force readiness. Organized with a non-traditional Air Force construct based on agile principles and a short chain of command, we pioneer innovative and cost-effective sustainment technologies and tools for the betterment of the sustainment enterprise.  The RSO is located near Wright-Patterson AFB, with a robust presence in AFLCMC's Advanced Technology & Training Centers (Dayton OH; Warner Robins GA; Pittsburgh PA).

## VISION

# MODERNIZE THE MAINTENANCE OPERATIONS AND SUSTAINMENT ENTERPRISE VITAL TO THE WORLD'S MOST ADVANCED AIR FORCE

## OBJECTIVE

# INCREASE MISSION READINESS AND CAPABILITIES BY IDENTIFYING, APPLYING AND SCALING TECHNOLOGY AND INNOVATIVE SOLUTIONS TO ADVANCE AND MODERNIZE SUSTAINMENT OPERATIONS OF THE UNITED STATES AIR FORCE

# OUR IMPACT

The RSO works with partners across the private and public sectors to bring the most advanced technology to the Air Force's sustainment enterprise. Some of our partners include: Headquarters Air Force, AFLCMC Program Executive Offices, Air Force Sustainment Centers, Air Force Research Laboratory, Major Commands, Federal Aviation Administration, Defense Innovation Unit, and the Defense Logistics Agency.

## 400+ BUSINESS DEVELOPMENT CALLS

The RSO is working with small and large businesses, while hosting pre-Pitch days with industry and working with over 600 organizations in the Air Force, across all MAJCOMs.

## 4,000+ SMALL BUSINESS INNOVATIVE RESEARCH (SBIR) PROPOSALS REVIEWED

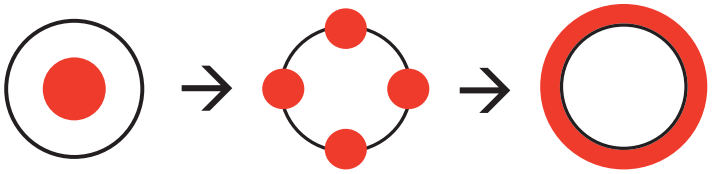
Over 4,000 SBIR Proposals were reviewed to identify sustainment application.

## 50 STATES

The RSO is executing work in 50 states, with both Air Force customers and partners as well as contractors to deliver sustainment solutions to the end user. Projects are also being showcased outside of the USA.

# OUR PROCESS

Our approach is a three-step process with distinct but overlapping phases to ensure potential solutions are prototyped and tested quickly and optimized for success at scale. The RSO is focused on a set of six core technology areas where emerging and commercial technology solutions have outsized impact on increasing readiness and decreasing costs.



**IDENTIFY**

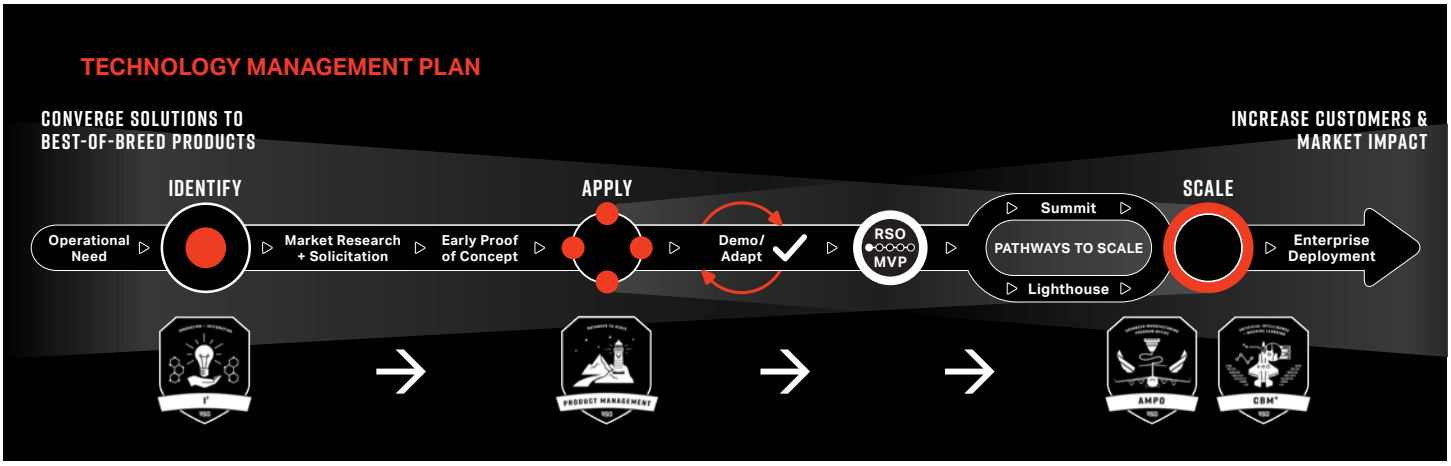
**Identify, assess and develop mature, new and emerging technologies from across the public and private sectors.**

**APPLY**

**Rapidly prototype and field in order to validate the utility of a solution in an Air Force environment.**

**SCALE**

**Deploy technology and processes across the Air Force enterprise that successfully demonstrate the ability to decrease cost and/or increase readiness.**




## PATHWAYS TO SCALE

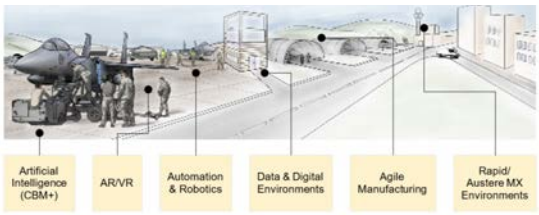
The traditional pilot direct-to-scale strategy for technology development remains a commonly misguided pathway to success, with only 29% of companies piloting Internet of Things solutions to scale. Effective scaling requires bridging pilots to scaling solutions through strategic pathways, such as organizationally-led and location-agnostic integration.

To help ensure our sustainment solutions achieve scale across the Air Force, we have developed the Pathways to Scale approach. This innovation system allows for a continuous flow of transformative technologies positively impacting the Air Force sustainment enterprise and legacy systems, platforms, and operations. These two distinct Pathways are: **Lighthouse** and **Summit.**

LIGHTHOUSE RSO

### Site Optimization

**Integrated approach with a focus on optimizing a location to gain maximum benefits from multiple new and emerging technologies**




SUMMIT RSO

### User Expansion

**Identifying exceptional technology solutions and propagating across multiple users/locations**

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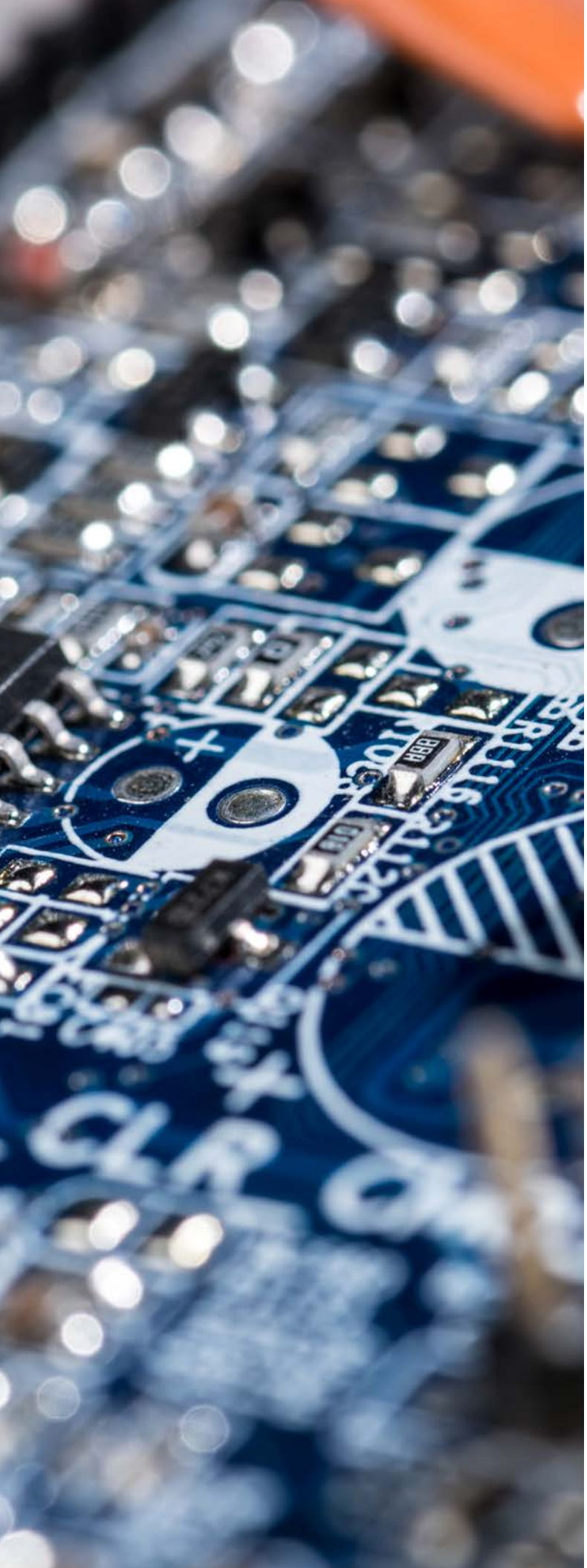
# TECHNOLOGY FOCUS AREAS

Artificial Intelligence & Machine Learning
Advanced Manufacturing
Automation & Robotics
Data & Digital Environments
Augmented & Virtual Reality
Rapid & Austere Maintenance Environments



# ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

We apply machine learning and artificial intelligence to optimize fleet maintenance, increase aircraft availability, and minimize aircraft downtime.

Our most prominent use of AI is our Condition Based Maintenance Plus (CBM+) program. Employing AI has enabled us to improve maintenance data quality and evaluate large sets of aircraft sensor data and maintenance history to predict component failures. These applications enable our CBM+ program to save thousands of maintenance hours every year.

**CBM+**

## Accomplishments

- Fielded CBM+ to more than 3,200 aircraft in Air Force fleet
- Removed over 500 parts before they failed
- Launched data analysis on 6 new platforms
- Fielded CBM+ on 8 new platforms – A-10, EC/HC-130, F-16, HH-60, RC-135, B-2, CV-22, and U-2
- Established a secure CBM+ data environment in Cloud One
- Configured next-generation AI platform for CBM+ analytics

## 2022 Opportunities

- Institutionalize CBM+ throughout Air Force enterprise
- Expand CBM+ technology, tools, and enablers

# ADVANCED MANUFACTURING

## Overview

The Advanced Manufacturing Program Office (AMPO) scales organic capability and serves as the Air Force's focal point for the application of AM in matters related to acquisition and sustainment.

The AMPO executes four major functions:

- Technology Assessment
- Airworthiness Certification Support
- Product Support Management
- Deployment Across the Enterprise

## Vision

Empowering Supply Chain Management and scaling AM across the Department of the Air Force to ensure continuous Warfighter advantage and readiness anytime, anywhere in the world

## Accomplishments

- Mobilized the VRC Raptor Cold Spray (CS) system at Ellsworth AFB to complete the Air Force's first "on-aircraft" CS repair, negating the need for B-1 major component disassembly
- Provided training to advance AM processes – 130 via online delivery, 18 in residence
- Delivered 153 AM metal and polymer parts
- Developed 18 parts that are now flying on various airframes
- Delivered 25 Technical Data Packages
- Published in JEDMICS Detail Specification for CoCrMo and Ti-6Al-4V Powders and Parts
- Began development of the Air Force Advanced Manufacturing Implementation Plan
- Executed first ever AMPO Air Force-wide Stakeholder Engagement, attended by 70+ members across 9 different organizations

## 2022 Opportunities

- Publish the Air Force Advanced Manufacturing Implementation Plan
- Transition printers to Field Units:
  - 2 EOS M290 to Hill AFB and 1 to Tinker AFB
  - 3 Stratasys Fortus 450 from the ATTC to Dover AFB, Robins AFB, and Westover AFB
  - 2 EOS M100s to the Air Force Academy, Department of Mechanical Engineering
- Field a prototype Cloud One-based Product Lifecycle Management (PLM) solution referred to as AGORA. AGORA will enable management of engineering processes and integrate Air Force supply, engineering and technical Data from multiple systems into a single system, creating opportunities to shorten the Air Force Supply Chain and improve aircraft operational readiness.
- Publish 2 JEDMICS Detail Specifications for F357 AL and NA718 Powders and Parts
- Award contracts to address Metals Development, Repair Capabilities, and an AM Digital Marketplace
- Continue to utilize the Commercial Solutions Offering to apply Congressional Add funding to form one or more partnerships with Industry to advance CS capabilities and achieve organic repair throughout the Air Force
- Deliver a schedule for all AM and CS courses to facilitate the organic growth of the capabilities


# AUTOMATION & ROBOTICS

## Overview

The RSO applies automation and robotics to eliminate maintenance tasks that are repetitive, labor-intensive, or hazardous, making it possible to accomplish these tasks safely and efficiently with a high degree of accuracy.

## Accomplishments

- Expanded laser de-coating system efforts to additional substrate and primer types for added aircraft capabilities
- Initiated robotic rapid prototyping for sheet metal forming as a potential replacement for costly and high maintenance tooling processes currently in use
- Developed improved handheld Electro Discharge Machining tool for removing non-aluminum fasteners for faster and less costly repair work
- Integrated thickness sensing technology into current laser coating removal system at Hill AFB

## 2022 Opportunities

- Develop robotic Integrated Bladed Rotor (IBR) scrubbing for repair maintenance cost and time savings
- Replace/upgrade robotic radome de-paint and paint capabilities
- Fully integrate Laser Coating Removal sensor technology to drive real-time robotic programing while de-coating aircraft
- Expand robotic match drilling of aircraft replacement skins

# DATA & DIGITAL ENVIRONMENTS

## Overview

We standardize maintenance and sustainment data collection to serve as a connector of data sources across the Air Force. Our process is to collect the data, identify what's useful, turn it into a functional format, and then leverage it to inform smart and proactive decisions.

## Accomplishments

- Currently have 5 Robotic Process Automation (RPA) efforts deployed, serving the 1 SOW at Hurlburt Field and 2 RPA efforts deployed at Scott AFB IL serving the 635 SCOW:
  - Flight-Crew Authorizations at Hurlburt – 600 Airmen hours returned to the mission annually
  - Range Scheduling at Hurlburt – 2,000+ Airmen hours returned to the mission annually
  - Part Number Creation at Scott – 1,300+ Airmen hours returned to the mission annually
- Successfully demonstrated an MVP with the 58 AMXG at Kirtland AFB, incorporating two maintenance procedures showing functional usage of digitally parsed Tech Orders in the Digital Maintenance Execution System
  - Reduces the amount of time to input maintenance data and refines the quality of data flowing into data system

## 2022 Opportunities

- Expand RPA solutions to additional Air Force maintenance use cases to unlock Airmen hours for higher productivity activities
- Explore further flightline operations digitization and integrate into emerging and legacy Air Force sustainment Management Information Systems

# AUGMENTED & VIRTUAL REALITY

## Overview

Augmented & Virtual Reality (AR/VR) technology creates an immersive environment for Airmen to train and execute more efficiently and effectively. The immersive access to digital resources allows the Air Force to predict, analyze, and solve problems faster, leading to a decrease in sustainment costs and increase in Airmen readiness. The AR/VR Product Team aims to continuously collaborate with users, characterize problems, and design and scale turn-key technological solutions that benefit the entire sustainment enterprise.

## Accomplishments

- Created AR/VR Product Team and established long term strategic vision for AR/VR integration
- Successfully demonstrated AR/VR technologies for both maintenance training and operations on B-1 and CV-22 platforms

## 2022 Opportunities

Further development of:

- Ruggedized Flightline Headsets
- PKI/CAC authentication and auditing
- Scalable & Adaptable Support Equipment
- AR Audio Integration
- Industrial Internet of Things Connectivity/ Integration Framework
- Machine Vision for Data Logging
- Safety Assistance/Working Recognition AI

# RAPID & AUSTERE MAINTENANCE ENVIRONMENTS

## Overview

The RSO provides Airmen with effective tools, leveraging modern, cross-cutting technologies to reduce the Air Force's logistical footprint and enhance mission capability. We want to be the Air Force's leading office for rapidly implementing emerging and solution-oriented technologies in austere environments.

## Accomplishments

- Exceeded user expectations for power generation with our Solar Powered Integrated Structure system during its deployment at the Patriot Exercise
- Further developed the Hands-Off Expeditionary Tent, a stand-alone, rapidly assembled autonomous structure, including a successful deployment to the Patriot Exercise
- Designed a fighter-sized hurricane-resistant maintenance hangar that is easy to transport and durable and can be assembled quickly with minimum personnel

## 2022 Opportunities

- Increase solar power generation capabilities
- Develop rapidly deployable maintenance hangars for LO coating repairs
- Advance expeditionary and deployable structures to support corrosion control
- Develop additive manufacturing machine containerization

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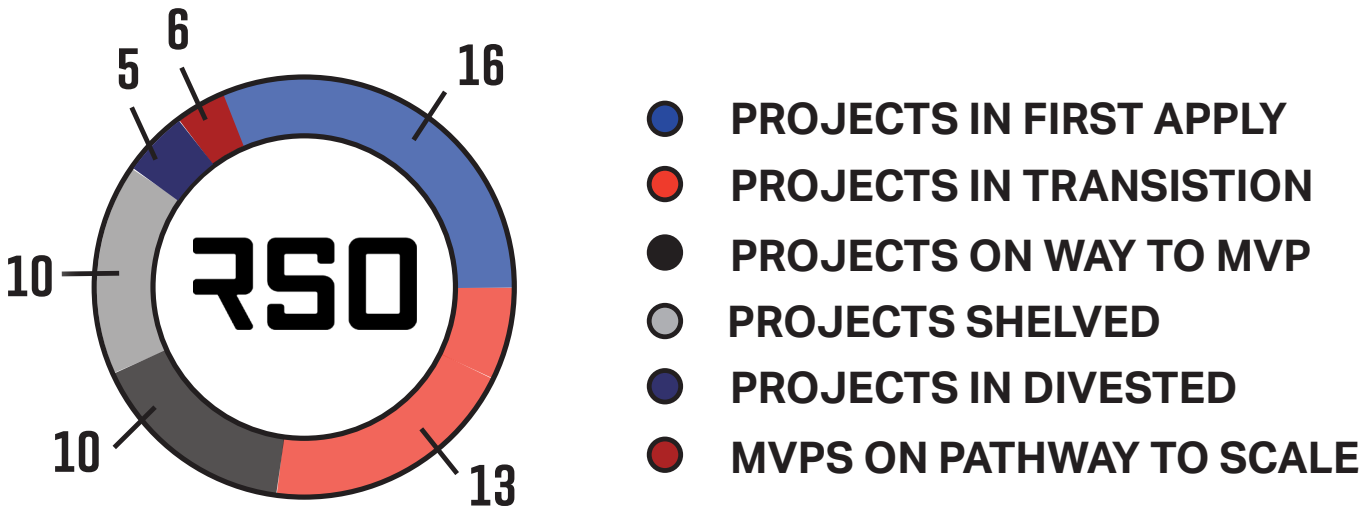
# OUR ACCOMPLISHMENTS

# KEY ACCOMPLISHMENTS

**The RSO identifies emerging technologies, applies and validates through rapid prototyping, then deploys and scales the technologies over time. Moving technology from one phase to another is an impressive feat that showcases the RSO's ability to rapidly deploy emerging technologies. Of the 132 projects during 2020, 23 were awarded a Phase I SBIR contract, and 15 of those were awarded a subsequent Phase II SBIR contract.**

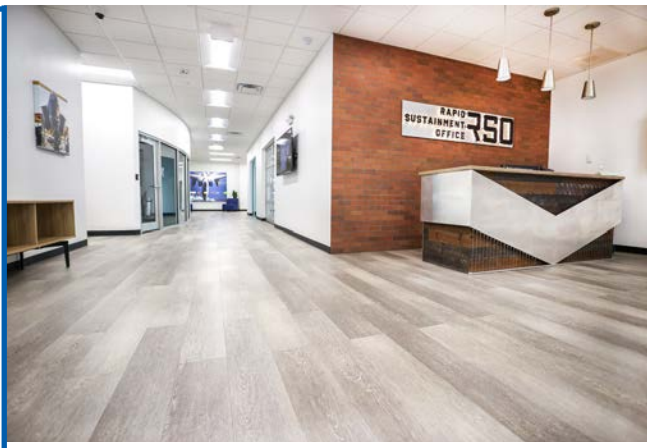
**In 2021, the RSO moved from 35 projects to 58 projects within the Identify and Apply phases.**



# BIG CHANGES, SAME MISSION

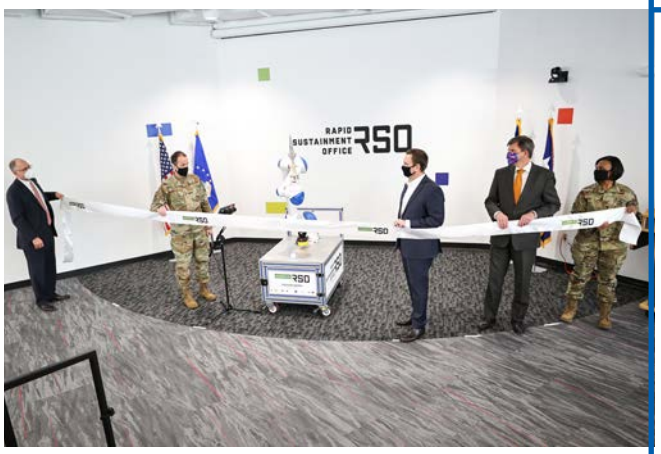
RSO moves into its new headquarters, Hangar 01

## JANUARY 2021




RSO holds official Hangar 01 ribbon cutting ceremony

## MARCH 2021




Mr. Rodney Stevens becomes the RSO's second Deputy Program Executive Officer

## AUGUST 2021


# PITCH DAY OVERVIEW


**Overview**

The RSO successfully hosted a single Pitch Day, 7-8 July 2021. After awarding 23 projects for Phase I SBIR awards in 2020, 18 companies were invited back to present their solutions to the RSO team for Phase II awards. Fifteen companies were ultimately awarded prototype contracts.

Months
(Phase I award to $1.5M
Phase II Apply effort)

**4**

Prototype Contracts
Value

**$20M**

Companies Proposed

**132**

Electroninks Incorporated
728 followers

Today Electroninks announced a $1.5M contract with The Air Force's Rapid Sustainment Office (RSO) .

"Electroninks particle-free inks and CircuitJet printers have the potential to provide a highly reliable and flexible solution required for development of printed circuit boards needed to help sustain important Air Force systems," said Leslie Edmondson, RSO Innovation & Integration Program Manager.

Obtained in Phase II Small Business Innovation Research (SBIR) our contract will allow the Air Force to print PCBs on demand and with a 90 percent reduction in the cost of metal inks using Electroninks CircuitJet Printers.

# PITCH DAY AWARDED COMPANIES

## ADVANCED MANUFACTURING

| | |
|---|---|
| **Electroninks** | User: Nellis AFB and Tyndall AFB<br>Effort: Portable Circuit Board Printer |
| **SIMBA Chain** | User: Texas ANG<br>Effort: Deployable Advanced Manufacturing Container |

## ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

| | |
|---|---|
| **Aging Aircraft** | User: Robins AFB<br>Effort: Work Unit Code Suggestion Tool |
| **Beacon** | User: Kirtland AFB – C-130<br>Effort: Work Unit Code Suggestion Tool |
| **Disruptiv** | User: KC-135<br>Effort: IUID Digital Twin Mapper |

## AUTOMATION & ROBOTICS

| | |
|---|---|
| **Kalscott** | User: Joint Base McGuire-Dix-Lakehurst<br>Effort: Auto-Electric Flightline Vehicle |
| **RE2** | User: Joint Base Lewis-McChord – C-17<br>Effort: Two-armed Robot Inserting Thrust Reverser Lock-out Pin |
| **Southie Autonomy** | User: Tinker AFB<br>Effort: Two-armed Robot Pulling Tools for kits |
| **The Albers Group** | User: Hill AFB<br>Effort: Ultra Short Pulsed Laser for Surface Preparation |
| **Wilder Systems** | User: Tinker AFB – KC-135<br>Effort: Mobile Base Autonomous Robot |

## DATA & DIGITAL ENVIRONMENTS

| | |
|---|---|
| **IoT/AI** | User: Luke AFB – F-16<br>Effort: Mesh Network with four different devices |
| **Parcell** | User: MacDill AFB and Nellis AFB<br>Effort: Smart Tool Crib |
| **Space Sciences** | User: Nellis AFB<br>Effort: Smart Artificial Intelligence Toolbox retrofit |

## RAPID & AUSTERE ENVIRONMENTS

| | |
|---|---|
| **Figure EN** | User: PACAF & AFCEC<br>Effort: Deployable Conditioned Air Repair Complex (Fighter-Sized) |
| **TRAC9** | User: PACAF & AFCEC<br>Effort: Rapidly Deployable Conditioned Air Repair Complex (Component-Sized) |

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# LOOKING AHEAD: 2022 SIGNIFICANT EVENTS

# 2022 SIGNIFICANT EVENTS

### CBM+ Authority to Operate (ATO)

January 2022

Authority to Operate (ATO) approves the CBM+ program to process production data in an authorized environment and provides permission to process near real time data for CBM+ analysis.

### CBM+ Cloud One Production Go-Live

February 2022

Cloud One Production Go-Live provides the technical ability to process operational data, increasing the level of system performance and support for the Air Force CBM+ enterprise.

### Advanced Manufacturing Program Office (AMPO) Technical Interchange Meeting

February 2022 | Virtual

This technical interchange meeting brings together the Air Force Advanced Manufacturing community to share advancements, exchange ideas and foster cooperation and collaboration among program offices, and learn more from experts in Advanced Manufacturing and Cold Spray technologies.

### Automation & Robotics Quarterly Working Group

March 2022 | Hill AFB

This Government-only event brings together A&R stakeholders from RSO, Air Logistics Complexes, and the Air Force Research Laboratory to collaborate on customer needs and the state of robotics technology.

### AR/VR Quarterly Working Group

April 2022 | RSO Hangar-01 & Virtual

This Government-only event brings together AR/VR stakeholders from across the Air Force and numerous MAJCOM customer representatives to collaborate on customer needs and the state of AR/VR technology.

### CBM+ Stakeholders Summit

May 2022 | Nellis AFB

This Government-only event invites CBM+ stakeholders to participate in valuable presentations, training sessions, and discussions to share successes, best practices and techniques, and lessons learned, promoting unity and collaboration across the DoD CBM+ community.

### RAPID + TCT Additive Manufacturing Summit

May 2022 | Detroit, MI

The RAPID + TCT AM event, hosted by the Society of Manufacturing Engineers and Rapid News Publications Ltd., is focused on emerging technologies for DoD and industry. The RSO AMPO will be presenting its current status for machine and material qualification.

### Lighthouse – LITE Final Demonstration

June 2022 | Nellis AFB

This technology demonstration will provide an evaluation of the culmination of Google's first period of performance in the development of the Lighthouse Integration Technology Engine (LITE).

### Automation & Robotics LCR Expansion Project

July 2022 | Davis-Monthan AFB

Delivery of a Laser Coating Removal (LCR) system to the Aerospace Maintenance and Regeneration Group (AMARG) at Davis-Monthan AFB. This project builds upon the LCR system currently in place at Hill AFB, to deliver expanded de-paint capacity for the maintenance of fighter-sized aircraft.

### AMPO Technical Interchange Meeting

November 2022 | RSO Advanced Technology & Training Center (ATTC), Dayton, OH

This technical interchange meeting brings together the Air Force Advanced Manufacturing community to share advancements, exchange ideas to foster cooperation and collaboration among program offices, and learn more from experts in Advanced Manufacturing and Cold Spray technologies.

RSO

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