National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility

NRW-5600
Effective Date: (16-June-2015)

Mission Operations Directive
(MOD)

41.113 Koehler RockOn 2015
Submitted:

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Concur:

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Principal Investigator

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Chief, Range and Mission Management Office

UNCONTROLLED WHEN PRINTED. VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

THE CONFIGURATION & DOCUMENT MANAGEMENT SYSTEM (CDMS) IS LOCATED AT: HTTPS://ROMS.WFF.NASA.GOV
## CHANGE RECORD SHEET

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<td>COUNTDOWN PROCEDURES</td>
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1000  GENERAL INFORMATION

The 41.113 Koehler project is a continuation of the annual Rock-On Sounding Rocket Workshop. It represents the collaborative effort of the Colorado Space Grant Consortium (COSGC), the Virginia Space Grant Consortium (VSGC), and Wallops Flight Facility (WFF). The workshop is intended to provide an introductory level space flight opportunity. This Rock-On workshop provides a hands-on, rocket flight training experience. NASA Wallops Flight Facility will provide all range support services, including tracking and data acquisition, safety, and range logistics functions for the 41.113 Koehler Rock-On mission.

The Flight Safety Plan (FSP) will define actual sequence of events that will govern launch, flight, and trajectory. Verify all safety data in this document with 41.113 Koehler Safety Plan 803-FSP-SRPO-41.113-01.

1010  Key Technical Personnel

<table>
<thead>
<tr>
<th>Project Team Member</th>
<th>Position/Expertise</th>
<th>Phone #</th>
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<tbody>
<tr>
<td>John Dickerson</td>
<td>Test Director (TD)</td>
<td>757-824-1482</td>
</tr>
<tr>
<td>Alice Rew</td>
<td>Project Manager (PM)</td>
<td>757-824-1665</td>
</tr>
<tr>
<td>Larry Lederer</td>
<td>Project Support Manager</td>
<td>757-824-1456</td>
</tr>
<tr>
<td>Rachel Empson</td>
<td>Range Services Manager (RSM)</td>
<td>757-824-1700</td>
</tr>
<tr>
<td>Chris Koehler</td>
<td>Principal Investigator (PI)</td>
<td>303-492-3141</td>
</tr>
<tr>
<td>Libby West/ Brian Hall</td>
<td>SRPO Projects Mgr.</td>
<td>757-824-2440</td>
</tr>
<tr>
<td>Nathan Empson</td>
<td>NSROC Mission Mgr. (MM)</td>
<td>757-824-1546</td>
</tr>
<tr>
<td>Greg Ellis</td>
<td>Launch Pad Manager (LPM)</td>
<td>757-824-2527</td>
</tr>
<tr>
<td>Sarah Daugherty</td>
<td>Range Operations Asst. (ROA)</td>
<td>757-824-2283</td>
</tr>
<tr>
<td>Katie Cranor</td>
<td>Range Safety Officer (RSO)</td>
<td>757-824-2107</td>
</tr>
<tr>
<td>Dave Knight</td>
<td>Ground Safety Analyst (GSA)</td>
<td>757-824-1035</td>
</tr>
<tr>
<td>Lee Long</td>
<td>Flight Safety Analyst (FSA)</td>
<td>757-824-1001</td>
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<tr>
<td>Dave Knight</td>
<td>Operations Safety Specialist (OSS)</td>
<td>757-824-1035</td>
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<tr>
<td>Mark Noll</td>
<td>Security</td>
<td>757-824-2467</td>
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<tr>
<td>Darryll Covington</td>
<td>Surveillance Officer (SO)</td>
<td>757-824-1922</td>
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<tr>
<td>Jordan West</td>
<td>Surveillance Coordinator (SC)</td>
<td>757-824-2949</td>
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<tr>
<td>Jeremy Eggers</td>
<td>Public Affairs Officer (PAO)</td>
<td>757-824-2958</td>
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1020 Funding Information

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<th>Non-Reimbursable</th>
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<tr>
<td></td>
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NASA Sounding Rocket Operations Contract (NSROC) personnel labor charges and mission cost will be tracked by NSROC in accordance with SRPO policy and standard practices.

ROC support will be applied to a standard charge number used for general NASA Sounding rocket mission support. Charges will be tracked at that level only.

ROC Project #: 00270

Civil Service labor charges will be tracked by WFF Resources Office. Charges will be applied to the following WBS number:

WBS # 962880.03.05.15.02

Safety and Project Management contractor support will be charged as required, and tracked by the RMMO Project Manager.

1030 Acronyms and Definitions

A complete list of acronyms can be found on the ROMS website: https://roms.wff.nasa.gov/

Category “A”: The condition in which an ordnance device will meet all of the following criteria:

1) Initiation of the device could, by expenditure of its own energy, or by initiating a chain of events, result in injury or death to personnel or damage to property;

2) Sufficient potential energy exists to initiate the device; and

3) Approved mechanical devices do not control the energy output of the device.

Category “B”: The condition in which an ordnance device:

1) Is highly improbable of being initiated or

2) Will not cause injury to personnel or damage to property by either the expenditure
of its own energy or the chain of events it initiates or

3) An approved mechanical device(s) controls the energy output of the device.

**Danger Area:** The defined area within which a person is subject to death or serious injury in the event of a catastrophic failure of a system and/or component.

**Final Arming:** Preparation of a system for flight by removal of inhibits in an electrical circuit that controls a hazardous system. The Final Arming operation is performed remotely during the last minutes of the countdown.

**Initial Arming:** Operations conducted on the launch pad, which ready the vehicle/payload pyrotechnic systems for final arming. Some examples of Initial Arming include connecting the booster to the booster firing circuit, installing the ARM plug in the sustainer ignition circuits, and removal of mechanical restraints.

### 1100 PROGRAM MISSION DESCRIPTION/OBJECTIVES

The Rock-On workshop provides university undergraduate level students and instructors with a space flight opportunity that involves minimal cost, minimal time investment, minimal complexity, and with minimal impact to the NASA Sounding Rocket Program (NSRP).

The mission of Rock-On is to teach university faculty and students the basics of rocket payload construction and integration. Rock-On also acts as the first step in the RockSat series where workshop participants return the following year to design, build, test, and fly their respective University experiment. The Rock-On payload is designed to capture and record 3-axis accelerations, pressure, temperature, and radiation counts over the course of the mission. The Wallops Range will provide project management support for Range functions sufficient to ensure smooth integration of WFF efforts and responsiveness to customer needs. This Rock-On mission is the first to use the nose cone as an additional payload storage area.

### 1110 Test Window

The launch window is presently scheduled to begin no earlier than June 25/26, 2015. The Terrier Improved Orion will launch from the Pad 2/MRL launcher.
1120  Operational Schedule

<table>
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<tr>
<th>L-DAY</th>
<th>RF AVOIDANCE</th>
<th>ACTIVITY DESCRIPTION</th>
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<td>30</td>
<td>No</td>
<td>Launcher preparations</td>
</tr>
<tr>
<td>14</td>
<td>Yes</td>
<td>Move motor to Wallops Island: 11 June 2015. Y-15 bay 8 (Motor build-up)</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
<td>Transport motor to rail 22 June 2015</td>
</tr>
<tr>
<td>1</td>
<td>Yes</td>
<td>Transport payload to rail 24 June 2015</td>
</tr>
<tr>
<td>1</td>
<td>No</td>
<td>Horizontal and vertical checks 24 June 2015</td>
</tr>
<tr>
<td>1</td>
<td>No</td>
<td>Pre-mission brief 24 June 2015</td>
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<tr>
<td>0</td>
<td>Intermittently</td>
<td>Launch window 25 June 2015 with Back Up on 26 June 2015</td>
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</table>

1130  Success Criteria

The following mission success criteria has been established for the project:

**Minimum Mission Success Criteria:** At least one hot count conducted for the Rock On/RockSat mission.

**Comprehensive Mission Success Criteria:** A successful launch on the Rock-On/RockSat-C payload, payload recovery and the data collected from the majority of the participant built experiments.

1200  TEST SYSTEM DESCRIPTION

1210  Vehicle Description

The Terrier-Improved Orion vehicle (Figure 1210-1) is a two stage, solid propellant, unguided, rail-launched, sounding rocket.

The first stage Terrier Mk-12 booster is 18” in diameter and has four fins set at 15 minutes positive incidence to induce a 1.4Hz clockwise spin rate at burnout. Burn time for the Terrier is 5.2 seconds. The inter-stage adapter at the head end of the Terrier motor slip-fits into the nozzle throat of the second stage sustainer motor.
The second stage sustainer is 14" in diameter and has four fins set at 49 minutes to induce a 5.5Hz clockwise spin rate at burnout. Burn time for the Improved Orion is 25.4 seconds.

Figure 1220-1 Launch Vehicle/Recovery System
Payload Description

The payload should contain three RockSat-W (RockOn) and six RockSat-C (RockSat) canisters (see Figure 1220-2). The 14inch diameter experiment carrier is provided by NASA. It should include a sealed nose cone, sealed experiment bays, and a recovery system. There is one new addition to this RockSat mission that differentiates it from those previous; a cubes-in-space experiment are planned to be housed inside the nosecone.

Figure 1220-2 Payload system
1300 TRAJECTORY

See Figures 1300-1 & 1300-2 for nominal trajectory/impact plots for this mission.

Figure 1300-1 Altitude vs Time
Figure 1300-2 Latitude/Longitude – Degrees (Impact Map)
1310  

**Table of Events**

MRL Launcher  Pad: 2 QE = 84 degrees  AZ = 105 degrees  
Payload weight (launch configuration: 659.2lbs.)

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<tr>
<th>Event</th>
<th>Time (sec)</th>
<th>Nominal Altitude (km)</th>
<th>Nominal Range (km)</th>
<th>Velocity (m/s)</th>
<th>Flight Elevation (deg)</th>
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<td>Rail Exit</td>
<td>0.4</td>
<td>0.0</td>
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<td>Terrier Burnout</td>
<td>5.2</td>
<td>1.9</td>
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<td>Fwd. Solenoids On</td>
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<td>Orion Ignition</td>
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<td>Orion Burnout</td>
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<td>34.2</td>
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<td>12</td>
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<td>300,000 ft Up-leg</td>
<td>97.8</td>
<td>91.4</td>
<td>17.9</td>
<td>754</td>
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<td>Payload Separation</td>
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<td>Apogee</td>
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1320  

**Area Clearance**

The following VACAPES operational areas are required for the 41.113 Koehler mission:

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<td>USCG NOTMAR</td>
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1400  

**RANGE USER INSTRUMENTATION**

Not Applicable
RANGE USER REQUIREMENTS WHICH CAN NOT BE MET

There are no requirements which cannot be met.
### GO/NO GO CRITERIA

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<td>Radar</td>
<td>2ea. C-band Radars</td>
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<td>ASR-8</td>
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<td>RSO/TD</td>
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<td>Aircraft sea surveillance radar</td>
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<td>RSO/TD</td>
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<td>SRPO/PM/TD</td>
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<td>Optical</td>
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<td>SRPO/PM/TD</td>
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<td>Communication</td>
<td>WFF local, specific MOVE channels waivable if inoperable</td>
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<td>TD/SRPO/PM/RSO</td>
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<td>Computer</td>
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<td>Winds</td>
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<td>Mandatory</td>
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<td>Cloud ceiling</td>
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<td>GO</td>
<td>PM/TD/SRPO/RSO</td>
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<td>Max. Cloud Coverage</td>
<td>Scattered</td>
<td>GO</td>
<td>PM/TD/SRPO/RSO</td>
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<td>Within Limits</td>
<td>GO</td>
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<td>Notice to mariners</td>
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<td>Air/Surface Hazard Area</td>
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<td></td>
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</tr>
<tr>
<td>Flight Safety Criteria</td>
<td>Requirements satisfied</td>
<td>GO</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Surveillance/Recovery</td>
<td>&lt;6ft seas (Sea State 4)</td>
<td>GO</td>
<td>RSO/PM/TD</td>
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## RANGE SUPPORT

### 2010 Range Support and Instrumentation Summary

<table>
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<tr>
<th>SYSTEM</th>
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<th>SYSTEM</th>
<th>REQ</th>
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<tr>
<td>TM</td>
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<td>RCC</td>
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</tr>
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<td>MED G1</td>
<td></td>
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<td>X</td>
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<td>X</td>
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<td>SKY SCREEN</td>
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<td>CMD TRANS</td>
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<td>C2/ Z35</td>
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<td>MET</td>
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<td>C4/ U80</td>
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<td>C5 / X65</td>
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<td>C9/ M2</td>
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<td>IONOSPHER</td>
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<td>RADAR</td>
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<td>R2</td>
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<td></td>
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<td>R4</td>
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<td>FIRE DEPT.</td>
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<td>R5</td>
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<td>X</td>
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<td>R18</td>
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<td>AIR COND.</td>
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<td></td>
<td></td>
<td></td>
<td>BSKT TRUCK</td>
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</tr>
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<td></td>
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<td>B.U. POWER</td>
<td>X</td>
<td>Standby</td>
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</table>

*UNCONTROLLED WHEN PRINTED. VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.*

THE CONFIGURATION & DOCUMENT MANAGEMENT SYSTEM (CDMS) IS LOCATED AT: [HTTPS://ROMS.WFF.NASA.GOV](https://ROMS.WFF.NASA.GOV)
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>WISSRDS</td>
<td>X</td>
<td>CRANE</td>
</tr>
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<td>ASR-8</td>
<td>X</td>
<td>AIRCRAFT</td>
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<td>APS</td>
<td>X</td>
<td>SURV X</td>
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<td>X</td>
<td>RECOVERY X</td>
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<td>LAUNCH VEH.</td>
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<td>RESCUE</td>
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<td>OTHER</td>
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<td>X</td>
<td>Pad 2 MRL</td>
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<tr>
<td>FIRING CON</td>
<td>X</td>
<td>BOAT</td>
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<tr>
<td>TEST ROCKET</td>
<td>X</td>
<td>Pad 2 SURVEILLANCE X</td>
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## Frequency Use Summary

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<th>FREQUENCY</th>
<th>USE</th>
<th>POWER</th>
<th>SOURCE</th>
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<tbody>
<tr>
<td>436 MHz</td>
<td>Payload Station Transmitter downlink to Ground Station at ODU</td>
<td>10 W</td>
<td>Old Dominion University Payload Station transmitter TBD</td>
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<tr>
<td>2400 – 2483.5 MHz</td>
<td>Ground Station at WFF Uplink to Payload Station</td>
<td>1 W</td>
<td>Mitchell Community College Ground Station Transmitter Model n2420F-ENC</td>
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<tr>
<td>2400 – 2483.5 MHz</td>
<td>Payload Station Downlink to Ground Station at WFF</td>
<td>1 W</td>
<td>Mitchell Community College Payload Station Transmitter Model n2420F</td>
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<tr>
<td>2400 – 2482 MHz</td>
<td>Communication is internal to the Payload experiment</td>
<td>2.5 milliwatts</td>
<td>Community College of Denver Payload Station Transmitters</td>
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<td>2725.0 MHz</td>
<td>Air Surveillance Radar</td>
<td>1.4 MW</td>
<td>ASR-8</td>
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<tr>
<td>3050.0 MHz</td>
<td>Surface Surveillance Radar</td>
<td>30 kW</td>
<td>WISSRDS-S</td>
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<tr>
<td>9392.5 MHz</td>
<td>Surface Surveillance Radar</td>
<td>8 kW</td>
<td>APS-143 On board King Air</td>
</tr>
<tr>
<td>9410.0 MHz</td>
<td>Surface Surveillance Radar</td>
<td>25 kW</td>
<td>WISSRDS-X</td>
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<tr>
<td>5690.0 MHz</td>
<td>Radar Interrogation</td>
<td>1.0 MW</td>
<td>Radar 3</td>
</tr>
<tr>
<td>5690.0 MHz</td>
<td>Radar Interrogation</td>
<td>3.0 MW</td>
<td>Radar 5</td>
</tr>
<tr>
<td>5690.0 MHz</td>
<td>Radar Interrogation</td>
<td>1.0 MW</td>
<td>Radar 18</td>
</tr>
<tr>
<td>5765.0 MHz</td>
<td>Transponder Return Frequency</td>
<td>50 watts</td>
<td>P/L Section</td>
</tr>
</tbody>
</table>
2030 Launcher System

The launcher and nominal flight angles are as follows:

**Terrier-Improved Orion, PAD 2 MRL Launcher**

- Elevation: 84.0°
- Azimuth: 105.0°

2100 RADAR SUPPORT

Radar will be required to support this mission from a range tracking and surveillance perspective.

1. At least 2 C-band radars are needed to track the onboard C-band transponder.
2. Radar tracking will support wind weighting as needed.
3. Surveillance of the designated impact hazard areas is required and will be provided by the WFF ASR-8, WISSRDS, and the APS-143 radar on the surveillance aircraft.
4. The bore sight camera records video of flight.
5. The radar tracking data is to be provided to the customer upon completion of the mission.

2110 Tracking Radar

Radar tracking support is required for tracking the RockOn P/L. MDDF data will be sent to the RCC for interface with the real time computer systems. The computer output will aid Safety, Payload and Science personnel in determining vehicle performance. An MDDF output is also required to support wind weighting procedures if requested.

The P/L will have an on-board C-band transponder to enhance the tracking capabilities of the radar.
2120  Radar Transponder Description

The C-band transponder specifications are as follows:

<table>
<thead>
<tr>
<th>Transponder Model</th>
<th>Herley MDC 50C-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>50 Watts</td>
</tr>
<tr>
<td>Interrogate Frequency</td>
<td>5690 MHz</td>
</tr>
<tr>
<td>Respond Frequency</td>
<td>5765 MHz</td>
</tr>
<tr>
<td>Code Spacing</td>
<td>5μsec</td>
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<tr>
<td>Delay</td>
<td>2.5μsec</td>
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</table>

2130  Radar Support Summary

<table>
<thead>
<tr>
<th>RADAR</th>
<th>TARGET</th>
<th>TRANSPONDER</th>
<th>PULSE</th>
<th>DATA</th>
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<tr>
<td></td>
<td></td>
<td>INT-RES MHz</td>
<td>CODE usec</td>
<td>DLY usec</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>WW/ payload</td>
<td>Skin/ Beacon</td>
<td>5690/5765</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>payload</td>
<td>Beacon</td>
<td>5690/5765</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>payload</td>
<td>Beacon</td>
<td>5690/5765</td>
<td>5</td>
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</table>

2140  Surveillance Radar Summary

<table>
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<th>RADAR</th>
<th>TARGET</th>
<th>SECTOR</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S A</td>
</tr>
<tr>
<td>APS-143</td>
<td>X</td>
<td>See Flt Safety Plan</td>
</tr>
<tr>
<td>ASR-8</td>
<td>X</td>
<td>80°/180°</td>
</tr>
<tr>
<td>WISSRDS</td>
<td>X</td>
<td>80°/180°</td>
</tr>
</tbody>
</table>

2150  Radar Contingency Plans

In the event of single radar Loss of Signal, the off-track radar can slave to an on-track source.

In the event of no on-track slaving source, radars can slave to the RAPS nominal file and initiate circular scans, if necessary.

In the event of a RAPS failure, designate to the stored INP file generated from look angles and initiate circular scans, if necessary.
Should radar acquire on a side lobe, or lose track, the radar coordinator will advise the radar operator and provide assistance with reacquiring.

2200  **TELEMETRY SUPPORT**

Telemetry will not be used for this mission. All P/L data will be recorded, and after P/L is returned to building F-10, the data will be downloaded.

2300  **OPTICAL AND TELEVISION SUPPORT SUMMARY**

1. Three tracking cameras are required for this mission. CS X85, CS V100, and CS X65 are requested to support this mission. IRIG-B Timing will be installed on the video products.

2. The primary tracking target is the booster, and payload, during the visible portion of flight.

3. Fixed lift-off cameras are required for this mission.

4. Documentary photographic coverage is required. (Pad still pictures if time permits)

5. Still pictures, surveillance video, video tracks and high speed data will be edited and recorded to DVD/CD which will be provided to the PM five duty days after the completion of the mission.

2310  **Camera Stations**

<table>
<thead>
<tr>
<th>CS X85</th>
<th>CS V100</th>
<th>CS X65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short &amp; Intermediate Range Optics</td>
<td>Intermediate Range Optics</td>
<td>Intermediate Range Optics</td>
</tr>
<tr>
<td>HD 60 fps video</td>
<td>HD 60 fps video</td>
<td>HD 60 fps video</td>
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</table>
Fixed Cameras

<table>
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<th>PURPOSE</th>
<th>LENS</th>
<th>FPS</th>
<th>DIGITAL</th>
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</thead>
<tbody>
<tr>
<td>Pad 2 MRL &amp; M3 blockhouse</td>
<td>Lift-off</td>
<td>zoom</td>
<td>500</td>
<td>High Speed Video</td>
</tr>
<tr>
<td></td>
<td>Lift-off</td>
<td>zoom</td>
<td>500</td>
<td>High Speed Video</td>
</tr>
<tr>
<td></td>
<td>Lift-off</td>
<td>zoom</td>
<td>7</td>
<td>Still Photography</td>
</tr>
<tr>
<td></td>
<td>Lift-off</td>
<td>zoom</td>
<td>7</td>
<td>Still Photography</td>
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Data Distribution

<table>
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<tr>
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<th>DATA TRACK</th>
<th>DATA FORMAT</th>
<th>TIME REQUIRED</th>
<th>PRODUCT</th>
<th>QTY</th>
<th>DISTRIBUTE TO</th>
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<tbody>
<tr>
<td>Photographs</td>
<td>As required</td>
<td>Digital</td>
<td>1 week</td>
<td>Color prints</td>
<td>Will vary</td>
<td>PM</td>
</tr>
<tr>
<td>Digital video of launch</td>
<td>T-0 to impact</td>
<td>Digital</td>
<td>1 week</td>
<td>All video sources to be edited on one DVD</td>
<td>1ea.</td>
<td>PM</td>
</tr>
</tbody>
</table>

METEOROLOGICAL SUPPORT

A weather briefing will be used for forecasting of the launch operations. In addition, special forecasts may be required for lightning and wind warnings/advisories issued for the range during vehicle build-up/launch operations.
2410. Summary of Meteorological and Ionospheric Support

<table>
<thead>
<tr>
<th>ITEM</th>
<th>System</th>
<th>Assignment</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>GPS Radiosonde</td>
<td>Wind Weighting air structure data from 300ft to 100k ft</td>
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<tr>
<td>2</td>
<td>Chaff Balloons</td>
<td>Wind weighting</td>
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<tr>
<td>3</td>
<td>Radiosonde System 1</td>
<td>GPS Radiosonde Data Acquisition and Processing</td>
</tr>
<tr>
<td>4</td>
<td>Radiosonde System</td>
<td>GPS Radiosonde Data Acquisition and Processing</td>
</tr>
<tr>
<td>5</td>
<td>Radiosonde System</td>
<td>GPS Radiosonde Data Acquisition and Processing</td>
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<tr>
<td>6</td>
<td>160/300ft WW tower</td>
<td>Air structure data from 50 to 300 feet</td>
</tr>
<tr>
<td>7</td>
<td>Island Surface System</td>
<td>Provide surface (30’) Met Data, WS, WD, Pressure, Temp, RH</td>
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2500. COMPUTER SUPPORT

The Range Control Center (RCC) and Data Reduction Group will have both Real Time Computer Systems and the PCGDS available for launch operations.

2510 Real-time Computer Graphic Displays

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<thead>
<tr>
<th>DISPLAY</th>
<th>COMP</th>
<th>AXIS</th>
<th>Symbol</th>
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<td>Y</td>
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<tr>
<td>DQG1</td>
<td>DQCB</td>
<td>Hor. Ring Y</td>
<td>Alt X</td>
</tr>
<tr>
<td>DQG2</td>
<td>DQCB</td>
<td>IIP long</td>
<td>IIP Lat</td>
</tr>
<tr>
<td>DQG1</td>
<td>DQCA</td>
<td>Hor. Ring Y</td>
<td>Alt. X</td>
</tr>
<tr>
<td>DQG2</td>
<td>DQCA</td>
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<td>IIP Lat</td>
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Real-time Computer Alpha-Numeric Displays

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<tbody>
<tr>
<td>BEST Altitude AGL (ft)</td>
<td>BEST SM Velocity (ft/sec)</td>
</tr>
<tr>
<td>BEST SM Hor Rng (yds)</td>
<td>BEST SM Velocity (ft/sec)</td>
</tr>
<tr>
<td>BEST SM Hor Range (NM)</td>
<td>BEST SM Hor Rng (yds)</td>
</tr>
<tr>
<td>BEST SM Azimuth (deg)</td>
<td>BEST Apogee (ft)</td>
</tr>
<tr>
<td>BEST SM Elevation (deg)</td>
<td>BEST Apogee (ft)</td>
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<tr>
<td>BEST SM PP Latitude (deg)</td>
<td>BEST IIP Latitude (deg)</td>
</tr>
<tr>
<td>BEST SM PP Longitude (deg)</td>
<td>BEST IIP Latitude (deg)</td>
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<tr>
<td>BEST SM PP Longitude (deg)</td>
<td>BEST IIP Range (feet)</td>
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<tr>
<td>BEST Max Altitude (ft)</td>
<td>BEST Max Altitude (ft)</td>
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<td>BEST Time Max Alt (sec)</td>
<td>BEST Time Max Alt (sec)</td>
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<td>R-3-WFF-ALT-AGL (Ft)</td>
<td>R-3-WFF-ALT-AGL (Ft)</td>
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<td>R-5-WFF-ALT-AGL (Ft)</td>
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IRIS DISPLAY PARAMETERS

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<th>SCALE MULTI</th>
<th>SCALE FIXED</th>
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<td>HOR RNG</td>
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</table>

2540 QUICK LOOK DATA SUMMARY

Quick Look Best Select radar data will be available at the post flight briefing. This will be delivered two CDs from either the DQCA or the DQCB.

2550 Final Data Summary

The following data products will be delivered directly to the Project Manager for distribution within 7 working days after launch.

1) The following plots of positional data are available upon request: Attitude vs Time, Range vs Time, Altitude vs Range, Velocity vs Time.
2) The final POSDAT data ASCII file at 10 pps will be emailed to the NASA Project Manager for distribution to range users. A different data rate can be supplied upon request.
3) The bore sight video from the radars is available upon request.

2600 COMMUNICATIONS SUPPORT SUMMARY

Range intercom support is required. Radio communication with the surveillance aircraft, recreational, and commercial boaters is also required.
# Intercom Summary

<table>
<thead>
<tr>
<th>Position</th>
<th>Ch. 1 Range Ops</th>
<th>Ch. 2 Radar</th>
<th>Ch. 3 TM</th>
<th>Ch. 4 Weather</th>
<th>Ch. 5 Anomaly</th>
<th>Ch. 6 Range</th>
<th>Ch. 7 Range User 1</th>
<th>Ch. 8 Range User 2</th>
<th>Ch. 9 Pad Ops</th>
<th>Ch. 10 Range Safety</th>
<th>Ch. 11 Range User 4</th>
<th>Ch. 12 Range User 5</th>
<th>Safety Surveillance</th>
<th>Radio 121.95</th>
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RF Communications

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<th>Freq. (MHz)</th>
<th>RCC</th>
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<th>Surveillance Aircraft</th>
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<tr>
<td>121.95</td>
<td>X</td>
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<td>X</td>
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<td>311.2</td>
<td>X</td>
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<tr>
<td>121.5</td>
<td>X</td>
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<td>X (Emergency)</td>
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<tr>
<td>243.0</td>
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<td>X (Emergency)</td>
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<tr>
<td>156.6 (MB 12)</td>
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<tr>
<td>157.1 (MB 22)</td>
<td>X</td>
<td>X</td>
<td>X (Backup use)</td>
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NASCOM Summary

NASCOM support is required to patch radar data in the Range Control Center.

Command Summary

Not Applicable.

Frequency Monitoring & Receiver Site Support

Frequency monitoring, recording of all intercoms and active radio frequencies are required for this mission.

Timing & Programming Support

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SUPPORT</th>
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<tbody>
<tr>
<td>Timing</td>
<td>NASA 36, IRIG B</td>
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<tr>
<td>Programming</td>
<td>Blockhouse 2 and Range Control Center</td>
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</table>
### SUPPORT SERVICES

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TIME</th>
<th>LOCATION</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>Guards</td>
<td>Launch Day</td>
<td>Island</td>
<td>T-2 hour and 30 min. Man roadblocks</td>
</tr>
<tr>
<td>Fire Department</td>
<td>Launch Day</td>
<td>Island</td>
<td>On call</td>
</tr>
<tr>
<td>Road Blocks</td>
<td>Launch Day</td>
<td>Launch Area</td>
<td>T-2 hour and 30 min.</td>
</tr>
<tr>
<td>Electrician</td>
<td>Launch Day</td>
<td>Island &amp; Main Base</td>
<td>On Standby</td>
</tr>
<tr>
<td>Air Condition</td>
<td>Launch Day</td>
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<td>On Standby</td>
</tr>
<tr>
<td>Basket truck/Operator</td>
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<tr>
<td>Fuel Truck</td>
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<tr>
<td>Emergency Power</td>
<td>Launch Day</td>
<td></td>
<td>Commercial pwr Prime starting at T-2 hr 30 min. W/B-U Generators</td>
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<td>Hazardous Waste</td>
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<tr>
<td>Excavation</td>
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<td></td>
<td>No Digging 2 days prior to launch in areas where it could impact operations</td>
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<td>Prohibition</td>
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<tr>
<td>Public Affairs Office</td>
<td>RockSat-C</td>
<td>Main Base and Island</td>
<td>PAO information line; provide live webcast and social media coverage of launch starting at T-60 min.</td>
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<td>70 students June 19-26 Badging and safety briefing at the Visitor Center at 7 a.m.</td>
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<td></td>
<td>RockOn 90 participants June 20-26 Badging the morning of June 20. Safety brief will be the morning of June 22 during breakfast.</td>
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4000 PAYLOAD RECOVERY

Recovery operations will begin immediately after payload impact. Recovery of this payload is desirable if determined to be floating after impact.

Surveillance & Recovery operational data can be found in the stand alone Surveillance & Recovery Operations Plan 1B8X1-PLAN-007480-.

4010 Operational Control

The Wallops Recovery Director should direct the recovery operation from the WFF RCC. The recovery vessel will be positioned such that it will not exceed 1 X 10⁻⁵ ship impact probability.

4020 Recovery Personnel

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<thead>
<tr>
<th>NAME</th>
<th>LOCATION</th>
<th>POSITION</th>
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<tr>
<td>Jordan West</td>
<td>WFF RCC</td>
<td>Recovery Control</td>
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<tr>
<td>Tom Eskridge</td>
<td>Recovery/Surveillance Boats (2)</td>
<td>Ship Captain</td>
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<tr>
<td>AirTec</td>
<td>Aircraft (2)</td>
<td>Pilot</td>
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4030 Recovery Participants

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<tr>
<th>UNIT &amp; CALL SIGN</th>
<th>LOCATION</th>
<th>PRIME FUNCTION</th>
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<td>Wallops Plot</td>
<td>WFF RCC</td>
<td>Recovery Control</td>
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<tr>
<td>Thomas Reed</td>
<td>Recovery Area</td>
<td>Primary Recovery Vessel</td>
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</table>

4040 Recovery System Description

Recovery System
• Recovery System: Extended IRMA, [750 lbs., 14”]

Parachute System
• Sandia/Raven 750 lbs. (MODII-750)
• Inhibits: Mechanical, V-band Safety, Safe/Arm Plug
• Description: 36’ Cruciform main with 8.56’ 20” conical ribbon drogue
Nominal chute sequence of events

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<tr>
<th>Time</th>
<th>Altitude</th>
<th>Range</th>
<th>Velocity</th>
<th>Mach</th>
<th>Q</th>
<th>FI- EG</th>
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<td>(SEC)</td>
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<td>(KM)</td>
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<td>(DEG)</td>
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<td>Chute Deploy</td>
<td>465.6</td>
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Raven 750# Recovery Load Analysis

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<th>Suspended weight</th>
<th>Impact Velocity</th>
<th>Alt (ft) MSL</th>
<th>Vel (fps)</th>
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<td>Drogue, reefed</td>
<td>636.1 lbs</td>
<td>31.0 ft/s</td>
<td>20,500</td>
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<td>Drogue, dis-reefed</td>
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<td>18,752</td>
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<td>Main, reefed</td>
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<td>Main, dis-reefed</td>
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4050 Vehicle Pyrotechnic Summary

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<td>Terrier Initiation</td>
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<td>PacSci Holex 7900-1</td>
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<td>TekOrd 231814</td>
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<td>4</td>
<td>Guillotine</td>
</tr>
</tbody>
</table>
4060 Recovery Hazards

Type Chute/Recovery Systems: Mod II – 750 lbs IRMA, Sandia/Raven 750 lb Aft recovery. The parachute will likely remain attached to the payload after impact. There is an entanglement hazard within 15 feet of the floating payload.

4070 Impact Determination

WFF tracking radars can track the descending payload using an onboard transponder. Wallops Plot will give the payload’s last known position (latitude and longitude) to the recovery vessel.

4080 Surface Vehicle Recovery Procedures

The Range and NSROC will provide safety personnel for the recovery, with at least one being an ordnance expert with certification. Safety personnel will be on the recovery boat prior to liftoff, and will be knowledgeable about the design of the payload pyrotechnic devices. The recovery operation is performed under the auspices of GSFC/WFF Code 803.1, Ground Safety, according to NASA’s Sounding Rocket Operations Contract (NSROC) Work Instruction VS59261, Rev B, entitled “Water Recovery of Sounding Rocket Payload“. A NSROC Operational Safety Specialist (OSS) will be onboard the vessel and will oversee all aspects of the recovery. The general recovery procedures for the payload are as follows:

- The boat will proceed to locate the payload as per last position from RCC and from communications with the surveillance/recovery aircraft.
- The boat will maneuver into position for the payload safety inspection, staying clear of the parachute and all lanyards.
- Range and NSROC Safety personnel will assess the status of the payload for retrieval:
  - The ordnance expert will confirm that all pyros on the floating payload have (or have not) been fired.
  - If the ordnance has all been fired, then the payload will be deemed ready for recovery.
  - If ordnance has not fired, then procedures within the work instruction will be followed to safe the ordnance for recovery.
  - The payload and parachute will be lifted into the boat and secured for return to Chincoteague.
4090 Recovery Vessel Return To Port

The recovery vessel will maintain periodic communications with the Recovery Director (RD) in the RCC throughout the return trip to port at Curtis Merritt harbor in Chincoteague. The RD will relay estimated time of arrival to personnel rendezvousing with the recovery vessel for transfer of the payload off the boat to land.

4091 Transfer of the Payload from the Boat to Land

Upon arrival of the recovery vessel back to Curtis Merritt harbor, the NSROC Mission Manager will have arranged for logistical and safety support for the safe transfer of the payload from the recovery vessel onto a suitable vehicle for transportation back to WFF. The transfer of the payload from the recovery vessel to the ground transportation vehicle will be performed under the auspices of the NSROC OSS, according to the work instruction referenced above.
5000  AIRCRAFT OPERATIONS AND SAFETY

5010  Aircraft Assets

Aircraft types and operations used in support of surveillance for this mission are described in detail in the Surveillance & Recovery Operations Plan Rock-On 41.113 (Koehler) as a standalone document. 1B8X1-PLAN-007480-.

5020  Description of Operations

The specific aircraft used for this mission will be selected from a list of NASA GSFC/WFF Aircraft Office, Code 830 approved assets. Tail numbers will be made known at the time of the Pilot’s Brief and communicated to controlling authorities who will, in return, provide transponder (squawk) codes to be used on any particular day of the mission. Mission Profile Specific flight patterns and altitudes for surveillance aircraft are provided in the Surveillance Operations Plan; this plan is reviewed by the Code 840 Project Manager, the Code 840 Aircraft Safety Officer, the entity supplying aircraft assets, and signed by ROC management and one of the NASA GSFC/WFF Range Safety Officers. As described in the Surveillance Operations Plan, special detailed maps and instructions are provided to the aircraft crew(s) prior to the first mission day for use on board during the mission. On the day of the mission, prior to take off of any aircraft, a Pilot’s Brief is held to review the mission profile and any special considerations.

Surveillance operations will be conducted on the day of the mission in such a manner as to insure a stable surveillance picture is generated, with all actual and potential range fowlers identified; surveillance operations are conducted under the auspices of the NASA GSFC/WFF Surveillance Officer. The calling of a “Green Range”, clearing the mission for launch, is made by the NASA GSFC/WFF Range Safety Officer for the mission with input from the Surveillance Officer using information provided by the Surveillance team.

Prior to launch, the aircraft will fly to a position outside of the Aircraft Hazard Area, as identified by the Surveillance Officer; the aircraft position will be confirmed using the ASR-8 or by radio relay of position from onboard navigation system.

5030  Communications and Control

Communications with the Aircraft from in the Surveillance Room in the Range Control Center will be on assigned frequencies, as detailed in the Surveillance Operations Plan. Continuous communications will be maintained at all times with all aircraft until they have exited the offshore area and declared “feet dry”.

WALLOPS FLIGHT FACILITY  MOD
RANGE AND MISSION MANAGEMENT OFFICE  41.113 KOEHLER ROCK-ON, NRW-5600
5040 Airspace

Aircraft operations for surveillance are planned within VACAPES warning areas with transit operations in the Federal Aviation Administration National Airspace System (FAA NAS). In all cases, pilots and project officials are required to coordinate and comply with applicable rules and regulations.

5050 Operational Flight Safety

Flight operations and aircraft used for the support of this mission will be under the auspices of NASA GSFC/WFF Aircraft Office, Code 830.

Operations within FAA airspace shall be conducted under an appropriate IFR/VFR flight rules.

Warning Area clearance shall be obtained by the Test Director and forwarded to the Surveillance Coordinator for dissemination to appropriate aircraft crews. Flight operations within the warning areas will be in accordance with FACSFAC VACAPES INST 3120.1H.

The minimum altitude for over flying surface vessels is 500 feet AGL.

6000  **GROUND SAFETY PLAN**

The Ground Safety Plan shall be provided by Range Safety as a standalone document.
7000  FLIGHT SAFETY PLAN

The Flight Safety Plan shall be provided by Range Safety as a standalone document.
8000 SPECIAL OPERATIONAL PROCEDURES

Not Applicable.
9000 COUNTDOWN PROCEDURES

The Countdown Procedures shall be provided by the Range and Mission Management Office as a standalone document.