Joint Eglin Acoustics Week 2013 Data Report

David A. Conner, James H. Stephenson, and Ben W. Sim
U.S. Army Aviation & Missile Research, Development, and Engineering Center
Langley Research Center, Hampton, Virginia

Michael E. Watts and Eric Greenwood
Langley Research Center, Hampton, Virginia

Charles D. Smith
Analytical Mechanics Associates, Inc., Hampton, Virginia

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DATA REPORT

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Aviation Development Directorate
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Michael E. Watts and Eric Greenwood
NASA Langley Research Center

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Charles D. Smith
Anaylitical Mechanics Associates, Inc

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Abstract

Far-field acoustic measurements were obtained for the AH-64D, HH-60M and CV-22B at the Eglin AFB, Test Area C-72, in July/August 2013. The primary purpose for this flight test was to obtain a benchmark database of detailed acoustic source noise characteristics for the aircraft operating at typical mission gross weights over a range of typical mission operating conditions. Data were acquired for a range of steady-state level and descending flight conditions, hover, and a variety of unsteady maneuver conditions. Between 30 and 37 microphones were deployed during these tests. Vehicle position and state data, as well as weather data, were acquired simultaneously with the acoustic data. This paper describes the test aircraft, onboard instrumentation, ground instrumentation, and the data acquired. Data from this test are available upon request and review.

Introduction

The Chicken Little Joint Project Office of the 46th Test Squadron at Eglin AFB sponsored Acoustics Week 2013 to provide a cost-leveraged test venue to gather developmental system performance, sensor system performance, and signature data for analysis and algorithm development. The US Army Aviation Development Directorate and the NASA Langley Research Center (LaRC) teamed with the US Army’s HH-60 and AH-64 Program Management Offices and the Naval Surface Warfare Center (NSWC) to collect acoustic signature data for the AH-64D, HH-60M, and the CV-22B aircraft. The test was conducted at the Eglin AFB, Test Area C-72, in July/August 2013. The primary purpose for this flight test was to obtain a benchmark database of detailed acoustic source noise characteristics for the aircraft operating at typical mission gross weights over a range of mission operating conditions, including both steady-state flight conditions as well as unsteady maneuvers. This database can be used to predict ground noise and aural detection footprints, develop low noise operations, study helicopter source noise mechanisms during maneuvering flight, and validate NASA/Army developed acoustic detection prediction codes. These prediction codes include the Rotorcraft Noise Model (RNM) (References 1 and 2), The Advanced Acoustic Model (AAM), the Acoustic Propagation and Emulation Toolset (APET), and Fundamental Rotorcraft Acoustic Modeling from Experiments (FRAME) (Reference 3). The data acquired are available to authorized organizations with a need to know. This paper will describe the testing of these aircraft and the data available.

Test Aircraft and Onboard Measurements

Test vehicles were the AH-64D and HH-60M helicopters and the CV-22B tiltrotor aircraft. Following is a brief description of each aircraft and the onboard measurements obtained for each aircraft.

The AH-64D (Tail Number 10-05626) was configured to achieve a mission representative gross weight (Figure 1). A 4-place AGM-114 Hellfire missile rack with one dummy missile was installed on each inboard pylon mount point, rocket pods (empty) were installed on each outboard pylon mount point, and an auxiliary fuel tank (Combo Pack) was installed internally, to achieve a takeoff gross weight of approximately 18,200 pounds. The Aircraft Navigation and Tracking System (ANTS), developed by
NASA Langley, was installed to obtain vehicle position and inertial navigation data. The ANTS unit incorporates a VectorNav VN-200 Inertial Navigation System (INS) chip into a self-contained device that receives the GPS signal, processes the GPS data in conjunction with built-in sensors, calculates a Kalman-filtered aircraft state solution, and logs the solution to an SD memory card at a programmable rate of 1 to 50 Hz. The state solution contains information about the location, velocity, acceleration, attitude, and attitude rates. The GPS signal was supplied by a GPS antenna installed on the tail of the aircraft during this test specifically for the ANTS. The ANTS unit was powered by internal batteries. During this test, data were sampled continuously and uninterrupted throughout the flight day at a rate of 20 Hz. Table 1 provides a list of the AH-64D variables that were acquired during this test.

The M-model HH-60 (Tail Number 04-27001), with the new wide-chord blade that is principally characterized by its unique tapered, anhedral tips (Figure 2), was used for this test. The takeoff gross weight was approximately 16,600 pounds during this test. Vehicle position and state data were obtained from the standard onboard Integrated Vehicle Health Management System (IVHMS). Table 2 provides a list of the HH-60M variables that were acquired during this test.

The AH-64D and HH-60M helicopters used during the Acoustics Week 2013 tests were based out of the US Army Aviation Development Directorate’s, Aviation Applied Technology Directorate (AATD) located at Ft. Eustis, VA. The research test pilots that flew the aircraft during these tests were also provided by AATD.

The US Air Force 413th Flight Test Squadron based at Hurlburt Field, FL provided the CV-22B tiltrotor aircraft (Tail Number 99-0021) and test pilots. The aircraft used for this test (Figure 3) was a standard vehicle with a takeoff gross weight of approximately 47,000 pounds. Onboard measurements came from a full-bus capture of four of the MIL-STD-1553 Data Bus channels – Avionics A, Avionics B, Flight Controls #1, and Flight Controls #2. A serial data stream from a NovAtel High-Precision Differential GPS Receiver was captured, as well as 4-6 video channels. All data were captured using an IRIG-106 Chapter 10 compliant recorder as the data collection system. The system had an internal time counter that was synched with UTC Time from a GPS receiver and has an accuracy of 100 nanoseconds. Table 3 provides a list of the CV-22B variables that were acquired during this test.

**Experimental Setup**

The Eglin remote Test Range C-72 was used for this test program. During the experiment, the aircraft were flown over a NASA deployed ground-based microphone array to measure source noise hemispheres for a range of flight conditions, including level flight, approaches, hovers, and maneuvers that are representative of typical mission operating conditions. In addition to the NASA microphones, Wyle Laboratory personnel deployed a set of microphones during the AH-64D testing. Because aircraft source noise is affected by gross weight and drag, it was desirable to ballast the aircraft, when feasible, to a typical mission gross weight and drag configuration. An overview of the test range showing the primary flight track and the locations of the microphones, weather balloon, hover points, descent target point, and the NASA command and instrumentation trailers is shown in Figure 4. Detailed descriptions of the microphone instrumentation, weather system, and flight conditions are discussed in the following sections.
Acoustic Instrumentation

Wireless Acoustic Measurement Systems (WAMS) were deployed to acquire all acoustic data obtained by during this test. With the WAMS, microphone gains are set and acoustic data acquisition is initiated and terminated wirelessly from a central command computer. The acoustic pressure-time history data are recorded on compact flash cards located within each remote unit. Upon termination of each run, sufficient data metrics and system health information are transmitted back to the command computer to assure that good data were acquired at each microphone station during the run. A typical WAMS microphone station deployment is shown in Figure 5. One-half inch prepolarized free-field response condenser microphones (B&K Model 4189) fitted with grid caps and standard 4-inch diameter windscreens were used. The microphones were mounted inverted above a 15-inch diameter round ground board, ¼ radius from the edge of the ground board, as shown in Figure 5. The spacing between the microphone diaphragm and the ground board was nominally ¼ inch. The analog microphone signals were low-pass filtered at 11,670 Hz and digitized at 25,000 Hz, then recorded on compact flash cards. Each remote unit uses a GPS receiver to acquire a common time code for synchronization of the acoustic data with the vehicle tracking and performance data, as well as the weather data. Wyle Laboratories deployed additional microphones during the AH-64D testing only. Wyle microphones were mounted inverted above NASA provided ground boards. Wyle used one-half inch externally polarized free-field response condenser microphones (B&K Model 4190) connected to Type 2669 preamplifiers powered by GRAS 12AA amplifiers. The output signal was transmitted via RG-58 coax cable to a PXI chassis containing National Instruments model 4472 data acquisition cards that digitized the signal with a 24-bit A/D converter at 25,000 Hz. Calibration tones were recorded before and after measurements every day.

The primary NASA microphone array consisted of 22 ground-board-mounted microphones deployed in a linear array aligned perpendicular to the flight path. The precise location of all microphones, as well as the descent target and the NASA and Naval Surface Warfare Center (NSWC) hover points, are provided in Table . The reference microphone (microphone 11) is situated directly on the flight path and forms the origin of the Cartesian coordinate system used in Table 4 and subsequent analysis. The coordinate system is a right-hand Cartesian system with X along the flight track in the direction of flight, Y positive to the left of the flight path, and Z positive up. With the aircraft directly overhead of the reference microphone at an altitude of 100 feet above ground level (AGL), the microphone spacing was designed to provide approximately 10° angular resolution, up to 10° below the horizon. Additional microphones provide observer angles as small as 2.4° below the horizon as shown in Table . A secondary NASA microphone array of 7 microphones was deployed perpendicular to the flight track at 1,400 feet before the primary microphone array (X = -1400) to capture the aft-propagated noise during approaches to the descent target. The Wyle microphone array of 7 microphones was deployed perpendicular to the flight track at a point 1,500 feet beyond the primary microphone array (X = 1500) for the purpose of validating a Wyle developed process called Hotspot that attempts to predict the directionality of the highest noise levels in front of the vehicle. NASA microphone 30 was co-located with Wyle microphone 34 to validate Wyle’s acoustic measurement capability.

Meteorological Instrumentation

A tethered weather balloon system (Figure 6) was used to acquire weather profiles during each day’s flight testing period. The system consists of a winch-controlled tethered balloon, an instrument/telemetry pod, a ground-based receiver/data controller, and a ground-based support computer. Profiles of pressure, temperature, relative humidity, wind speed, and wind direction were acquired at altitudes up to 750 feet AGL. The weather balloon was located near the NASA Command Trailer as shown in Figure 4. In addition to the balloon mounted weather sensors, tripod mounted weather sensors (see Figure 5) measuring wind
velocity, pressure, temperature, and humidity were located near the centerline microphone for each of the three microphone arrays at a height of 5 feet AGL, and at the command trailer location at a height of 30 feet AGL.

**Test Procedures and Flight Conditions Measured**

Acoustic measurements are extremely sensitive to atmospheric conditions, especially wind and temperature profiles. During this test program flights began at dawn (approximately 0600 hours) when the winds are typically the lowest of the day, and were terminated when winds and thermals built to unacceptable levels (typically between 0900 and 1100). Experimental setup began each day with microphone system deployment approximately 3 hours prior to first flight. This allowed time to deploy the equipment, resolve system problems, and acquire all pretest data. The weather balloon was also deployed during this setup period, but kept below 100 feet AGL until approved by range control.

During data acquisition, the aircraft approached the microphone array from a distance great enough to allow the pilot to achieve a steady-state flight condition on the prescribed flight path (Heading 307° True, 310° Magnetic) at the prescribed airspeed prior to beginning acoustic data acquisition. The pilot provided data-on and -off radio calls when the aircraft reached prescribed ranges as defined in the next section. A hard deck of 50 feet AGL was maintained for safety, at all times. Upon completion of data acquisition each day, posttest data were acquired and all data were provided to the data reduction and analysis engineer for processing.

**AH-64D Helicopter**

AH-64D steady-state flight conditions tested are provided in Table  while the maneuver flight conditions are provided in Table . Daily flight cards for the three test days for this vehicle are provided in Table through Table .

**Steady-State Conditions**

Steady-state test conditions measured for the AH-64D are provided in Table . The aircraft was flown in a steady-state condition throughout the duration of acoustic data acquisition, at the prescribed airspeed and glideslope, along the primary flight path shown in Figure 4.

For all level flyovers, the aircraft was flown at an altitude of 100 feet AGL at the reference microphone location. Data-on was called at 5000 feet before the primary microphone array (X = -5000) and data-off was called 6000 feet past the primary microphone array (X = 6000).

Approaches were flown to acquire the prescribed glideslope and airspeed at a sufficient range to be in a steady-state operating condition for one mile from the Descent Target, which was located on the flight path centerline 500 feet before the primary microphone array (X = -500). Approaches were flown on the prescribed glideslope, with the glideslope intersecting a point 50 feet above the descent target as shown in Figure 7. This steady-state condition was held for as long as possible throughout the approach to the point 50 feet above the Descent Target, with the pilot pulling out of the descent at the lowest possible altitude for safe flight operations or at an altitude sufficient to not burst the 50-foot hard deck, whichever came first. Data-on was called at 5000 feet out (X = -5000) and data-off at the point of the pullout from the steady-state condition.

It should be understood that the pilot was flying an approximate (due to instrument resolution and
accuracy) descent rate using standard cockpit instrumentation and that there was a certain amount of
guesswork required given the typical wind variability with altitude. The emphasis was placed on
minimizing control inputs rather than on hitting the precise descent point. Also, emphasis was placed on
staying on the flight track centerline over maintaining a precise glideslope.

Hover data were acquired with the aircraft hovering at the prescribed heading and altitude over either
the NASA hover point or the NSWC hover point (Figure 4). The pilot called data-on when a steady hover
was achieved, and data-off was called by ground control after 60 seconds of acoustic data had been
acquired.

**Maneuver Conditions**

AH-64D maneuver test point conditions are provided in Table . Conditions M1 – M16 were right and
left turns at bank angles of 20° to 60°, airspeeds of 70 and 120 knots, and altitudes of 100 to 500 feet AGL.
For all turns, the aircraft approached along the primary flight track and initiated the turns 2000 feet before
the primary microphone array (X = -2000). The pilot called data-on 1000 feet before initiating the turn (X
= -3000). The turn was held until the vehicle heading had changed by 90° (heading change from 307° to
037° or 217° True) at which point the pilot called data-off and terminated the run. M1 – M6 were 20° and
30° bank turns at 100 feet AGL. M7 and M8 were 120 knot right and left turns while descending at a rate
of 500 feet per minute (fpm) such that the aircraft reached an altitude of 100 feet AGL when the run was
terminated. The desire for the 45° and 60° bank turns (M9 – M16) was to obtain acoustic data when the
turns were initiated at 300 feet AGL. However, due to safety concerns that altitude loss during the turns
could exceed 250 feet, some of these turns were first flown at an initial altitude of 500 feet AGL. Also,
conditions M9 – M16 were only flown after aircraft weight had been reduced by at least 1200 pounds
through fuel burn.

M17 and M18 were quick stops performed along the primary flight path. The goal was to stop the
aircraft as quickly as possible while not exceeding normal terrain flight maneuver operating conditions.
M17 was a quick stop from 90 knots in level flight at 100 feet AGL, while M18 was a quick stop from 90
knots at a 500 fpm descent rate, ending in hover at an altitude between 50 and 100 feet AGL. For both
these conditions, the deceleration from steady flight at 90 knots was initiated at X = -2000 feet. Data-on
was called 1000 feet prior to initiating the deceleration (X = -3000) and data-off called once the aircraft had
achieved a hover condition.

M19 and M20 were pull-up/push-over maneuvers performed along the primary flight path at 100 and
120 knots, respectively. The pull-up was initiated at X = -2000, with data-on called at X = -3000. Data-
off was called at the end of the push-over, once the aircraft had established a level flight condition.

M21 was a maximum level flight acceleration maneuver. The aircraft approached along the primary
flight path at 100 feet AGL and 40 knots airspeed. A maximum acceleration level flight condition was
initiated at X = -2000 and held until the vehicle reached 140 knots airspeed. Data-on was called 5 seconds
prior to initiating the acceleration and data-off was called once the vehicle reached 140 knots.

**HH-60M Helicopter**

The HH-60M steady-state flight conditions tested are provided in Table , and the maneuver flight
conditions are provided in Table . Daily flight cards for the three test days for this vehicle are provided in
Table through Table .
Steady-State Conditions

The steady-state test conditions measured for the HH-60M are provided in Table 1. The aircraft was flown in a steady-state condition throughout the duration of acoustic data acquisition, at the prescribed airspeed and glideslope, along the primary flight path shown in Figure 4.

For all level flyovers, the aircraft was flown at an altitude of 100 feet AGL at the reference microphone location. Data-on was called at $X = -5000$ and data-off was called at $X = 6000$.

Approaches were flown to acquire the prescribed glideslope and airspeed at a sufficient range to be in a steady-state operating condition one mile from the Descent Target, which was located on the flight path centerline 500 feet before the primary microphone array ($X = -500$). Approaches were flown on the prescribed glideslope, with the glideslope intersecting a point 50 feet above the descent target as shown in Figure 7. This steady-state condition was held for as long as possible throughout the approach to the point 50 feet above the Descent Target, with the pilot pulling out of the descent at the lowest possible altitude for safe flight operations or at an altitude that would prevent bursting the 50-foot hard deck, whichever came first. Data-on was called at $X = -5000$ and data-off at the point of the pullout from the steady-state condition.

It should be understood that the pilot was flying an approximate (due to instrument resolution and accuracy) descent rate using standard cockpit instrumentation and that there was a certain amount of guesswork required given the typical wind variability with altitude. The emphasis was placed on minimizing control inputs rather than on hitting the precise descent point. Also, emphasis was placed on staying on the flight track centerline over maintaining a precise glideslope.

Hover data were acquired with the aircraft hovering at the prescribed heading and altitude over either the NASA hover point or the NSWC hover point (Figure 4). The pilot called data-on when a steady hover was achieved and data-off was called by ground control after 60 seconds of acoustic data had been acquired.

Maneuver Conditions

HH-60M maneuver test point conditions are provided in Table 1. All maneuver test points were conducted at 100.5% RPM. Condition M1 is a variable glideslope, variable airspeed approach terminating in a hover at 50 feet above the Descent Target, as shown in Figure 8. The data-on call occurred at $X = -4500$ and data-off was called when a hover condition had been achieved.

Maneuver points M2 – M13 are right and left turns conducted at 100 feet AGL. M2 – M4 and M8 – M10 are 20° bank turns while M5 – M7 and M11 – M13 are 30° bank turns. For all turns, the aircraft approached along the normal flight track and initiated the turns at $X = -2000$. Data-on was called 1000 feet prior to initiating the turn. The turn was held until the vehicle heading had changed by 90° (heading change from 307° to 037° or 307° to 217° True) at which point data-off was called and the test point was terminated.

Maneuver points M14 & M15 are quick stops – the aircraft was stopped as quickly as possible while not exceeding normal terrain flight maneuver operating conditions. M14 was a quick stop from 90 knots in level flight at 100 feet AGL, while M15 was a quick stop from 90 knots on a 3° descending glideslope that terminated at an altitude between 50 and 100 feet AGL. For both these runs, the deceleration from steady flight at 90 knots was initiated 2000 feet before the primary microphone array. Data-on was called 1000 feet prior to initiating the deceleration ($X = -3000$), and data-off was called once the aircraft had achieved a hover condition.
CV-22B Tiltrotor Aircraft

All test conditions measured for the CV-22B are provided in Table; while the daily flight cards for the two test days for this vehicle are provided in Table and Table. Note that in Table, every condition code has a unique priority, in case testing was ended abruptly. Due to adequate time on station, all test points were measured multiple times. During testing, for all test conditions except M1 and M2, the aircraft was flown in a steady-state condition throughout the duration of acoustic data acquisition, at the prescribed airspeed and glideslope, along the primary flight path shown in Figure 4. The rotors were operated at 84% $N_r$ while in airplane mode (0° nacelle angle) unless otherwise noted in the flight cards. When the nacelle angle was set to anything other than 0°, the rotors were operated at 100% $N_r$.

For all level flyovers, the aircraft was flown at an altitude of 150 feet AGL at the reference microphone location. Data-on was called at X = -7000 and data-off was called at X = 6000.

Approaches were flown to acquire the prescribed glideslope and airspeed at a sufficient range to be in a steady-state operating condition for one mile from the Descent Target, which was located on the flight path centerline at X = -500. Approaches were flown on the prescribed glideslope, with the glideslope intersecting a point 50 feet above the descent target as shown in Figure 7. This steady-state condition was held for as long as possible throughout the approach to the point 50 feet above the Descent Target, with the pilot pulling out of the descent at the lowest possible altitude for safe flight operations or at an altitude that would not burst the 50-foot hard deck, whichever came first. Data-on was called at X = -5000 and data-off was called when the pilot initiated his pullout from the descent condition.

Hover data were acquired with the aircraft hovering at the prescribed heading and altitude over the prescribed hover point (Figure 4). The pilot called data-on when a steady hover was achieved and data-off was called by ground control after approximately 60 seconds of acoustic data acquisition.

Maneuver test point conditions for the CV-22B were simply transitions from cruise flight in airplane mode at 200 knots airspeed to hover. The aircraft approached along the normal flight track at 200 knots in airplane mode and one mile back from the target hover point began transitioning such that a hover condition was achieved over the target hover point. The only difference between conditions M1 and M2 is that M1 terminates in a 100-foot hover over the NASA hover point while M2 terminates in a 250-foot hover over the NSWC hover point. Data-on was called 5 seconds prior to initiating the transition from airplane mode and data-off was called once a stable hover condition had been achieved.

Data Reduction and Processing

Time-synchronized, calibrated pressure time history data from all microphones, weather data, vehicle position data and vehicle state data are available throughout the duration of all runs. Acoustic data are also available in the form of narrowband spectra and one-third-octave band spectra computed every 0.5 seconds during a run. Source noise hemispheres are available for all steady-state runs in one-third-octave band and narrowband format upon request and review.

The digital acoustic time domain data were transformed to the frequency domain using 4096-point Fast Fourier Transforms (FFTs) with a Hamming window applied. Averaged narrowband spectra were computed by averaging five 4096-point FFTs with 50% overlap, resulting in 0.4915-second data blocks. These averaged narrowband spectra were computed every 0.5 seconds for each microphone for the duration
of each flyover. The averaged narrowband spectra were then integrated to obtain one-third octave band spectra for center band frequencies from 10 Hz to 10 kHz. Source noise hemispheres have been created using the Rotorcraft Noise Model/Acoustic Re-propagation Technique (RNM/ART) methodology (Reference 1) using the measured flight track and acoustic data.

Vehicle position data have been processed for transformation into the local Cartesian coordinate system as described in the Acoustic Instrumentation section of this paper, but are also available in the original latitude, longitude, and altitude GPS data format. Vehicle state and weather data are available in the original text file format as a function of time.

**Concluding Remarks**

Far-field acoustic measurements were obtained for the AH-64D, HH-60M and CV-22B at the Eglin AFB, Test Area C-72, in July/August 2013. The measurements were obtained as part of the Acoustics Week 2013 test sponsored by the Chicken Little Joint Project Office of the 46 Test Squadron to gather developmental system performance, sensor system performance, and signature data for analysis and algorithm development. The US Army Aviation Development Directorate, the NASA Langley Research Center (LaRC), the US Army’s HH-60 and AH-64 Program Management Offices, and the Naval Surface Warfare Center (NSWC) teamed to collect this acoustic signature data for these vehicles during the Acoustics Week 2013 tests. The primary purposes for these measurements were to obtain a benchmark database of detailed acoustic source noise characteristics for these aircraft for the prediction of ground noise footprints, to develop low noise operations, to study helicopter source noise mechanisms during maneuvering flight, and for validation of NASA/Army developed acoustic prediction codes such as RNM, AAM, APET and FRAME.

Data were obtained for the vehicles operating at typical mission gross weights over a range of typical mission operating conditions, including both steady-state flight conditions as well as unsteady maneuver operations. Details of all flight conditions measured during these tests, as well as the experimental setup, vehicle onboard measurements and flight procedures have been provided. Acoustic, weather, vehicle position and vehicle state data were acquired for each run. 37 microphones were deployed during the AH-64D tests while 30 microphones were deployed during the HH-60M and CV-22B tests. Acoustic data are also available in the form of pressure time-histories, narrowband spectra, and one-third-octave band spectra computed every 0.5 seconds during a run, and source noise hemispheres in one-third-octave band and narrowband formats. Vehicle state and weather data are available in the original text file format as a function of time. Data from this test are available upon request and review.

**References**

Table 1. Vehicle data acquired during AH-64D testing.

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Table 2. Vehicle data acquired during HH-60M testing. Note: Units unavailable at time of publication.

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Table 3. Vehicle data acquired during CV-22B testing.

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<tr>
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<td>LWINS1 Acceleration Z</td>
<td>ft/sec²</td>
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Footnote: '-' in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 8. AH-64D flight card for 7/30/16.

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<th>Steve Paris / Pete Montrond</th>
<th>Note: UTC time hack agrees with AATD &quot;Watson&quot;, cards in UTC-0</th>
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Footnote: ‘-’ in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
**Table 9. AH-64D flight card for 7/31/13.**

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<th>FPA (°)</th>
<th>Temp (°F)</th>
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<tr>
<td>191</td>
<td>3-6</td>
<td>13:13:40</td>
<td>13:14:53</td>
<td>L3</td>
<td>100</td>
<td>0</td>
<td>75.3</td>
<td>0.0</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>192</td>
<td>4-3</td>
<td>13:17:43</td>
<td>13:19:06</td>
<td>L4</td>
<td>80</td>
<td>0</td>
<td>75.8</td>
<td>0.0</td>
<td>351</td>
<td></td>
</tr>
<tr>
<td>193</td>
<td>5-2</td>
<td>13:22:04</td>
<td>13:23:42</td>
<td>L5</td>
<td>70</td>
<td>0</td>
<td>76.1</td>
<td>0.0</td>
<td>99</td>
<td></td>
</tr>
<tr>
<td>194</td>
<td>6-2</td>
<td>13:26:48</td>
<td>13:28:43</td>
<td>L6</td>
<td>60</td>
<td>0</td>
<td>76.4</td>
<td>0.0</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>195</td>
<td>33-1</td>
<td>13:31:54</td>
<td>13:32:48</td>
<td>M19</td>
<td>100</td>
<td>0</td>
<td>76.4</td>
<td>0.0</td>
<td>29</td>
<td>Pull-up/push-over</td>
</tr>
<tr>
<td>196</td>
<td>34-1</td>
<td>13:36:13</td>
<td>13:37:11</td>
<td>M20</td>
<td>120</td>
<td>0</td>
<td>76.9</td>
<td>0.7</td>
<td>181</td>
<td>Pull-up/push-over</td>
</tr>
<tr>
<td>197</td>
<td>35-1</td>
<td>13:40:16</td>
<td>13:42:09</td>
<td>M21</td>
<td>40-140</td>
<td>0</td>
<td>77.2</td>
<td>1.7</td>
<td>180</td>
<td>Max accel.</td>
</tr>
<tr>
<td>198</td>
<td>24-2</td>
<td>13:47:06</td>
<td>13:47:44</td>
<td>M10</td>
<td>120</td>
<td>0</td>
<td>79.1</td>
<td>0.2</td>
<td>224</td>
<td>Right turn 45° bank Mic 24 O/D</td>
</tr>
</tbody>
</table>

Footnote: '-' in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.

20
Table 9. Continued.

<table>
<thead>
<tr>
<th>NASA Run #</th>
<th>Eglin Run #</th>
<th>Data On Time</th>
<th>Data Off Time</th>
<th>Flight Condition</th>
<th>KCAS (°)</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>199</td>
<td>28-2</td>
<td>13:49:31</td>
<td>13:50:07</td>
<td>M14</td>
<td>120</td>
<td>-</td>
<td>78.5</td>
<td>4.6</td>
<td>210</td>
<td>Right turn 60° bank many mics overdriven</td>
</tr>
<tr>
<td>200</td>
<td>28-3</td>
<td>13:52:10</td>
<td>13:52:53</td>
<td>M14</td>
<td>120</td>
<td>-</td>
<td>78.4</td>
<td>2.7</td>
<td>222</td>
<td>Right turn 60° bank 25, 26 O/D</td>
</tr>
<tr>
<td>201</td>
<td>28-4</td>
<td>13:55:32</td>
<td>13:56:10</td>
<td>M14</td>
<td>120</td>
<td>-</td>
<td>79.5</td>
<td>1.0</td>
<td>217</td>
<td>Right turn 60° bank</td>
</tr>
<tr>
<td>202</td>
<td>26-2</td>
<td>13:58:08</td>
<td>13:58:45</td>
<td>M12</td>
<td>120</td>
<td>-</td>
<td>78.2</td>
<td>2.0</td>
<td>237</td>
<td>Left turn 45° bank Mic 15 O/D</td>
</tr>
<tr>
<td>203</td>
<td>30-2</td>
<td>14:00:45</td>
<td>14:01:55</td>
<td>M16</td>
<td>120</td>
<td>-</td>
<td>78.7</td>
<td>1.2</td>
<td>215</td>
<td>Left turn 60° bank</td>
</tr>
<tr>
<td>204</td>
<td>31-3</td>
<td>14:04:53</td>
<td>14:06:08</td>
<td>M17</td>
<td>90-0</td>
<td>0</td>
<td>78.6</td>
<td>2.9</td>
<td>211</td>
<td>Quick stop</td>
</tr>
<tr>
<td>205</td>
<td>32-2</td>
<td>14:08:34</td>
<td>14:10:11</td>
<td>M18</td>
<td>90-0</td>
<td>-</td>
<td>79.0</td>
<td>0.2</td>
<td>238</td>
<td>Descending quick stop (500 fpm descent)</td>
</tr>
<tr>
<td>206</td>
<td>12-1/14-1/13-1</td>
<td>14:12:20</td>
<td>14:15:32</td>
<td>H2/ H3/ H4</td>
<td>0</td>
<td>0</td>
<td>79.0</td>
<td>2.4</td>
<td>254</td>
<td>NASA hover, hover turn perpendicular to track (217), popup at perpendicular heading (217)</td>
</tr>
<tr>
<td>207</td>
<td>3-7</td>
<td>14:18:44</td>
<td>14:19:59</td>
<td>L3</td>
<td>100</td>
<td>0</td>
<td>78.9</td>
<td>3.4</td>
<td>243</td>
<td></td>
</tr>
<tr>
<td>907</td>
<td>N/A</td>
<td>14:26:00</td>
<td>14:27:00</td>
<td>ambient</td>
<td>n/a</td>
<td>n/a</td>
<td>79.3</td>
<td>3.9</td>
<td>256</td>
<td>Radio chatter during ambient</td>
</tr>
</tbody>
</table>

Footnote: ‘-‘ in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 10. HH-60M steady-state test conditions.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Condition Code</th>
<th>KCAS</th>
<th>% RPM</th>
<th>Glide slope, deg</th>
<th>Descent rate, fpm</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L1 Vh (145)</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>L2</td>
<td>130</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>L3</td>
<td>110</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>L4</td>
<td>90</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>L5</td>
<td>70</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>L6</td>
<td>50</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>L7 Vh (145)</td>
<td>96.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>L8</td>
<td>130</td>
<td>96.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>L9</td>
<td>110</td>
<td>96.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>L10</td>
<td>90</td>
<td>96.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>L11</td>
<td>70</td>
<td>96.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>L12</td>
<td>50</td>
<td>96.5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A1</td>
<td>80</td>
<td>100.5</td>
<td>6</td>
<td>847</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A2</td>
<td>80</td>
<td>100.5</td>
<td>6</td>
<td>847</td>
<td>25° nose left sideslip or 1 ball width sideslip left or right</td>
</tr>
<tr>
<td>1</td>
<td>A3</td>
<td>70</td>
<td>100.5</td>
<td>3</td>
<td>371</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A4</td>
<td>70</td>
<td>100.5</td>
<td>6</td>
<td>741</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A5</td>
<td>70</td>
<td>100.5</td>
<td>9</td>
<td>1109</td>
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</tr>
<tr>
<td>2</td>
<td>A6</td>
<td>70</td>
<td>98</td>
<td>3</td>
<td>371</td>
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</tr>
<tr>
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<td>A7</td>
<td>70</td>
<td>98</td>
<td>6</td>
<td>741</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A8</td>
<td>70</td>
<td>98</td>
<td>9</td>
<td>1109</td>
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</tr>
<tr>
<td>2</td>
<td>A9</td>
<td>70</td>
<td>96.5</td>
<td>3</td>
<td>371</td>
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</tr>
<tr>
<td>1</td>
<td>A10</td>
<td>70</td>
<td>96.5</td>
<td>6</td>
<td>741</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A11</td>
<td>70</td>
<td>97</td>
<td>9</td>
<td>1109</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A12</td>
<td>50</td>
<td>100</td>
<td>3</td>
<td>265</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A13</td>
<td>50</td>
<td>100</td>
<td>6</td>
<td>529</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A14</td>
<td>50</td>
<td>100</td>
<td>9</td>
<td>792</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A15</td>
<td>50</td>
<td>98</td>
<td>3</td>
<td>265</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A16</td>
<td>50</td>
<td>98</td>
<td>6</td>
<td>529</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A17</td>
<td>50</td>
<td>98</td>
<td>9</td>
<td>792</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A18</td>
<td>50</td>
<td>97</td>
<td>3</td>
<td>265</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>A19</td>
<td>50</td>
<td>97</td>
<td>6</td>
<td>529</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A20</td>
<td>50</td>
<td>97</td>
<td>9</td>
<td>792</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>H1</td>
<td>0</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td>Altitude 200 feet, Heading 310°, at NSWC hover point</td>
</tr>
<tr>
<td>1</td>
<td>H2</td>
<td>0</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td>Altitude 50 feet, Heading 310°, at NASA hover point</td>
</tr>
<tr>
<td>2</td>
<td>H3</td>
<td>0</td>
<td>100.5</td>
<td>-</td>
<td>-</td>
<td>Altitude 50 feet, Heading 40°, at NASA hover point</td>
</tr>
</tbody>
</table>
Table 11. HH-60M maneuver test conditions.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Condition Code</th>
<th>KCAS</th>
<th>Alt, ft</th>
<th>Descent FPA (°)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M1</td>
<td>70 to 50 to hover</td>
<td>var.</td>
<td>9 to 0 to 6</td>
<td>Ingress profile, transition from level flight to descent (see Figure 8)</td>
</tr>
<tr>
<td>1</td>
<td>M2</td>
<td>110</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° right turn at a 20° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>2</td>
<td>M3</td>
<td>90</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° right turn at a 20° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>1</td>
<td>M4</td>
<td>70</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° right turn at a 20° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>1</td>
<td>M5</td>
<td>110</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° right turn at a 30° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>2</td>
<td>M6</td>
<td>90</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° right turn at a 30° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>1</td>
<td>M7</td>
<td>70</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° right turn at a 30° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>3</td>
<td>M8</td>
<td>110</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° left turn at a 20° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>3</td>
<td>M9</td>
<td>90</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° left turn at a 20° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>3</td>
<td>M10</td>
<td>70</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° left turn at a 20° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>3</td>
<td>M11</td>
<td>110</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° left turn at a 30° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>3</td>
<td>M12</td>
<td>90</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° left turn at a 30° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>3</td>
<td>M13</td>
<td>70</td>
<td>100</td>
<td>0</td>
<td>Level flight 90° left turn at a 30° bank angle starting 2000’ before primary array</td>
</tr>
<tr>
<td>2</td>
<td>M14</td>
<td>90-0</td>
<td>100</td>
<td>0</td>
<td>Quick stop starting 2000’ before primary array and ending near hover point</td>
</tr>
<tr>
<td>1</td>
<td>M15</td>
<td>90-0</td>
<td>var.</td>
<td>3</td>
<td>Quick stop ending at 100 feet AGL, starting 2000’ before primary array and ending near hover point</td>
</tr>
</tbody>
</table>
Table 12. HH-60M flight card for 8/5/13.

<table>
<thead>
<tr>
<th>Aircraft: HH-60M</th>
<th>Flight Number: 104</th>
<th>Gw#: 16,600 ± 50</th>
<th>Fuel Start Wt #: 2377</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: 8/5/13 UTC=Local + 5 hours</td>
<td>LTC Evan Brown / CW3 Clark Hall</td>
<td>Note: Times in UTC-0 (a/c time hack agrees)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NASA Run #</th>
<th>Eglin Run #</th>
<th>Data On Time</th>
<th>Data Off Time</th>
<th>Flight Condition</th>
<th>KCAS</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>908</td>
<td>N/A</td>
<td>12:22:25</td>
<td>12:23:28</td>
<td>Ambient</td>
<td>n/a</td>
<td>n/a</td>
<td>72.0</td>
<td>3.2</td>
<td>205</td>
<td>car near NSWC hover point</td>
</tr>
<tr>
<td>301</td>
<td>3</td>
<td>13:08:00</td>
<td>13:09:23</td>
<td>L3</td>
<td>110</td>
<td>0</td>
<td>74.4</td>
<td>2.2</td>
<td>354</td>
<td>Aircraft time may be 2 sec behind 100.5% Nr</td>
</tr>
<tr>
<td>302</td>
<td>6</td>
<td>13:12:13</td>
<td>13:13:27</td>
<td>L6</td>
<td>50</td>
<td>0</td>
<td>75.6</td>
<td>2.2</td>
<td>346</td>
<td>ABORT: terminated at pilot discretion</td>
</tr>
<tr>
<td>303</td>
<td>6-1</td>
<td>13:17:42</td>
<td>13:20:22</td>
<td>L6</td>
<td>50</td>
<td>0</td>
<td>75.0</td>
<td>3.2</td>
<td>340</td>
<td></td>
</tr>
<tr>
<td>304</td>
<td>5</td>
<td>13:23:10</td>
<td>13:24:57</td>
<td>L5</td>
<td>70</td>
<td>0</td>
<td>76.1</td>
<td>1.2</td>
<td>354</td>
<td></td>
</tr>
<tr>
<td>305</td>
<td>4</td>
<td>13:28:05</td>
<td>13:29:26</td>
<td>L4</td>
<td>90</td>
<td>0</td>
<td>76.7</td>
<td>1.7</td>
<td>328</td>
<td></td>
</tr>
<tr>
<td>306</td>
<td>3-1</td>
<td>13:32:58</td>
<td>13:34:07</td>
<td>L3</td>
<td>110</td>
<td>0</td>
<td>76.7</td>
<td>2.0</td>
<td>330</td>
<td></td>
</tr>
<tr>
<td>307</td>
<td>2</td>
<td>13:37:13</td>
<td>13:38:13</td>
<td>L2</td>
<td>130</td>
<td>0</td>
<td>76.9</td>
<td>1.7</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>308</td>
<td>1</td>
<td>13:41:35</td>
<td>13:42:26</td>
<td>L1</td>
<td>145</td>
<td>0</td>
<td>77.5</td>
<td>3.4</td>
<td>329</td>
<td>152 KTAS actual</td>
</tr>
<tr>
<td>309</td>
<td>12</td>
<td>13:46:08</td>
<td>13:48:29</td>
<td>L12</td>
<td>50</td>
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<td>reduced NR (96.5)</td>
</tr>
<tr>
<td>310</td>
<td>11</td>
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<td>13:53:57</td>
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<td>38</td>
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</tr>
<tr>
<td>311</td>
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<td>13:58:45</td>
<td>L10</td>
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<td>4.2</td>
<td>347</td>
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</tr>
<tr>
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<td>14:03:11</td>
<td>L9</td>
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<td>0</td>
<td>78.8</td>
<td>1.7</td>
<td>350</td>
<td>reduced NR (96.5)</td>
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<tr>
<td>313</td>
<td>8</td>
<td>14:06:35</td>
<td>14:07:36</td>
<td>L8</td>
<td>130</td>
<td>0</td>
<td>79.6</td>
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<td>14:12:04</td>
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<td>0</td>
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<td>315</td>
<td>reduced NR (96.5)--150 KTAS actual</td>
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<tr>
<td>315</td>
<td>13</td>
<td>14:16:16</td>
<td>14:17:13</td>
<td>A1</td>
<td>80</td>
<td>6</td>
<td>80.3</td>
<td>1.5</td>
<td>313</td>
<td>headwinds aloft (ABORT: terminated at pilot discretion)</td>
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<tr>
<td>316</td>
<td>13-1</td>
<td>14:20:28</td>
<td>14:21:25</td>
<td>A1</td>
<td>80</td>
<td>6</td>
<td>79.5</td>
<td>3.7</td>
<td>336</td>
<td>headwinds aloft</td>
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<tr>
<td>317</td>
<td>14</td>
<td>14:25:43</td>
<td>14:26:43</td>
<td>A2</td>
<td>80</td>
<td>6</td>
<td>79.7</td>
<td>0.0</td>
<td>342</td>
<td>nose left sideslip (20°-25°)</td>
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<tr>
<td>318</td>
<td>15</td>
<td>14:31:06</td>
<td>14:32:12</td>
<td>A3</td>
<td>70</td>
<td>3</td>
<td>81.1</td>
<td>0.0</td>
<td>20</td>
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<td>319</td>
<td>16</td>
<td>14:36:18</td>
<td>14:37:20</td>
<td>A4</td>
<td>70</td>
<td>6</td>
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<td>0.5</td>
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<td>320</td>
<td>17</td>
<td>14:41:48</td>
<td>14:42:48</td>
<td>A5</td>
<td>70</td>
<td>9</td>
<td>81.5</td>
<td>0.0</td>
<td>15</td>
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<td>321</td>
<td>21</td>
<td>14:46:36</td>
<td>14:47:38</td>
<td>A9</td>
<td>70</td>
<td>3</td>
<td>80.9</td>
<td>1.2</td>
<td>6</td>
<td>reduced NR (96.5), pilot was OK skipping 98% runs</td>
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<tr>
<td>322</td>
<td>22</td>
<td>14:51:15</td>
<td>14:52:18</td>
<td>A10</td>
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<td>2.2</td>
<td>271</td>
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<td>323</td>
<td>3-2</td>
<td>14:55:52</td>
<td>14:57:05</td>
<td>L3</td>
<td>110</td>
<td>0</td>
<td>81.4</td>
<td>0.7</td>
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</tr>
<tr>
<td>909</td>
<td>N/A</td>
<td>15:08:31</td>
<td>15:09:30</td>
<td>Ambient</td>
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<td>n/a</td>
<td>82.2</td>
<td>1.7</td>
<td>8</td>
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Footnote: '-' in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 13. UH-60M flight card for 8/6/13.

<table>
<thead>
<tr>
<th>Date: 8/6/13</th>
<th>UTC=Local + 5 hours</th>
<th>Aircraft: HH-60M</th>
<th>Flight Card for 8/6/13 UTC=Local + 5 hours</th>
<th>Note: Times in UTC-0</th>
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<td>Flight Number: 105</td>
<td>Local + 5 hours</td>
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<td>Evin Brown / CW3 Clark Hall</td>
<td>GW#: 16,600 ± 50 Fuel Start Wt#: 2377</td>
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<table>
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<tr>
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<th>Eglin Run #</th>
<th>Data On Time</th>
<th>Data Off Time</th>
<th>Flight Condition</th>
<th>KCAS</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
<th>Comments</th>
</tr>
</thead>
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<td>910</td>
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<td>10:15:46</td>
<td>10:16:47</td>
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<td>n/a</td>
<td>70.5</td>
<td>0.0</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>324</td>
<td>3-3</td>
<td>11:10:45</td>
<td>11:11:59</td>
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<td>67.9</td>
<td>0.0</td>
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<tr>
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<td>11:16:01</td>
<td>11:16:57</td>
<td>A1</td>
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<td>6</td>
<td>68.3</td>
<td>0.0</td>
<td>27</td>
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<tr>
<td>326</td>
<td>14-1</td>
<td>11:21:58</td>
<td>11:22:57</td>
<td>A2</td>
<td>80</td>
<td>6</td>
<td>70.5</td>
<td>0.0</td>
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<td>15-1</td>
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<td>11:28:34</td>
<td>A3</td>
<td>70</td>
<td>3</td>
<td>68.5</td>
<td>0.0</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>328</td>
<td>16-1</td>
<td>11:32:32</td>
<td>11:33:34</td>
<td>A4</td>
<td>70</td>
<td>6</td>
<td>68.5</td>
<td>0.0</td>
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<td>17-1</td>
<td>11:37:35</td>
<td>11:38:42</td>
<td>A5</td>
<td>70</td>
<td>9</td>
<td>68.8</td>
<td>0.0</td>
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</tr>
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<td>11:42:37</td>
<td>11:43:42</td>
<td>A3</td>
<td>70</td>
<td>3</td>
<td>69.3</td>
<td>0.0</td>
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</tr>
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<td>331</td>
<td>16-2</td>
<td>11:47:44</td>
<td>11:48:48</td>
<td>A4</td>
<td>70</td>
<td>6</td>
<td>69.6</td>
<td>0.0</td>
<td>27</td>
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</tr>
<tr>
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<td>23</td>
<td>11:53:47</td>
<td>11:54:54</td>
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<td>9</td>
<td>69.9</td>
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</tr>
<tr>
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<td>12:00:17</td>
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<td>70</td>
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<td>0.0</td>
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</tr>
<tr>
<td>334</td>
<td>22-1</td>
<td>12:04:55</td>
<td>12:06:00</td>
<td>A4</td>
<td>70</td>
<td>6</td>
<td>70.7</td>
<td>0.0</td>
<td>27</td>
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</tr>
<tr>
<td>335</td>
<td>24</td>
<td>12:10:20</td>
<td>12:11:32</td>
<td>A12</td>
<td>50</td>
<td>3</td>
<td>71.2</td>
<td>0.0</td>
<td>27</td>
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</tr>
<tr>
<td>336</td>
<td>25</td>
<td>12:15:48</td>
<td>12:17:06</td>
<td>A13</td>
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<td>6</td>
<td>72.0</td>
<td>0.0</td>
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<td>337</td>
<td>26</td>
<td>12:21:38</td>
<td>12:22:58</td>
<td>A14</td>
<td>50</td>
<td>9</td>
<td>72.2</td>
<td>0.0</td>
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<tr>
<td>338</td>
<td>30</td>
<td>12:27:16</td>
<td>12:28:31</td>
<td>A18</td>
<td>50</td>
<td>3</td>
<td>72.7</td>
<td>1.7</td>
<td>24</td>
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<tr>
<td>339</td>
<td>31</td>
<td>12:32:58</td>
<td>12:34:21</td>
<td>A19</td>
<td>50</td>
<td>6</td>
<td>73.2</td>
<td>0.0</td>
<td>6</td>
<td>reduced NR (96.5%)</td>
</tr>
<tr>
<td>340</td>
<td>32</td>
<td>12:38:55</td>
<td>12:40:16</td>
<td>A20</td>
<td>50</td>
<td>9</td>
<td>74.0</td>
<td>0.0</td>
<td>4</td>
<td>reduced NR (96.5%)</td>
</tr>
<tr>
<td>341</td>
<td>3-4</td>
<td>12:44:50</td>
<td>12:47:52</td>
<td>L3</td>
<td>110</td>
<td>0</td>
<td>74.6</td>
<td>0.7</td>
<td>28</td>
<td>extended path</td>
</tr>
<tr>
<td>342</td>
<td>36</td>
<td>12:52:07</td>
<td>12:53:25</td>
<td>M1</td>
<td>70-50-0</td>
<td>-</td>
<td>74.9</td>
<td>0.5</td>
<td>29</td>
<td>compound approach (50' high) jet overflight</td>
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<tr>
<td>343</td>
<td>36-1</td>
<td>12:58:03</td>
<td>12:59:37</td>
<td>M1</td>
<td>70-50-0</td>
<td>-</td>
<td>74.7</td>
<td>0.0</td>
<td>16</td>
<td>compound approach</td>
</tr>
<tr>
<td>344</td>
<td>34</td>
<td>13:00:27</td>
<td>13:02:03</td>
<td>H2/H3</td>
<td>0</td>
<td>0</td>
<td>75.3</td>
<td>0.2</td>
<td>19</td>
<td>NASA hover (30 sec then heading change)</td>
</tr>
<tr>
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<td>33</td>
<td>13:03:42</td>
<td>13:04:23</td>
<td>H1</td>
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<td>0</td>
<td>75.7</td>
<td>0.0</td>
<td>19</td>
<td>NSWC hover</td>
</tr>
</tbody>
</table>

Footnote: '-' in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 13. Continued.

<table>
<thead>
<tr>
<th>NASA Run #</th>
<th>Eglin Run #</th>
<th>Data On Time</th>
<th>Data Off Time</th>
<th>Flight Condition</th>
<th>KCAS (kts)</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
<th>Comments</th>
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</thead>
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<tr>
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<td>13:14:21</td>
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<td>n/a</td>
<td>n/a</td>
<td>74.7</td>
<td>0.0</td>
<td>19</td>
<td>extended path (jet noise in area near beginning of run)</td>
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<tr>
<td>346</td>
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<td>13:54:41</td>
<td>L3</td>
<td>110</td>
<td>0</td>
<td>79.3</td>
<td>0.0</td>
<td>359</td>
<td>20° bank right turn</td>
</tr>
<tr>
<td>347</td>
<td>37</td>
<td>13:58:16</td>
<td>13:59:07</td>
<td>M2</td>
<td>110</td>
<td>0</td>
<td>79.9</td>
<td>0.5</td>
<td>8</td>
<td>20° bank right turn</td>
</tr>
<tr>
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<td>40</td>
<td>14:01:15</td>
<td>14:02:19</td>
<td>M5</td>
<td>110</td>
<td>0</td>
<td>80.0</td>
<td>0.0</td>
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<td>30° bank right turn</td>
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<tr>
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<td>14:05:02</td>
<td>14:07:21</td>
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<tr>
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<td>14:11:59</td>
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<td>70</td>
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<td>80.5</td>
<td>1.2</td>
<td>298</td>
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<tr>
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<td>4-1</td>
<td>14:14:59</td>
<td>14:16:15</td>
<td>L4</td>
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<td>0</td>
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<td>2.4</td>
<td>332</td>
<td>pickup idling near NSWC since REFUEL</td>
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<tr>
<td>352</td>
<td>3-6</td>
<td>14:20:14</td>
<td>14:22:43</td>
<td>L3</td>
<td>110</td>
<td>0</td>
<td>81.9</td>
<td>0.7</td>
<td>28</td>
<td>extended path</td>
</tr>
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<td>353</td>
<td>2-1</td>
<td>14:25:55</td>
<td>14:26:55</td>
<td>L2</td>
<td>130</td>
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<td>81.6</td>
<td>1.7</td>
<td>346</td>
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<td>14:35:08</td>
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<td>2.0</td>
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<td>152 KTAS actual</td>
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<tr>
<td>355</td>
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<td>14:38:08</td>
<td>14:39:02</td>
<td>L7</td>
<td>145</td>
<td>0</td>
<td>81.8</td>
<td>1.2</td>
<td>7</td>
<td>150 KTAS actual, reduced NR(96.5%)</td>
</tr>
<tr>
<td>356</td>
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<td>14:42:00</td>
<td>14:43:00</td>
<td>L8</td>
<td>130</td>
<td>0</td>
<td>81.7</td>
<td>1.5</td>
<td>347</td>
<td>reduced NR (96.5%)</td>
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<td>357</td>
<td>9-1</td>
<td>14:45:37</td>
<td>14:46:51</td>
<td>L9</td>
<td>110</td>
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<td>81.6</td>
<td>2.4</td>
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<td>10-1</td>
<td>14:49:39</td>
<td>14:51:07</td>
<td>L10</td>
<td>90</td>
<td>0</td>
<td>82.8</td>
<td>0.2</td>
<td>344</td>
<td>reduced NR (96.5%)</td>
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<td>359</td>
<td>11-1</td>
<td>14:53:58</td>
<td>14:55:48</td>
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<td>70</td>
<td>0</td>
<td>83.3</td>
<td>0.0</td>
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<tr>
<td>360</td>
<td>12-1</td>
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<td>15:01:02</td>
<td>L12</td>
<td>50</td>
<td>0</td>
<td>83.0</td>
<td>2.9</td>
<td>14</td>
<td>reduced NR (96.5%)</td>
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<tr>
<td>912</td>
<td>N/A</td>
<td>15:10:31</td>
<td>15:11:31</td>
<td>ambient</td>
<td>n/a</td>
<td>n/a</td>
<td>82.6</td>
<td>4.9</td>
<td>31</td>
<td>UH-1 inbound to C7 during ambient</td>
</tr>
</tbody>
</table>

Footnote: ‘-‘ in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 14. HH-60M flight card for 8/7/13.

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<thead>
<tr>
<th>Aircraft: HH-60M</th>
<th>Flight Number: 106</th>
<th>UTC=Local + 5 hours</th>
<th>LTC Evan Brown / CW3 Clark Hall</th>
<th>Note: Times in UTC-0</th>
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<tbody>
<tr>
<td>Date: 8/7/13</td>
<td>16,600 ± 50</td>
<td>Fuel Start Wt #: 2377</td>
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</tr>
<tr>
<td>NASA Run #</td>
<td>Eglin Run #</td>
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<td>Data Off Time</td>
<td>Flight Condition</td>
</tr>
<tr>
<td>913</td>
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<td>10:02:55</td>
<td>n/a n/a</td>
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<td>361</td>
<td>3-7</td>
<td>11:06:28</td>
<td>11:07:53</td>
<td>L3 110 0</td>
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<th>WD (deg)</th>
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Footnote: '-' in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 14. Continued.

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Footnote: '-' in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 14. Concluded.

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<th>Flight Condition</th>
<th>KCAS (°)</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
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<td>L10</td>
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<td>2.2</td>
<td>54</td>
<td>reduced NR (96.5%)</td>
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<tr>
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Footnote: ‘-‘ in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 15. CV-22B test conditions.

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<tr>
<th>Priority</th>
<th>Condition Code</th>
<th>KCAS</th>
<th>Nacelle Angle, deg.</th>
<th>Glide slope, deg</th>
<th>Descent rate, fpm</th>
<th>Comments</th>
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<td>87</td>
<td>10</td>
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<td>16</td>
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<td>-</td>
<td>-</td>
<td>Altitude 250 feet, Heading 310°, at NSWC hover point</td>
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<tr>
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<td>H2</td>
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<td>87</td>
<td>-</td>
<td>-</td>
<td>Altitude 100 feet, Heading 310°, at NASA hover point</td>
</tr>
<tr>
<td>20</td>
<td>H3</td>
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<td>-</td>
<td>-</td>
<td>Altitude 100 feet, Heading 40°, at NASA hover point</td>
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<td>as req'd</td>
<td>Transition from cruise to land at approach point compressed to start at 1 mile</td>
</tr>
<tr>
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<td>as req'd</td>
<td>as req'd</td>
<td>as req'd</td>
<td>Transition from cruise to land at NSWC hover point compressed to start at 1 mile</td>
</tr>
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Table 16. CV-22B flight card for 8/13/13.

<table>
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<tr>
<th>NASA Run #</th>
<th>Eglin Run #</th>
<th>Data On Time</th>
<th>Data Off Time</th>
<th>Flight Condition</th>
<th>KCAS</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
<th>Comments</th>
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<td>10:27:30</td>
<td>ambient</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td>All level flights at 150' altitude</td>
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<tr>
<td>501</td>
<td>3</td>
<td>11:36:43</td>
<td>11:37:45</td>
<td>L3</td>
<td>192</td>
<td>0</td>
<td>69.3</td>
<td>0.0</td>
<td>321</td>
<td>0° nacelle (rear door open), gear up</td>
</tr>
<tr>
<td>502</td>
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<td>11:40:24</td>
<td>11:41:19</td>
<td>L3</td>
<td>192</td>
<td>0</td>
<td>69.8</td>
<td>0.0</td>
<td>321</td>
<td>0° nacelle (192 KCAS), gear up</td>
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<tr>
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<td>11:45:28</td>
<td>L1</td>
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<td>0</td>
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<td>0.0</td>
<td>321</td>
<td>0° nacelle (temp. inversion +10°F over 300') 267 KCAS actual, gear up</td>
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<td>0° nacelle, gear up</td>
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<td>220</td>
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<td>69.8</td>
<td>0.0</td>
<td>321</td>
<td>0° nacelle, gear up</td>
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<tr>
<td>507</td>
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<td>11:58:59</td>
<td>L5</td>
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<td>321</td>
<td>0° nacelle (160 KCAS @ 84% NR), gear up</td>
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<tr>
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<td>12:01:14</td>
<td>12:02:16</td>
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<td>12:05:46</td>
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<td>0</td>
<td>71.7</td>
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<td>318</td>
<td>44° nacelle, 100% NR, Mics O/D, gear up</td>
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<tr>
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<td>12:09:42</td>
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<td>318</td>
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<td>12:13:47</td>
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<td>73.1</td>
<td>0.0</td>
<td>318</td>
<td>44° nacelle, 100% NR, gear up</td>
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<tr>
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<td>12:17:49</td>
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<td>73.6</td>
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<td>60° nacelle, gear down</td>
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<td>12:21:43</td>
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<td>110</td>
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<td>74.2</td>
<td>0.0</td>
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<td>60° nacelle, gear down</td>
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<tr>
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<td>12:26:45</td>
<td>L7</td>
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<td>74.8</td>
<td>0.0</td>
<td>318</td>
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<td>515</td>
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<td>12:31:27</td>
<td>L7</td>
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<td>0</td>
<td>74.6</td>
<td>0.0</td>
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<tr>
<td>516</td>
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<td>12:34:27</td>
<td>12:36:37</td>
<td>L8</td>
<td>74 var</td>
<td>0</td>
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<td>0.0</td>
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<td>70</td>
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<td>75.5</td>
<td>0.0</td>
<td>293</td>
<td>81° nacelle, 100% NR, gear down</td>
</tr>
<tr>
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<td>12:45:48</td>
<td>L8</td>
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<td>75.7</td>
<td>0.0</td>
<td>293</td>
<td>81° nacelle, 100% NR, gear down</td>
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<td>12:48:29</td>
<td>12:51:38</td>
<td>L9</td>
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<td>76.5</td>
<td>2.2</td>
<td>297</td>
<td>85° nacelle, 104% NR, gear down</td>
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<td>3.2</td>
<td>274</td>
<td>80° nacelle, steeper approach near beginning of run (15 kts headwind @ 300')</td>
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<td>13:11:39</td>
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<td>80±3</td>
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<td>77.5</td>
<td>2.2</td>
<td>276</td>
<td>80° nacelle, ±3 kts A/S</td>
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</table>

Footnote: '-' in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
Table 16. Continued.

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<th>NASA Run #</th>
<th>Eglin Run #</th>
<th>Data On Time</th>
<th>Data Off Time</th>
<th>Flight Condition</th>
<th>KCAS (°)</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
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<td>78.0</td>
<td>1.2</td>
<td>274</td>
<td>104% NR for a little bit at beginning, 80° nacelle, ±3 kts A/S</td>
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<td>60±3</td>
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<td>78.3</td>
<td>0.0</td>
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<td>13:32:49</td>
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<td>319</td>
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<td>13:37:44</td>
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<td>13:43:11</td>
<td>A4</td>
<td>60±3</td>
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<td>78.9</td>
<td>4.4</td>
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<td>82° nacelle (bit shallow)</td>
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<td>1.0</td>
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<td>13:57:41</td>
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<td>3.2</td>
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<td>14:03:06</td>
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<td>4.6</td>
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<td>4.9</td>
<td>255</td>
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<td>14:09:37</td>
<td>14:11:13</td>
<td>M1</td>
<td>200-0</td>
<td>-</td>
<td>79.5</td>
<td>4.3</td>
<td>253</td>
<td>overshot PMA, slight O/D</td>
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<td>14:23:44</td>
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<td>-</td>
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<td>287</td>
<td>170 KCAS entry (abort)</td>
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<td>14:31:22</td>
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<td>5.1</td>
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<td>14:39:13</td>
<td>14:40:12</td>
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<td>range quiet after 10 sec</td>
</tr>
</tbody>
</table>

Footnote: ‘-‘ in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
**Table 17. CV-22B flight card for 8/14/13.**

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<tr>
<th>NASA Run #</th>
<th>Eglin Run #</th>
<th>Data On Time</th>
<th>Data Off Time</th>
<th>Flight Condition</th>
<th>KCAS (°)</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
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<td>70.7</td>
<td>0.0</td>
<td>313</td>
<td>thunder during ambient?</td>
</tr>
<tr>
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<td>3-5</td>
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<td>11:28:33</td>
<td>L3</td>
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<td>0</td>
<td>68.5</td>
<td>0.0</td>
<td>314</td>
<td>84% NR</td>
</tr>
<tr>
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<td>11:31:21</td>
<td>11:33:22</td>
<td>A1.1</td>
<td>80</td>
<td>4</td>
<td>68.5</td>
<td>0.7</td>
<td>314</td>
<td>60° nacelle (deck not level)</td>
</tr>
<tr>
<td>546</td>
<td>11-2</td>
<td>11:36:58</td>
<td>11:39:33</td>
<td>A2</td>
<td>60</td>
<td>4</td>
<td>68.9</td>
<td>0.5</td>
<td>315</td>
<td>level deck</td>
</tr>
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<td>11:44:11</td>
<td>A1</td>
<td>80</td>
<td>4</td>
<td>69.6</td>
<td>0.0</td>
<td>315</td>
<td>78° nacelle (level deck)</td>
</tr>
<tr>
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<td>12-2</td>
<td>11:47:03</td>
<td>11:49:07</td>
<td>A3</td>
<td>80</td>
<td>7</td>
<td>69.9</td>
<td>0.0</td>
<td>315</td>
<td>79° nacelle (level deck)</td>
</tr>
<tr>
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<td>11:52:13</td>
<td>11:54:08</td>
<td>A3.1</td>
<td>80</td>
<td>7</td>
<td>69.7</td>
<td>0.0</td>
<td>315</td>
<td>70° nacelle (deck not level)</td>
</tr>
<tr>
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<td>11:57:22</td>
<td>11:59:18</td>
<td>A3.2</td>
<td>80</td>
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<td>69.7</td>
<td>0.2</td>
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</tr>
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<td>12:02:18</td>
<td>12:04:45</td>
<td>A4</td>
<td>60</td>
<td>7</td>
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<td>0.0</td>
<td>339</td>
<td>83° nacelle (level deck)</td>
</tr>
<tr>
<td>552</td>
<td>14-2</td>
<td>12:07:12</td>
<td>12:09:13</td>
<td>A5</td>
<td>80</td>
<td>10</td>
<td>70.4</td>
<td>0.0</td>
<td>340</td>
<td>80° nacelle (level deck)</td>
</tr>
<tr>
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<td>12:14:16</td>
<td>A5.1</td>
<td>80</td>
<td>10</td>
<td>70.1</td>
<td>0.0</td>
<td>340</td>
<td>70° nacelle (deck not level)</td>
</tr>
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<td>12:17:18</td>
<td>12:19:35</td>
<td>A5.2</td>
<td>80</td>
<td>10</td>
<td>69.7</td>
<td>2.7</td>
<td>340</td>
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<td>12:25:07</td>
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<td>83° nacelle (level deck)</td>
</tr>
<tr>
<td>556</td>
<td>19-3</td>
<td>12:28:02</td>
<td>12:29:11</td>
<td>M1</td>
<td>-</td>
<td>-</td>
<td>70.1</td>
<td>0.0</td>
<td>340</td>
<td></td>
</tr>
<tr>
<td>557</td>
<td>19-4</td>
<td>12:33:24</td>
<td>12:35:03</td>
<td>M1</td>
<td>-</td>
<td>-</td>
<td>70.6</td>
<td>0.0</td>
<td>340</td>
<td></td>
</tr>
<tr>
<td>558</td>
<td>20-3</td>
<td>12:37:49</td>
<td>12:38:54</td>
<td>M2</td>
<td>-</td>
<td>-</td>
<td>70.7</td>
<td>0.0</td>
<td>340</td>
<td>Mic O/D on SMA, center PMA</td>
</tr>
<tr>
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<td>20-4</td>
<td>12:41:52</td>
<td>12:43:00</td>
<td>M2</td>
<td>-</td>
<td>-</td>
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<td>VH</td>
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<td>265 KCAS actual</td>
</tr>
<tr>
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<td>12:49:58</td>
<td>L2</td>
<td>220</td>
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<td>71.6</td>
<td>0.0</td>
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</tr>
<tr>
<td>562</td>
<td>3-5</td>
<td>12:52:11</td>
<td>12:53:02</td>
<td>L3</td>
<td>190</td>
<td>0</td>
<td>71.5</td>
<td>0.0</td>
<td>343</td>
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</tr>
<tr>
<td>563</td>
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<td>12:55:19</td>
<td>12:56:15</td>
<td>L4.2</td>
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<td>300</td>
<td>100% NR</td>
</tr>
<tr>
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<td>4-2</td>
<td>12:58:16</td>
<td>12:59:13</td>
<td>L4</td>
<td>160</td>
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<td>1.0</td>
<td>309</td>
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<tr>
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<td>13:02:32</td>
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<tr>
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<td>13:06:22</td>
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<td>4.9</td>
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<td>13:10:05</td>
<td>L6</td>
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<td>72.0</td>
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<td>308</td>
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<tr>
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<tr>
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<td>L7</td>
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<td>72.1</td>
<td>0.0</td>
<td>308</td>
<td>79° nacelle (level deck)</td>
</tr>
<tr>
<td>570</td>
<td>8-3</td>
<td>13:21:17</td>
<td>13:23:06</td>
<td>L8</td>
<td>70</td>
<td>0</td>
<td>72.3</td>
<td>0.0</td>
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<tr>
<td>571</td>
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<td>13:28:33</td>
<td>L9</td>
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<td>0</td>
<td>72.6</td>
<td>0.0</td>
<td>309</td>
<td>85° nacelle, 104% NR</td>
</tr>
</tbody>
</table>

Footnote: '-' in KCAS or FPA indicates flight speed or path angle was “as required”. See description of test conditions for more information.
<table>
<thead>
<tr>
<th>NASA Run #</th>
<th>Eglin Run #</th>
<th>Data On Time</th>
<th>Data Off Time</th>
<th>Flight Condition</th>
<th>KCAS</th>
<th>FPA (°)</th>
<th>Temp (°F)</th>
<th>WS (kts)</th>
<th>WD (deg)</th>
<th>Comments</th>
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<tr>
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<td>11-3</td>
<td>13:36:37</td>
<td>13:39:01</td>
<td>A2</td>
<td>60</td>
<td>4</td>
<td>74.4</td>
<td>0.0</td>
<td>345</td>
<td>83° nacelle (level deck)</td>
</tr>
<tr>
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<td>12-3</td>
<td>13:41:49</td>
<td>13:43:35</td>
<td>A3</td>
<td>80</td>
<td>7</td>
<td>75.1</td>
<td>1.5</td>
<td>347</td>
<td>78° nacelle (level deck)</td>
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<tr>
<td>575</td>
<td>13-3</td>
<td>13:46:15</td>
<td>13:48:40</td>
<td>A4</td>
<td>60</td>
<td>7</td>
<td>74.8</td>
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<td>2</td>
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<tr>
<td>576</td>
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<td>13:51:30</td>
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<td>334</td>
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<td>14:00:29</td>
<td>14:02:30</td>
<td>A5</td>
<td>80</td>
<td>10</td>
<td>77.3</td>
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<td>80° nacelle (deck level), jet noise</td>
</tr>
<tr>
<td>578</td>
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<td>14:06:05</td>
<td>14:08:02</td>
<td>A5</td>
<td>80</td>
<td>10</td>
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<td>A6</td>
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<td>10</td>
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<tr>
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<td>14.1-1</td>
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<td>14:18:08</td>
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<td>76.8</td>
<td>1.7</td>
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<td>14:23:01</td>
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<td>10</td>
<td>76.8</td>
<td>1.7</td>
<td>306</td>
<td>63° nacelle (deck not level)</td>
</tr>
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<td>14:29:09</td>
<td>L6</td>
<td>110</td>
<td>0</td>
<td>76.9</td>
<td>4.4</td>
<td>321</td>
<td>60° nacelle, extended run-in, some jet noise</td>
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<tr>
<td>583</td>
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<td>L1</td>
<td>VH</td>
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<td>77.6</td>
<td>1.0</td>
<td>262</td>
<td>270 KCAS actual (rear door closed)</td>
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<tr>
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<td>n/a</td>
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<td>3.7</td>
<td>287</td>
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</tr>
</tbody>
</table>

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Figure 1. AH-64D Apache Helicopter.

Figure 2. HH-60M Blackhawk Helicopter.
Figure 3. CV-22B Tiltrotor Aircraft.
Figure 4. Test range overview.
Figure 5. Typical WAMS microphone station deployment.

Figure 6. Tethered weather balloon system.
Figure 7. Approach profile graphic with glideslope intercept altitudes.

<table>
<thead>
<tr>
<th>Descent Angle, deg</th>
<th>h @ 5000’ out</th>
<th>h at 6000’ out</th>
<th>h at 7000’ out</th>
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<td>3</td>
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<td>10</td>
<td>932</td>
<td>1108</td>
<td>1284</td>
</tr>
</tbody>
</table>

Figure 8. HH-60M descent maneuver M1 graphic.
Joint Eglin Acoustics Week 2013 Data Report

Conner, David A.; Stephenson, James; Sim Ben W.; Greenwood, Eric; Watts, Michael E.; Smith, Charles D.

NASA Langley Research Center
Hampton, Virginia  23681-2199

Far-field acoustic measurements were obtained for the AH-64D, HH-60M and CV-22B at the Eglin AFB, Test Area C-72, in July/August 2013. The primary purpose for this flight test was to obtain a benchmark database of detailed acoustic source noise characteristics for the aircraft operating at typical mission gross weights over a range of typical mission operating conditions. Data were acquired for a range of steady-state level and descending flight conditions, hover, and a variety of unsteady maneuver conditions. Between 30 and 37 microphones were deployed during these tests. Vehicle position and state data, as well as weather data were acquired simultaneously with the acoustic data. This paper describes the test aircraft, onboard instrumentation, ground instrumentation, and the data acquired. Data from this test are available upon request and review.