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**Assessment of Human Performance in a  
Simulated Rotorcraft Downwash  
Environment**

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**Air Force Research Laboratory  
Human Effectiveness Directorate  
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| 14. ABSTRACT<br>Operational Requirements Document (ORD) CAF 315-97-B calls for the development of a Personnel Recovery Vehicle (PRV) to be used during Combat Search and Rescue missions undertaken by the Special Operations Command. Tests were conducted in the Aerospace Vehicle Survivability Facility of the 46th Operation's Group's Munitions Test Division (46 OGM), WPAFB to determine the horizontal and vertical airflow velocity limits in which personnel can perform necessary tasks. Horizontal test profiles included subjects walking into airflow wearing representative gear and carrying a Stokes litter with a patient. Vertical tests included descending a fast rope, climbing a ladder, and hoisting a litter into the airflow. Data analysis resulted in definition of horizontal airflow velocity limits. Vertical airflow limits were not defined due to poor experimental flow conditions. Horizontal flow is the limiting factor operationally as it is much stronger than vertical flow. |             |                         |                               |                                      |                                                                       |  |
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## **PREFACE**

The Special Operations Forces Systems Group (SOFSG/THE) requested that AFRL/HEPA provide air velocity limits for Pararescuemen (PJs) operating in the vicinity of a hovering Personnel Recovery Vehicle (PRV). Tests were conducted in the Aerospace Vehicle Survivability Facility of the 46th Operation's Group's Munitions Test Division (46 OGM), Area B, WPAFB. This testing was formally approved by the Wright Research Site Institutional Review Board (WRS IRB) under protocol F-WR-2004-0034-H and performed under work unit 71840216.

The work performed in this Technical Report was conducted between December 2004 to August 2005. John Plaga of AFRL/HEPA served as the principal investigator and project manager, with Nathan Wright and John Buhrman as associate investigators. Brian Grattan of General Dynamics AIS provided contractor support.

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## INTRODUCTION

Operational Requirements Document (ORD) CAF 315-97-B calls for the development of a Personnel Recovery Vehicle (PRV) to be used during Combat Search and Rescue missions undertaken by the Special Operations Command. Section 4.1.1.7 of the ORD states that safe operations are not to be hindered due to PRV downwash. Safe operations are defined as the ability to perform “hover extraction operations (hoist), providing emergency lifesaving measures to isolated personnel, placement of a non-ambulatory personnel in a hoist recovery device, overland movement, self-protection, communication, and swimming.” Literature and data exist on rotorcraft downwash flow fields for a variety of aircraft. There is also limited literature on human limb aerodynamic coefficients and human performance in downwash flow fields. However, literature has not been found on human performance in flow fields during rescue operations or while carrying injured personnel on litters. Therefore, there was no data available in which to develop human performance criteria or modeling for this particular application. This necessitated a human test program in order to formulate human performance criteria for rescue operations such as litter transport in a downwash flow field.

## BACKGROUND

Helicopters have been used by the United States Armed Forces since the Korean conflict to quickly extract and transport injured soldiers from the battlefield to areas where medical care can be provided, and to locate and recover isolated aircrew members who had to abandon their aircraft. This capability was used extensively during the Vietnam conflict and resulted in a tremendous reduction in fatalities from combat injuries. Although many “MedEvac” flights were performed with the Army’s lightweight (10,000-lb) UH-1 Huey helicopters during ground extractions, the Air Force had been



**Figure 1: HH-60 Pave Hawk**

chartered with the Combat Search and Rescue (CSAR) mission. During the Vietnam conflict, more than two thirds of the 4,120 who found themselves isolated within enemy territory were recovered with three quarters of the rescues accomplished within two hours of notification, typically by the 22,000-lb CH-3 helicopters nicknamed "Jolly Green Giants" (Kennedy 2001). In the early 1980's, the Army's Huey helicopters were replaced by the UH-60 Black Hawk for troop transport. The USAF also replaced their CH-3 helicopters with a similar aircraft, the HH-60 Pave Hawk, for Search and Rescue missions. The 22,000-lb Pave Hawk (Figure 1) is a highly modified HH-60 that includes retractable in-flight refueling probe, internal auxiliary fuel tanks, and advanced avionics. Although the helicopter has been successfully used for the CSAR mission for the past 20+ years starting with Operation Just Cause in Panama, the aging airframe and small interior volume of the aircraft make it difficult for the crew to stow all of the required rescue equipment and provide adequate on-board care for an injured person.

In 1997 the Combat Air Forces (CAF) issued Mission Need Statement (MNS) 315-97, which was validated by the Joint Requirements Oversight Council Memorandum (JROCM) 005-99 (13 Jan 99) as 'Mission Need Statement (MNS) for USAF Combat Search and Rescue (CSAR) Capability'. This MNS requested a medium-lift vertical take-off and landing aircraft to replace the existing Pave Hawk. Since all of the previous CSAR helicopters have had low-lift capabilities, this change to a medium-lift vehicle will result in a larger cabin volume to accommodate additional search and rescue equipment and to treat multiple patients. However, this higher lift capability comes with its drawbacks.

A vertical take-off and landing aircraft relies on moving a mass of air past the propeller blades in order to lift and keep the aircraft airborne. The heavier the aircraft, the higher the mass flow of air is required to lift the aircraft. This results in high speed downwash fields being generated below the aircraft. As the airflow approaches the ground, the ground redirects the vertical airflow into an accelerated horizontal flow. The flow then generally propagates in a radial pattern from the center of the aircraft, slowing as it moves outwards. The area directly under the rotors of the aircraft is relatively benign due to the radial motion of the airflow, but below the aircraft near the tips of the rotors, the air velocities become drastically violent. This violent airflow is known as the downwash field, and near heavy aircraft, can produce hurricane level winds, preventing a rescue crew from being able to perform their duties.

Various downwash velocities and qualitative ease-of-movement of personnel around for different aircraft have been reported. The downwash flow field velocity for the V-22 has been measured both on land and ship in different orientations with respect to the aircraft and for varying aircraft heights (Lake 1998, 1999). A peak velocity of ~104 mph for over land hover and ~92 mph for sea-board hover were measured at 0 deg relative to the aircraft at a distance of 38 feet from the aircraft center. Test subjects were used to qualitatively rate the difficulty of moving in the flow field. The "limit of forward movement while maintaining stability" varied with different body mass percentiles with 55 lbf for a 10%ile and 105 lbf for a 95%ile. A similar report for the CH-53E helicopter states a peak downwash velocity of 104 mph with a dominate pulse of ~1.5 Hz while at a gross weight of 70,000 lbs (Harris 1978). The downwash velocity is high, but it is consistent with a very high disc loading, the weight of aircraft divided by the area that the rotors rotate, of 36.5 lb/ft<sup>2</sup>. As a comparison the UH-60, or Black Hawk helicopter, has a gross weight of 22,000 lbs with a disk loading of 11 lb/ft<sup>2</sup>. Through talking with a Black Hawk mechanic, movement under the helicopter with the rotors turning is like walking "in a storm" and not easy.

A large volume of testing has been performed with humans subjected to air flow fields over the past 35 years. Wind tunnel tests were performed by Payne under contract by the Aerospace Medical Research Laboratory (AMRL) throughout the early 1970s to set airspeed limits for limb flailing during ejection and to check ejection seat stability. Between 1972 and 1974, Payne strapped a human volunteer into an ejection seat to measure the gross limb dislodgement forces in the hands, knees, and feet. Wind tunnel velocities ranged from 62-124 mph ( $q$  of 20-40 lb/ft<sup>2</sup>) with yaw angles of 0 to 30 degrees (Hawker 1975). Payne suspended human volunteers from the wind tunnel ceiling and measured the aerodynamic drag of the human body in different body orientations including sitting, standing, and prone. In 1978 AMRL collaborated with the Air Force Flight Dynamics Laboratory (AFFDL) to conduct wind tunnel tests in the 40 by 80 foot wind tunnel at NASA Ames (Rogers 1978). A human subject was placed in the forebody of an F-16 to determine the tolerance to flying without a canopy both in a steady and unsteady flow.

The upstream air velocity ranged from 139-202 mph ( $q$  of 50-105 lb/ft<sup>2</sup>). Additional wind tunnel tests were conducted at similar wind velocities in the 1980's at AMRL using human volunteer subjects to test ejection seat flow-stagnation concepts (Specker 1990).

In a study by Swearington and McFadden (Schane 1967), test subjects were subjected to windblast while in different orientations. The study was performed to see a human's reaction to rapid depressurization of an aircraft. Two "limits" were set: imbalance and complete disorientation beyond recovery. It was found that a wind velocity of 57.5 mph caused a temporary imbalance of the test subject that was recoverable. A wind velocity of 86 mph caused an unrecoverable imbalance. Though the testing was not specifically designed to set limits of human performance in windblast, the test data correlates well with anecdotal field data.

The results of this program will be used to establish human performance versus airflow velocity criteria for both horizontal and vertical airflows, filling a relatively large gap in biodynamics testing. The data will be used in the selection of a Personal Recovery Vehicle (PRV) or a Combat Search and Rescue (CSAR) vehicle to be used by Air Force Special Operations Command. Without the experimental data obtained from this human test program, the safety and performance of rescue personnel using this vehicle could be compromised.

## METHODS

Test Facility. All tests for the program were conducted at the 46<sup>th</sup> OGM Aerospace Vehicle Survivability Facility (AVSF) Range 3 facility located at Wright-Patterson AFB. This facility provides for the Research, Development, Testing and Evaluation (RDT&E) and transition of DoD technologies related to aircraft survivability aspects of fuel fire and explosion, projectile threats, hydrodynamic ram, inlet fuel injection, armor, structural damage and repair, and airflow effects on damage. The facility employs "bypass air" from jet engines that are capable of producing wind speeds of over 460 mph with air temperatures less than 90 degrees F at the test section. The AVSF uses a modern data acquisition system to precisely conduct test programs and record, process, analyze, refine for presentation, and archive data. The test facility also provided several fixed and panning cameras to digitally record the performance of each subject during each test.



Figure 2: Test Section

For the horizontal velocity tests, bypass air from the lower 2 engines (Lower Range 3) were used to provide the airflow (Figure 2). A raised wooden floor covered with artificial turf was constructed in the test area and marked with paint at 5 foot increments to show distances away from the exit of the air nozzle. Calibration runs were conducted by measuring temperatures and both average and time-dependent (10 second window) velocities (one dimensional) at 2.5 foot increments at 1,3, and 5 feet above the ground along the center line of the nozzle of the range at exit velocities of 60, 80, 100, and 120 KEAS (12.2, 21.7, 34.0, and 49.1 PSF). Structural padding to minimize any potential injuries to the subjects were installed within the windblast area and were inspected prior to each test day to ensure they remained secured.



**Figure 3: Upper duct**

For the vertical tests, the engine bypass air from the top 5 engines in the upper test range were ducted down through a hole in the metal grating floor of the upper test ranges into the lower test section (Figure 3). The flow was very unsteady and not purely vertical, so the data were only qualitatively analyzed.

#### Preliminary Testing:

Prior to the start of human testing, preliminary tests were

conducted the week of 17 January 2005 at the highest nozzle output wind velocity of the test program with a large, dressed manikin. Tests were performed with the manikin sitting on a chair in the airflow and laying in the airflow both with and without a helmet to measure sound pressure levels (SPLs), drag force, neck loads, air temperature, and dynamic pressure within the test section. In addition SPLs were measured where the test conductors and medical monitors were to stand during actual testing to ensure that the required hearing protection required by the range would be sufficient for long periods of time. The test facility sound pressure levels were also monitored by the Wright-Patterson Bioenvironmental Office to ensure proper hearing protection.

Test Subjects and Equipment. The test panel was comprised of both male and female human volunteers. Initial testing was conducted with volunteers recruited from the AFRL/HEPA Impact Acceleration Panel (IAP) and fitted with protective gear similar to that worn by the PJ's.

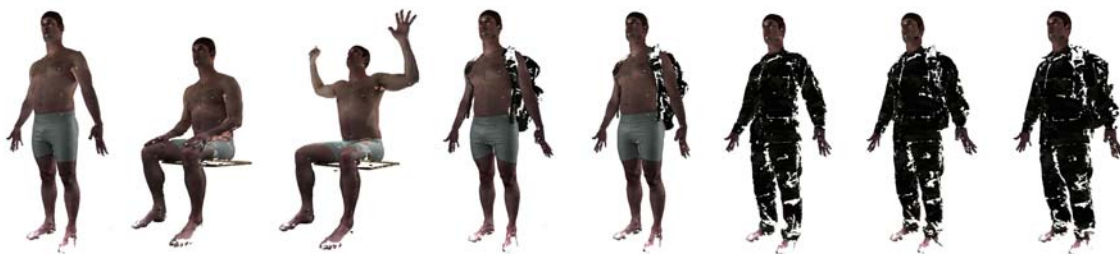


**Figure 4: Sample of 3D Whole Body Scan**

The baseline subjects wore clothing similar to that worn by PJ's during their rescue missions, which included Battle Dress Uniform (BDU's), Modular/Integrated Communications Helmet (MICH), eye safety goggles, standard military boots, gloves, and hearing protection. Height, weight, and other pertinent anthropometry measurements were taken of the subjects and maintained in the AFRL/HEPA Biodynamics Data Bank. Additional subjects included two



**Figure 5: Operational PJs with Standard Gear**

Survival Evasion Resistance Escape (SERE) instructors and one non-active PJ. These test subjects were used to validate the testing methodology and to provide baseline performance data for the horizontal airflow testing. To accurately assess the performance of rescuers, a group of volunteer Special Operations PJ's wearing their typical combat search & rescue (CSAR) equipment were also

used in a later phase of testing. The PJs were 3D whole body scanned with and without their gear (Figure 4). The majority of these later tests were performed by both active Air Force members from Moody AFB and Air Guard pararescumen volunteers (Figure 5). A total of 9 active PJs participated. The subjects were loosely tethered to rigid structures and tended by test personnel outside the main windblast area to minimize uncontrollable motion should a fall occur.

| Table 1: Test Subjects |             |                                  |                                       |                  |                  |
|------------------------|-------------|----------------------------------|---------------------------------------|------------------|------------------|
| Subject ID             | Height (in) | Weight-Minimum,<br>no Body Armor | Weight-Minimum,<br>w/Body Armor (lbs) | Weight-35lb pack | Weight-60lb pack |
| C-32                   | 65          | 190                              | 205                                   | 240              | 265              |
| D-18 (F)               | 70          | 170                              | 185                                   | 220              | 245              |
| GT                     | 69.5        | 180                              | 195                                   | 230              | 255              |
| M-47                   | 71.5        | 205                              | 220                                   | 255              | 280              |
| P-14                   | 70          | 245                              | 260                                   | 295              | 320              |
| PJ-1                   | 69          | 185                              | 200                                   | 235              | 260              |
| PJ-10                  | 74          | 217                              | 232                                   | 267              | 292              |
| PJ-2                   | 70          | 216                              | 231                                   | 266              | 291              |
| PJ-3                   | 72          | 218                              | 233                                   | 268              | 293              |
| PJ-4                   | 71          | 216                              | 231                                   | 266              | 291              |
| PJ-5                   | 70          | 227                              | 242                                   | 277              | 302              |
| PJ-6                   | 71          | 285                              | 300                                   | 335              | 360              |
| PJ-7                   | 69          | 178                              | 193                                   | 228              | 253              |
| PJ-8                   | 69          | 194                              | 209                                   | 244              | 269              |
| PJ-9                   | 71          | 219                              | 234                                   | 269              | 294              |
| R-27                   | 71.5        | 180                              | 195                                   | 230              | 255              |
| S-39 (F)               | 66          | 130                              | 145                                   | 180              | 205              |
| SI-1                   | 75          | 248                              | 263                                   | 298              | 323              |

**Procedures.** Each subject was screened prior to testing with baseline vital signs to include: blood pressure, pulse rate, and respiratory rate. Prior to their first exposure, each subject received a briefing on the test objectives, procedures, medical risk, and each subject signed an informed consent form. All subjects were briefed on emergency procedures and test protocol. The subjects were instructed to remove all extraneous personal objects such as rings and bracelets. Prior to testing all non-PJs received training in proper body positioning and bracing techniques for walking during the windblast exposures, as well as proper procedures for lifting, carrying and hoisting the Stokes litter. These techniques and procedures were based on the recommendation



**Figure 6: Subjects walking into the flow (a) and stepping outside the flow (b)**

of experienced pararescue personnel. All subjects were first tested at low windblast exposure levels to ensure implementation of these procedures and to allow the test subjects to become familiar with the flow field. The subjects were fitted with their test gear. The subjects were tethered to rigid structures and tended by test personnel outside the main windblast area. While the engines were at idle, the tethered subjects moved to the center of the far end of the raised platform and waited for the airflow velocity to be

increased to the test level, at which point a hand signal was given to the subjects to proceed into the flow (Figure 6a). The subjects proceeded into the increasing airflow until they could no longer advance forward, then they moved to the side which was outside the airflow (Figure 6b), and walked back to the far end of the facility as the engines were returned to idle speed. The experimental test matrix for the horizontal airflow tests is summarized in Table 2, followed by brief descriptions of each cell configuration. Table 3 summarizes the vertical airflow tests.

| Table 2: Horizontal Cell Description |                                        |          |            |        |               |
|--------------------------------------|----------------------------------------|----------|------------|--------|---------------|
| Cell                                 | Description                            | Backpack | Body Armor | Litter | Manikin       |
| A-1a                                 | No backpack, no body armor             | No       | No         | No     | No            |
| A-1b                                 | No backpack, body armor                | No       | Yes        | No     | No            |
| A-2a                                 | 30lb backpack, no body armor           | 30       | No         | No     | No            |
| A-3a                                 | 55lb backpack, no body armor           | 55       | No         | No     | No            |
| A-3b                                 | 55lb backpack, body armor              | 55       | Yes        | No     | No            |
| B-1a                                 | Litter, L-Case 1, no body armor        | No       | No         | Yes    | L-Case 1      |
| B-1b                                 | Litter, L-Case 1, body armor           | 55       | Yes        | Yes    | L-Case 1      |
| B-2a                                 | Litter, L-Case 1+55lb, no body armor   | No       | No         | Yes    | L-Case 1+55lb |
| B-3a                                 | Litter, Medium, no body armor          | No       | No         | Yes    | 50%           |
| B-3b                                 | Litter, Medium, body armor             | 55       | Yes        | Yes    | 50%           |
| C-a                                  | Ambulatory, no body armor              | No       | No         | No     | No            |
| C-b                                  | Ambulatory, body armor                 | No       | Yes        | No     | No            |
| D-1                                  | Forward/Back, no litter                | No       | Yes        | No     | No            |
| D-2                                  | Forward/Back, Litter                   | No       | Yes        | Yes    | No            |
| E                                    | Crouching                              | No       | Yes        | No     | No            |
| F-1                                  | Kneeling, w/o backpack                 | No       | Yes        | No     | No            |
| F-2                                  | Kneeling, with backpack                | 30       | Yes        | No     | No            |
| G                                    | Zig Zag with backpack                  | 30       | Yes        | No     | No            |
| H                                    | Horse collar                           | 30       | Yes        | No     | No            |
| I                                    | Life pack                              | 30       | Yes        | No     | No            |
| T-1a                                 | Training, no backpack, no body armor   | No       | No         | No     | No            |
| T-1b                                 | Training, no backpack, body armor      | No       | Yes        | No     | No            |
| T-2a                                 | Training, 30lb backpack, no body armor | 30       | No         | No     | No            |
| T-2b                                 | Training, 30lb backpack, body armor    | 30       | Yes        | No     | No            |

| Table 3: Vertical Cell Description |                                                |          |            |        |                |
|------------------------------------|------------------------------------------------|----------|------------|--------|----------------|
| Cell                               | Description                                    | Backpack | Body Armor | Litter | Manikin        |
| J1                                 | Hoist litter, Case 1 manikin,                  | No       | Yes        | Yes    | Case 1         |
| J2                                 | Hoist litter, Case 1 manikin, 50%ile barrelman | No       | Yes        | Yes    | Case 1, 50%ile |
| K1                                 | Hoist litter, Case 6 manikin                   | No       | Yes        | Yes    | Case 6         |
| K2                                 | Hoist litter, Case 6 manikin, 50%ile barrelman | No       | Yes        | Yes    | Case 6, 50%ile |
| L1                                 | Hoist empty litter                             | No       | Yes        | No     | No             |
| M1                                 | Rope ladder                                    | No       | No         | No     | No             |
| M2                                 | Rope ladder, backpack                          | yes      | No         | No     | No             |
| N1                                 | Fast rope                                      | No       | No         | No     | No             |
| N2                                 | Fast rope, backpack                            | yes      | No         | No     | No             |



**Figure 7: Cell A-2a**



**Figure 8: Cell B-1a**



**Figure 9: Cell C-a**



**Figure 10: Cell D-2**

Cell A-x: Subjects were first asked to walk into the flow without any additional gear. Next, subjects were asked to wear a pack that added 35 pounds of additional weight and then 60 pounds respectively of additional weight (Figure 7). The purpose of this cell was a baseline for the other tests. The addition of a back pack and weight changed the aerodynamics of the subject as well as increased the surface friction.

Cell B-x: Subjects wore flights suits and BDUs along with helmets, gloves, and goggles. Two test subjects of varying size and weights were instructed to pick up a Stokes litter and carry it as far as they felt they could go in the flow. Only the front subject was tethered. Hand signals and gestures were arranged to allow the subject at the rear of the litter know what the subject in the front was going to do. Three different sizes and weights of patient manikins were used: a 103 lb Case 1 manikin, a Case 1 manikin with an additional 55 lbs added, and a large 240lb Case 6 manikin (Figure 8). Through this cell it was seen that subjects could walk further than when alone as the subject at the rear was shielded by the airflow and generally pushed the front subject further.

Cell C-x: Cell C used an additional test subject as a “patient” limping being helped from the side by a medic to simulate an ambulatory case (Figure 9). Both subjects were tethered by a common line.

Cell D-x: PJ subjects wore body armor and survival vests along with helmets, goggles, and gloves. Subjects were asked to walk into the flow with the litter as they would operationally and then turn around and walk to the back of the test section. The litter was held vertically and to the side (Figure 10). It was noticed that the litter caught much more air than it did when held between the subjects and the subject at the rear could not push the front subject into the flow as easily, causing more instability at a lower velocity than Cells B-x.



**Figure 11: Cell F-2**

Cell E: The subjects stopped at the 5 foot increments on the ground and the airflow was ramped up. The flow was then cut, the subject approached another 5 feet, and the flow again ramped. Subjects wore body armor and backpacks. This was to simulate a helicopter approaching and to observe the subject's stability in the flow.

Cell F-x: subjects were instructed to kneel at 5 foot increments at one nozzle airspeed and then continue on to the next 5 foot increment (Figure 11). This cell was included to look at stability and mobility within the flow.



**Figure 12: Cell I**

Cell G: subjects wore a 30 lb backpack and crossed perpendicular to the flow at the 5 foot increments. With the flow being relatively narrow, the entering and exiting of the cross flow attributed to the stability of the subjects in unsteady flow. Operationally, a helicopter coming to a pick up point causes a strong airflow "wave" to hit the PJs.

Cell H: Subjects were instructed to place a horse collar around another subject while in the airflow.

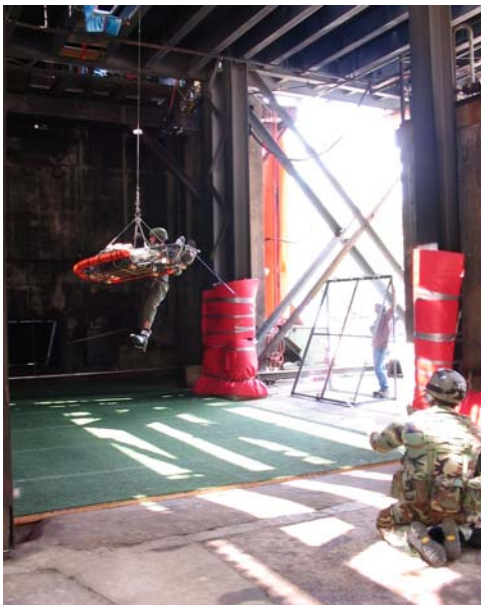


**Figure 13: Cell K2**

Cell I: The subject wore body armor, a 30 lb backpack, and carried an additional 30 lbs in handbags to simulate medical supplies (Figure 12). The addition of the handbags substantially changed the aerodynamics of the subject and was more difficult.

Cells Jx, Kx, and L1: A litter with a manikin and a barrelman was hoisted into the vertical flow. This cell was included to see how well the subject could guide the litter and barrelman into the flow (Figure 13).

Cell Mx: A standard rope ladder used in Combat Search and Rescue (CSAR) aircraft was mounted near the exit of the vertical airflow nozzle, approximately 25' above the ground. Trained and qualified PJ's wore a climbing harness and were connected to a safety rope that was run through a carabineer (secure ring) at the top of the test fixture and then down to a trained belayer

at the bottom of the test range. The subject climbed up the rope ladder into the airflow at increasing air velocities (no greater than 130 mph) to within 5' of the nozzle exit in order to



**Figure 14: Cell M2**

determine the maximum air velocity that this activity can be accomplished (Figure 14). Another subject secured the bottom of the ladder to prevent whipping and provide stability.

Cell Nx: The subject descended a fast rope that was attached through the center of the duct (Figure 15). Another subject held the rope from flopping around in the airflow. The subject was tethered and belayed by another subject. Tests with and without backpacks were run.



**Figure 15: Cell N1**

On 7 February 2005, initial human orientation tests were conducted. Testing logistics were checked and modified as necessary. Different scenarios were rehearsed and proper testing levels recorded. Humans were put into the flow and asked to perform tasks listed in the test matrix. This day of testing was also practice for the test facility to use lighting, cameras, and general procedure. Human testing continued 14-16 February with a mix of test subjects from the HEPA Impact Test Panel (ITP), two Survival, Evasion, Resistance and Escape (SERE) instructors, a non-active PJ, and military members from ASC involved with the program. A total of seven subjects, two of whom are female, participated in the testing. Of these seven, four completed all testing. The subjects were examined by medical personnel after each test to ensure they could continue testing.

During 7-9 March, additional horizontal flow tests were conducted with Air National Guard PJs. The PJs wore their operational gear which included: helmets, body armor, and survival vests. The vertical airflow tests and some additional horizontal airflow tests were conducted in April using Active Duty PJs.

Vertical tests were conducted with PJ subjects as described in Table 3. This included the subjects descending a fast rope, climbing a rope ladder up into the flow, and using a hoist to raise a litter with varying manikin occupants up into the flow.

A total of 391 horizontal flow tests were performed with both male and female subjects. Seventy-five vertical flow tests were conducted with PJs subjects descending a fast rope, guiding a litter ascending into the airflow with different occupant weights, and climbing a rope ladder into the flow with different gear configurations.

Upon completion of the testing, the videos were analyzed to determine the farthest forward motion of each subject for each test. A subjective determination of a stumbling point or first difficulty point was also determined if possible. This information was correlated against the flow mapping of the test facility and the engine parameters to estimate the air velocity at these

points. These data were tabulated and analyzed against various variables such as subject weight and subject type to determine any trends or correlations.

## RESULTS

Eighteen subjects participated in this experiment (9 PJs, 7 non-PJ males, 2 non-PJ female) generating 286 final velocities across all horizontal cells. The height and weight of the PJs ranged from 69-74 inches and 164-261 lbs respectively. The height and weight of the non-pararescumen males ranged from 65-75 inches and 175-243 lbs respectively. The females heights were 66 and 70 inches and weights were 125 and 165 lbs respectively.

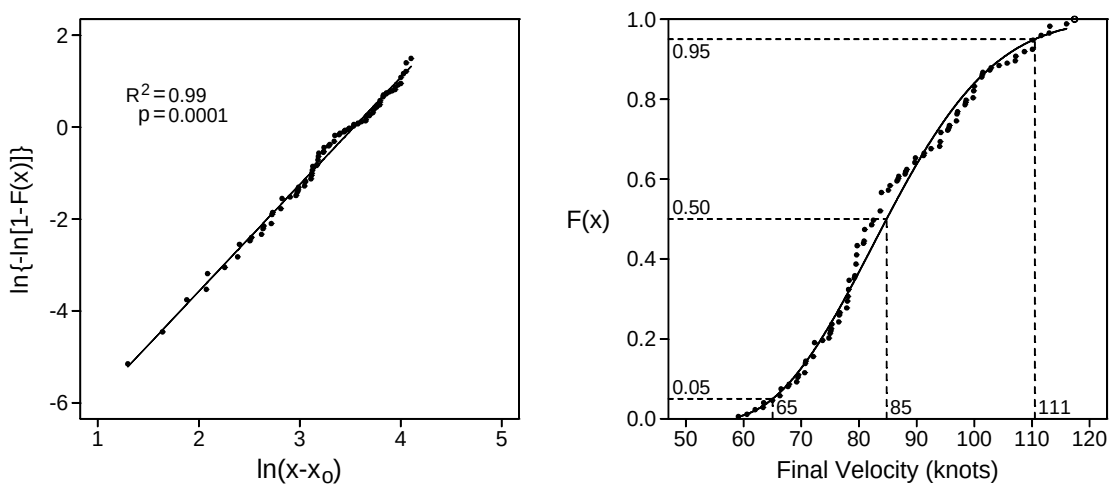


**Figure 16: Sample Cumulative Distribution – All Subjects**

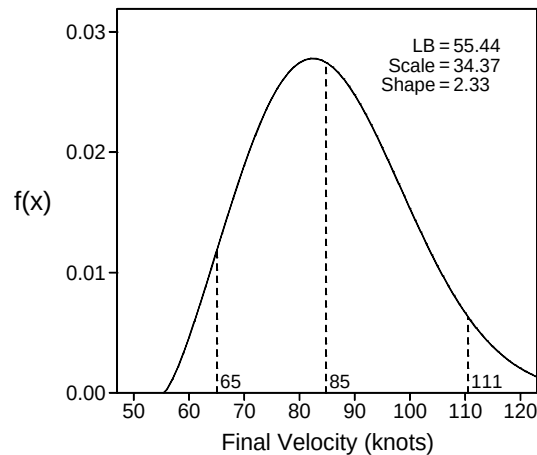


**Figure 17: Cumulative Distribution – All Subjects**

Figures 16 and 17 show the fit of final velocity sample cumulative proportions using the Weibull cumulative distribution. All PJ final velocities were used ( $n = 173$ ). Which cells and subjects the values came from were not considered. Referenced values are 5th, 50th, and 95th percentiles.

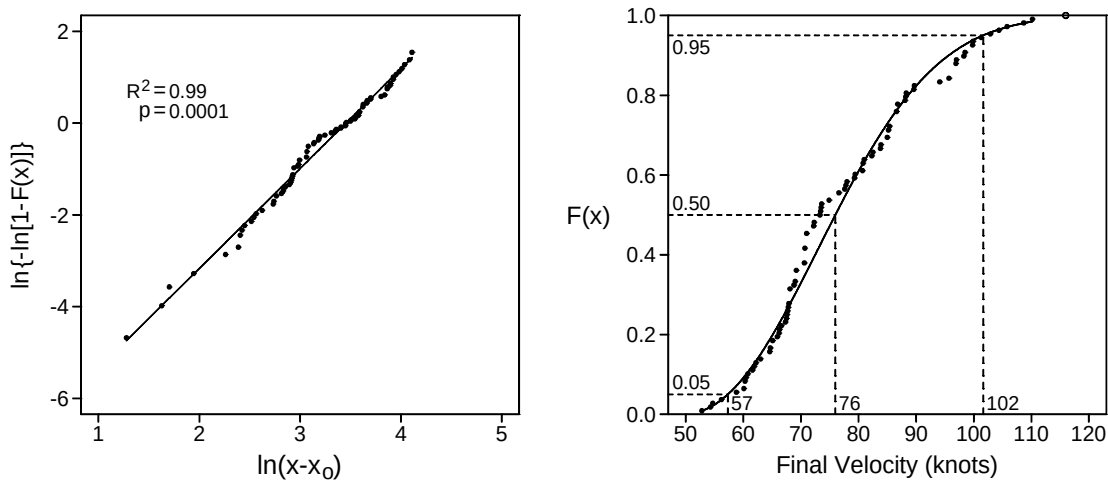


**Figure 18: Sample Cumulative Distribution - PJs**

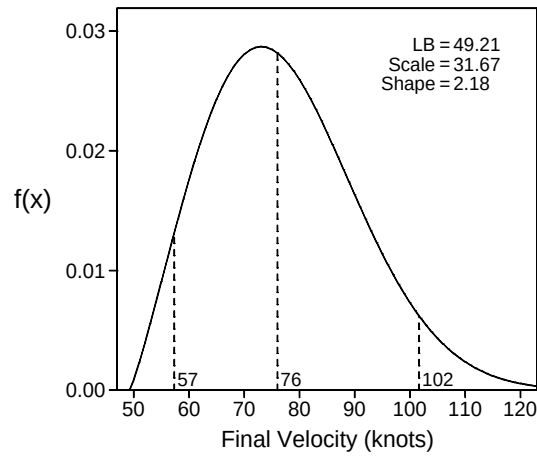


**Figure 19: Cumulative Distribution - PJs**

Figures 18 and 19 show fit of final velocity sample cumulative proportions using the Weibull cumulative distribution. All non-PJ males final velocities were used ( $n = 109$ ) except for a final velocity of 47 (cell C-a) which hurt the fit too much to be included. Which cells and subjects the values came from were not considered. Referenced values are 5th, 50th, and 95th percentiles.

## DISCUSSION

The purpose of the analyses was to: (1) determine if there is a relationship between the maximum velocities subjects can achieve and the subjects' weight, (2) generate a distribution of maximum velocities subjects can achieve for each cell, and determine which cell resulted in the limiting performance factor, (3) generate an overall distribution of maximum velocities subjects can achieve for all cells combined, (4) determine differences in maximum velocities subjects can achieve, if any, between PJs and non-PJ males.

### Test Facility Flow Field:

Prior to the start of human testing for the horizontal airflow tests, the test facility conducted flow mappings by measuring total pressures at the exit nozzle and at five foot increments away from the nozzle along the nozzle centerline at 1, 3, and 5 feet above the ground. These data were collected for four exit velocities and were used to estimate the velocity where the subjects were no longer able to proceed into the airflow based upon the exit velocity and the

maximum achieved distance from the exit nozzle. Upon analyzing the data from the first two human test series, it was determined that the five foot increments downrange from the exit nozzle was not sufficient to accurately determine the subjects' maximum obtained velocity. Therefore, the test facility conducted another flow survey in which the pressure measurements were taken in 2.5 foot increments from the nozzle.

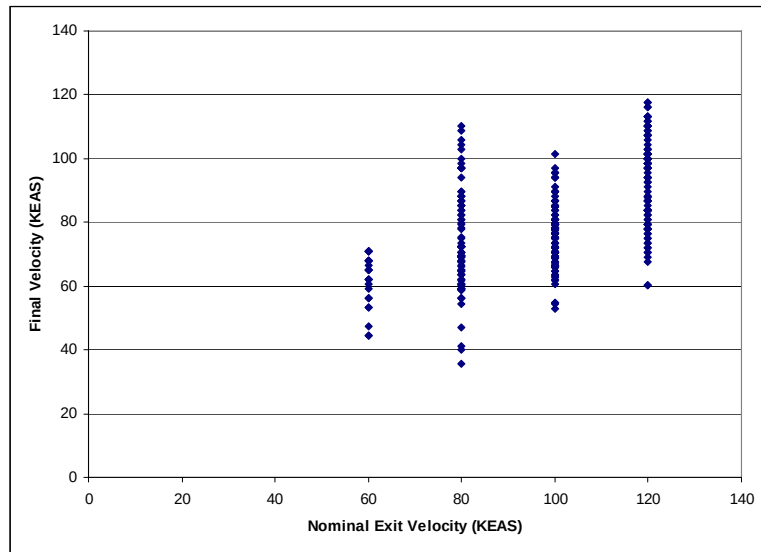


**Figure 20: Final Velocity vs Nominal Exit Velocity**

When the results from the second flow mapping were compared to the first, there were large discrepancies. This led to a third flow mapping attempt using pitot-static pressure tubes rather than total pressure tubes as was used earlier. When data from this third flow mapping were used to estimate the subjects' maximum obtainable velocities, there were significant differences for each of the exit velocities. This indicated that the correlations between the exit velocity and the velocities downrange that were determined during the flow mapping were inconsistent, and that some parameter or parameters other than exit velocity alone had an effect on the downrange velocities. When the flow mapping data were correlated against the test runs, discrepancies existed which led to further examination that determined the test reference pressures (used to determine downrange velocities) did not uniquely identify downrange velocities. This could be seen when the final velocity achieved by the subjects were plotted against the nominal exit velocity (Figure 20) as the velocity achieved also increased as the exit velocity increased, which is counter-intuitive if the flow gradients are close to the same for different nominal exit velocities.

In order to better understand the test facility flow field, detailed analysis of the flow mapping data against Computational Fluid Dynamics (CFD) was used to model the flow from the two aircraft engines, through the air duct, and out into the test section (Figures 21 and 22). The CFD analysis indicated that the engine RPM had a major effect on downrange velocities. The CFD simulations conducted by ASC/ENFT resulted in a set of air velocity data as a function of engine RPM, ambient temperature, and ambient pressure. Since the CFD simulations only bounded the parameters of the actual testing, a linear regression was formed from the CFD data. The velocity at different positions in the flow was found using only the Total %N1 (the sum of the rotor speeds from each engine as a percentage of maximum rated speed) and position in the flow as independent variables.

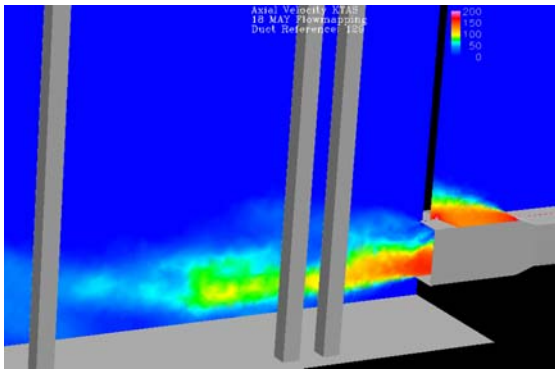


Figure 21: CFD Flow Field of Test Section

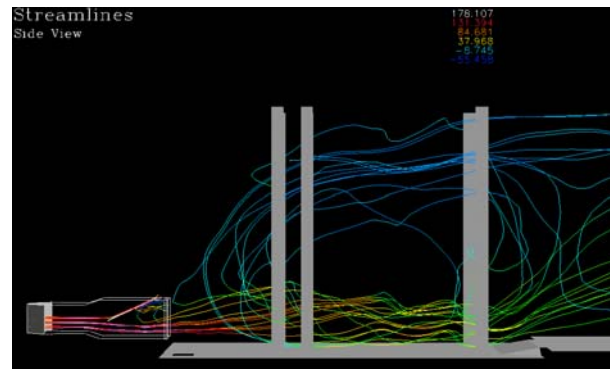
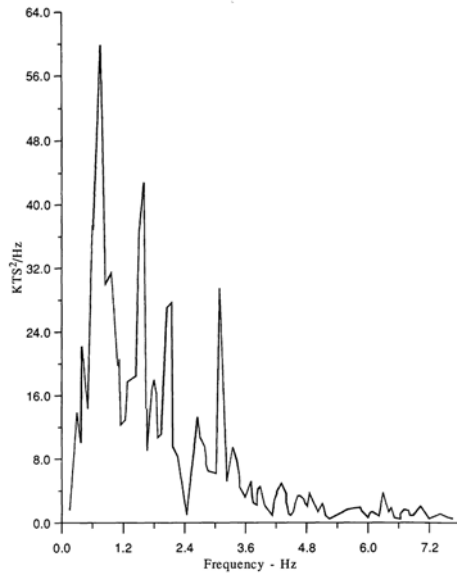


Figure 22: CFD Streamlines of Test Section

$$\text{Velocity (in KEAS)} = -1.29 + 1.45(\%N1) - 2.94 * (\text{Position in feet})$$

This relationship has an R-squared value of 0.97. Ambient temperature and pressure were found not to be important variables in fitting the CFD data.

Airflow Differences Between Test Facility and Rotorcraft: There were some considerable differences in the flow within the test facility and flow experienced from rotorcraft downwash. Test Reports of measurements of downwash from various rotorcraft indicate that there are relatively large oscillations in the airflow. The variations can be up to 45 knots peak-to-peak for a helicopter such as the CH-53E with frequencies of these oscillations typically in the 1-4 Hertz range (Figure 23) (Ferguson 1994). The airflow in the test facility was predominately steady state with only high frequency oscillations that generally did not have a noticeable effect on the subjects. The PJ test subjects felt that the steady state nature of the test facility made it much easier to maintain balance and proceed forward into the increasing air velocity than in the oscillatory downwash conditions encountered during their missions with rotorcraft.



Source: Reference 24.

FIGURE 9 POWER SPECTRAL DENSITY OF THE CH-53E TIME SERIES PRESENTED IN FIGURE 8

**Figure 23: CH-53E Airflow Velocity Frequency Oscillations**

The flow mapping and CFD analysis of the three-dimensional flow indicate large variations in velocities from the subjects' feet to head, with a peak velocity occurring at approximately 2 feet above the ground. Reports containing horizontal airflow data collected during tests of various rotorcraft and CFD analysis of PRV candidates indicate that airflow is generally the greatest just above the surface of the ground and decays as it moves farther above the ground. These differences in velocity profiles result in different locations of the center of pressure and the total equivalent velocities on the subjects in the test scenario versus them being in the airflow of actual rotorcraft.

PJ-1 was included in the active airmen test pool as he was no longer an active pararescumen in the field. In looking at the data, PJ-1 final velocities were consistently closer to that of the non-Pararescuemen airmen and he was removed from cells D-1, D-2, E, G, and I. Analyzing his

data with regular Airmen was felt to give a better picture of what velocities the active pararescumen can truly withstand and still perform their tasks.

The two females were not used in any analysis as the sample size was too small and there are currently no female PJs. For all analyses, replications from the same subject were considered independent as if they came from a different subject.

There was only one cell (A-1a, no backpack or body armor) where PJs and non-PJs both performed. To compare the performance of PJs vs. non-PJs, an analysis of covariance was performed for cell A-1a. Final velocity was the dependent variable. The factor was group (PJ, non-PJ) with covariates body weight and total %N1. An unequal slopes model did not find any significant interactions ( $p > 0.4476$ ), therefore, an equal slopes model was used. The F-test found a significant difference between the groups  $\{F(1,35) = 23.76, p = 0.0001\}$ . Least squares means were determined for each group. The means are estimated means for each group at the average value of the covariates and were: 78.8 knots for PJs, 67.1 knots for non-PJs. The slope for body weight was significantly different from 0 ( $p = 0.0117$ ) with an increase of 1 lb in body weight corresponding with a 0.13 increase in final velocity. The slope for total %N1 was not significantly different from 0 ( $p = 0.7986$ ).

Analyses determined that the height of the subject had no meaningful influence on final velocity, however, the subject's weight did in at least some cells.

**Table 4: Cell Correlations to Engine Strength and Body Weight**

| Cell | Cell Description                     | Subjects | Total %N1 |        | Body Weight (lb) |        |
|------|--------------------------------------|----------|-----------|--------|------------------|--------|
|      |                                      |          | Slope     | p      | Slope            | p      |
| A-1b | No backpack, body armor              | PJ       | 1.22      | 0.0001 | 0.16             | 0.0008 |
| A-2a | 30lb backpack, no body armor         | non-PJ   | 0.02      | 0.8616 | 0.13             | 0.0809 |
| A-2b | 30lb backpack, body armor            | PJ       | 0.89      | 0.0002 | 0.17             | 0.0100 |
| A-3a | 55lb backpack, no body armor         | non-PJ   | 0.34      | 0.0139 | 0.21             | 0.0028 |
| A-3b | 55lb backpack, body armor            | PJ       | 0.75      | 0.0110 | -0.02            | 0.7258 |
| B-1a | Litter, L-Case 1, no body armor      | non-PJ   | 2.26      | 0.0183 | 0.31             | 0.0016 |
| B-1b | Litter, L-Case 1, body armor         | PJ       | 1.64      | 0.0023 | 0.14             | 0.0197 |
| B-2a | Litter, L-Case 1+55lb, no body armor | non-PJ   | 0.07      | 0.9355 | 0.19             | 0.0829 |
| B-3b | Litter, Medium, body armor           | PJ       | 1.30      | 0.0059 | 0.05             | 0.3229 |
| C-a  | Ambulatory, no body armor            | non-PJ   | 0.71      | 0.4473 | 0.33             | 0.0144 |
| C-b  | Ambulatory, body armor               | PJ       | 1.42      | 0.0017 | 0.14             | 0.0645 |
| D-1  | Forward/Back, no litter              | PJ       | 1.17      | 0.0041 | 0.12             | 0.1832 |
| D-2  | Forward/Back, litter                 | PJ       | 1.53      | 0.2294 | 0.08             | 0.7011 |
| E    | Crouching                            | PJ       | 0.76      | 0.1945 | 0.08             | 0.6244 |
| G    | Zig Zag with backpack                | PJ       | 1.67      | 0.0047 | -0.08            | 0.3193 |
| I    | Life pack                            | PJ       | 0.43      | 0.0361 | 0.21             | 0.0022 |

Table 4 shows the results from linear regression with final velocity as the dependent variable. Independent variables were Total %N1 and body weight. For cells D-1, D-2, E, G, and I, the one non-PJ was removed from analysis.

**Table 5: Cell Data Distribution**

| Cell | Cell Description                     | Subjects | Percentiles (knots) |     |     |     |     |
|------|--------------------------------------|----------|---------------------|-----|-----|-----|-----|
|      |                                      |          | min                 | 25  | 50  | 75  | max |
| A-1a | No backpack, no body armor           | non-PJ   | 53                  | 61  | 68  | 71  | 85  |
|      |                                      | PJ       | 66                  | 78  | 80  | 81  | 94  |
| A-1b | No backpack, body armor              | PJ       | 59                  | 68  | 71  | 79  | 87  |
| A-2a | 30lb backpack, no body armor         | non-PJ   | 62                  | 65  | 68  | 73  | 82  |
| A-2b | 30lb backpack, body armor            | PJ       | 64                  | 76  | 82  | 89  | 100 |
| A-3a | 55lb backpack, no body armor         | non-PJ   | 61                  | 71  | 78  | 87  | 101 |
| A-3b | 55lb backpack, body armor            | PJ       | 69                  | 72  | 78  | 81  | 99  |
| B-1a | Litter, L-Case 1, no body armor      | non-PJ   | 82                  | 87  | 97  | 100 | 109 |
| B-1b | Litter, L-Case 1, body armor         | PJ       | 97                  | 100 | 101 | 112 | 116 |
| B-2a | Litter, L-Case 1+55lb, no body armor | non-PJ   | 85                  | 93  | 97  | 101 | 110 |
| B-3b | Litter, Medium, body armor           | PJ       | 97                  | 101 | 107 | 110 | 117 |
| C-a  | Ambulatory, no body armor            | non-PJ   | 47                  | 65  | 77  | 87  | 104 |
| C-b  | Ambulatory, body armor               | PJ       | 68                  | 79  | 88  | 94  | 101 |
| D-1  | Forward/Back, no litter              | PJ       | 71                  | 80  | 82  | 97  | 100 |
| D-2  | Forward/Back, litter                 | PJ       | 62                  | 65  | 76  | 84  | 90  |
| E    | Crouching                            | PJ       | 78                  | 84  | 92  | 103 | 112 |
| G    | Zig Zag with backpack                | PJ       | 90                  | 94  | 104 | 113 | 117 |
| I    | Life pack                            | PJ       | 64                  | 74  | 77  | 84  | 98  |

Table 5 gives the minimum, maximum, and percentiles in knots for each test cell based on the available test data. Overall estimated distributions for non-PJ males and PJs are not comparable for multiple reasons but most importantly since they are not balanced in how many values come from particular cells. The only valid comparison of non-PJ males vs. PJs is from Cell A-1a. In addition, since there was no control about which subjects performed in which cells, and how

many times, both of the estimated distributions should be considered rough estimates and one should be cautious in using these estimated distributions to make conclusions.

**Qualitative Horizontal Airflow Tests:** A few test cells could not be analyzed with the other cells as they were significantly different enough and did not give a true measure of final velocity. These cells were still useful in looking at general human reaction to being in a high-speed airflow and can be analyzed qualitatively and general observations can be made.

Kneeling (Cells F-1, F-2): Subjects were instructed to stop at each 5 foot mark away from the nozzle exit. While at each mark, the airflow velocity was increased to 120 knots. These cells were included to look at relative stability of the subjects in a ramping flow, something a PJ would encounter for a helicopter coming in to a landing area for pickup of aircrew and patients. The initial “whoosh” from a helicopter would be considerably quicker and stronger than that of what was tested but it still gave a good idea of general stability and relative strain on the subjects. Subjects were able to stay their position, though it would have been extremely difficult to change positions if required.

Horse collar (Cell H): Subjects were instructed to place a horse collar around another subject while in the airflow. It was shown that it was difficult to don a horse collar on a subject in an intense airflow (80 knots at the 10 ft line). If the horse collar had not been restrained, it could have very easily been lost and blown downstream, making it inaccessible to the PJ in real conditions.

**Vertical Airflow Testing:** Given that the flow for the vertical portion of the downwash testing was very turbulent and not purely vertical, there was no reliable data that could be quantitatively analyzed. Still, qualitative observations can be made.

Hoist litter (Cells J, K, and L): A PJ was instructed to guide a litter into the vertical flow. The litter was shown to be more stable as the occupant became heavier. With no manikin or the Case 1 small manikin, the litter was more prone to swing violently, making it more difficult for the PJ to control.

Rope ladder (Cell F): PJs were asked to climb a rope ladder up into the vertical flow. A PJ held the bottom of the rope ladder to keep it from swinging violently. Still, subjects on the ladder found it very difficult to climb the ladder.

Fast rope (Cell N): Subjects did not have difficulty descending the fast rope while in the flow.

## SUMMARY

Testing to simulate helicopter downwash was performed to set velocity limits. Based upon the above test data, AFRL/HEPA recommends instituting an air velocity limit of 65 knots to enable PJs to approach a hovering rotorcraft. This velocity limit results in all of the PJs who participated in the study being able to approach a hovering rotorcraft while wearing their standard gear, and 95% of the PJs in the study being able to approach the hovering rotorcraft while carrying additional gear in their hands.

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## APPENDIX A: SUBJECTIVE RESPONSE QUESTIONNAIRE

### Downwash Program

| Study    | Test No. | Subj ID | Test Cell | Position | Test Velocity | Test Date |
|----------|----------|---------|-----------|----------|---------------|-----------|
| Downwash |          |         |           |          |               |           |

#### IMPRESSION OF WINDBLAST

Mild 1 2 3 4 5 Severe

#### VARIATIONS IN WIND SPEED

None 1 2 3 4 5 Very noticeable

#### PHYSICAL DISCOMFORT/PAIN

Comfortable 1 2 3 4 5 Uncomfortable

#### MOVING IN WIND

Easy 1 2 3 4 5 Difficult

#### MAINTAINING BALANCE

Easy 1 2 3 4 5 Difficult

#### HOISTING STOKES LITTER

Easy 1 2 3 4 5 Difficult N/A

#### HELMET/HEARING PROTECTION

Comfortable 1 2 3 4 5 Uncomfortable

#### BODY EQUIPMENT

Comfortable 1 2 3 4 5 Uncomfortable

LOCATION AND TYPE (DULL, SHARP, ETC.) OF ANY DISCOMFORT OR PAIN  
EXPERIENCED: \_\_\_\_\_

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SPECIFIC DIFFICULTIES ENCOUNTERED: \_\_\_\_\_

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OTHER COMMENTS: \_\_\_\_\_

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LIST AIRCRAFT THAT YOU HAVE EXPERIENCE OPERATING IN THE DOWNWASH FIELD (IF  
APPLICABLE): \_\_\_\_\_

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HOW DOES THIS TEST COMPARE WITH EXPOSURE TO ACTUAL ROTORCRAFT  
DOWNWASH (SPEED, OSCILLATIONS, ETC)? \_\_\_\_\_

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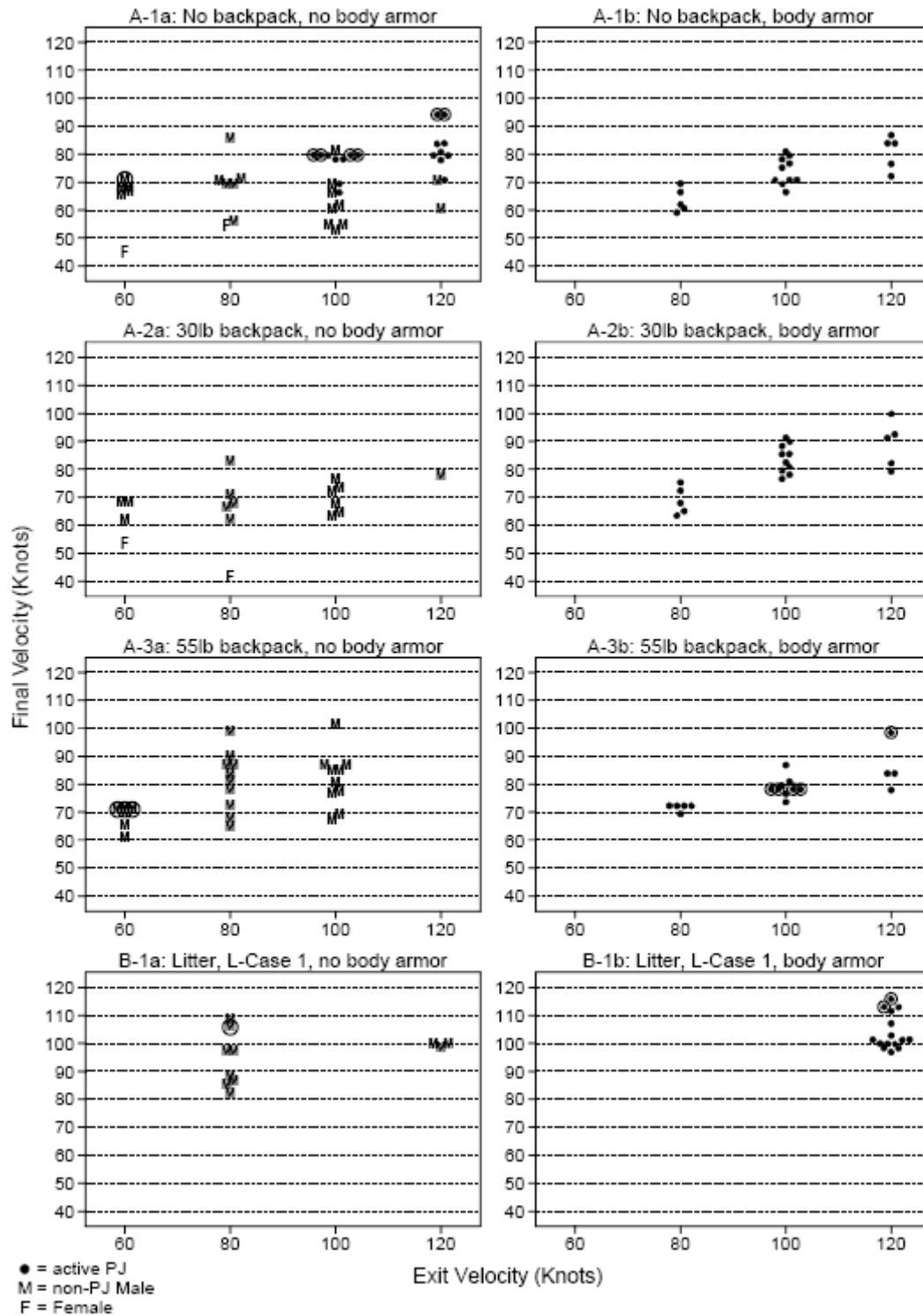
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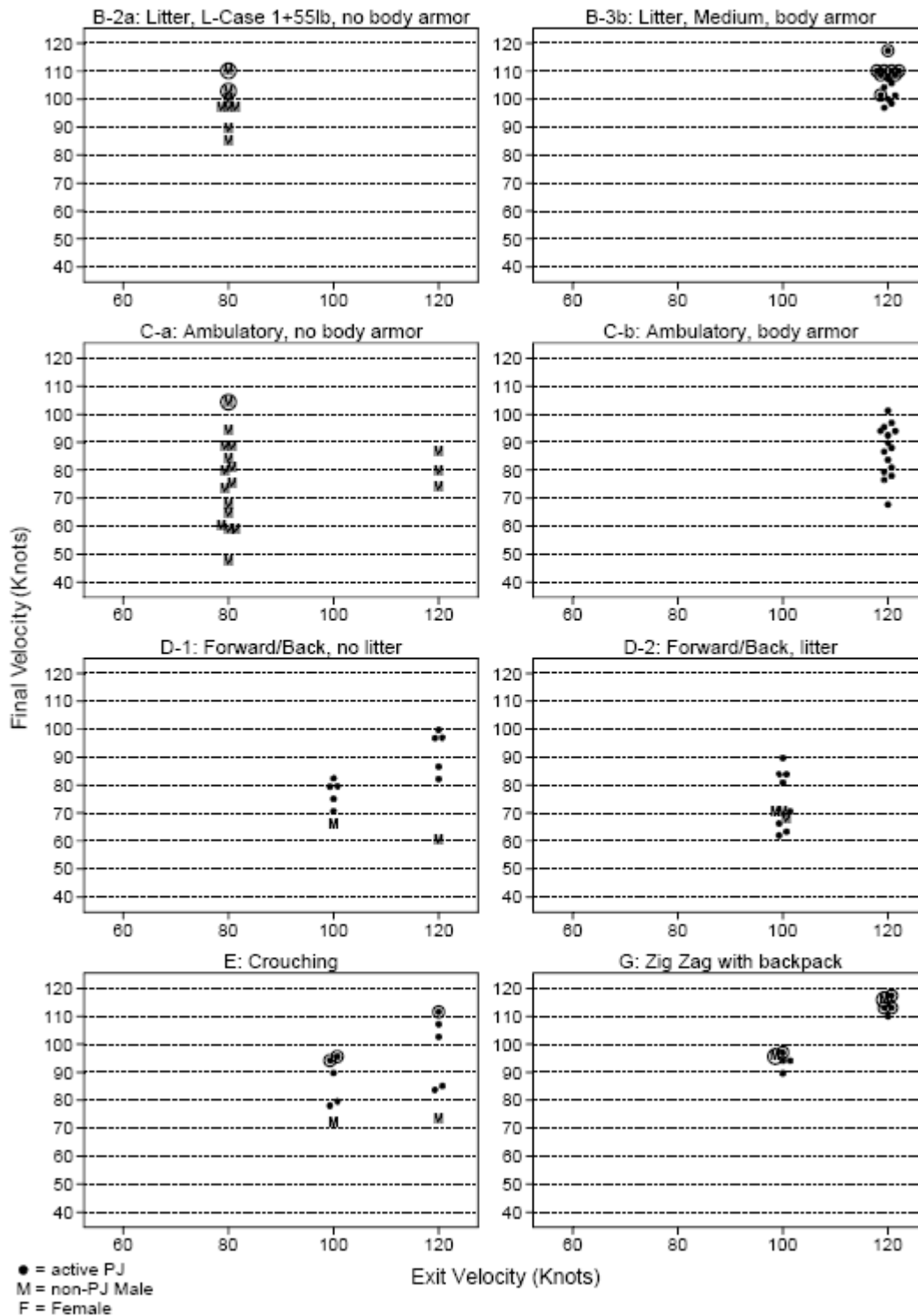
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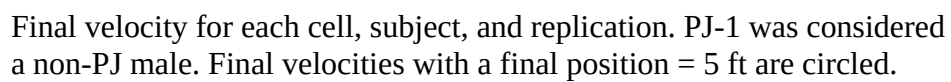
## APPENDIX B: DATA PLOTS

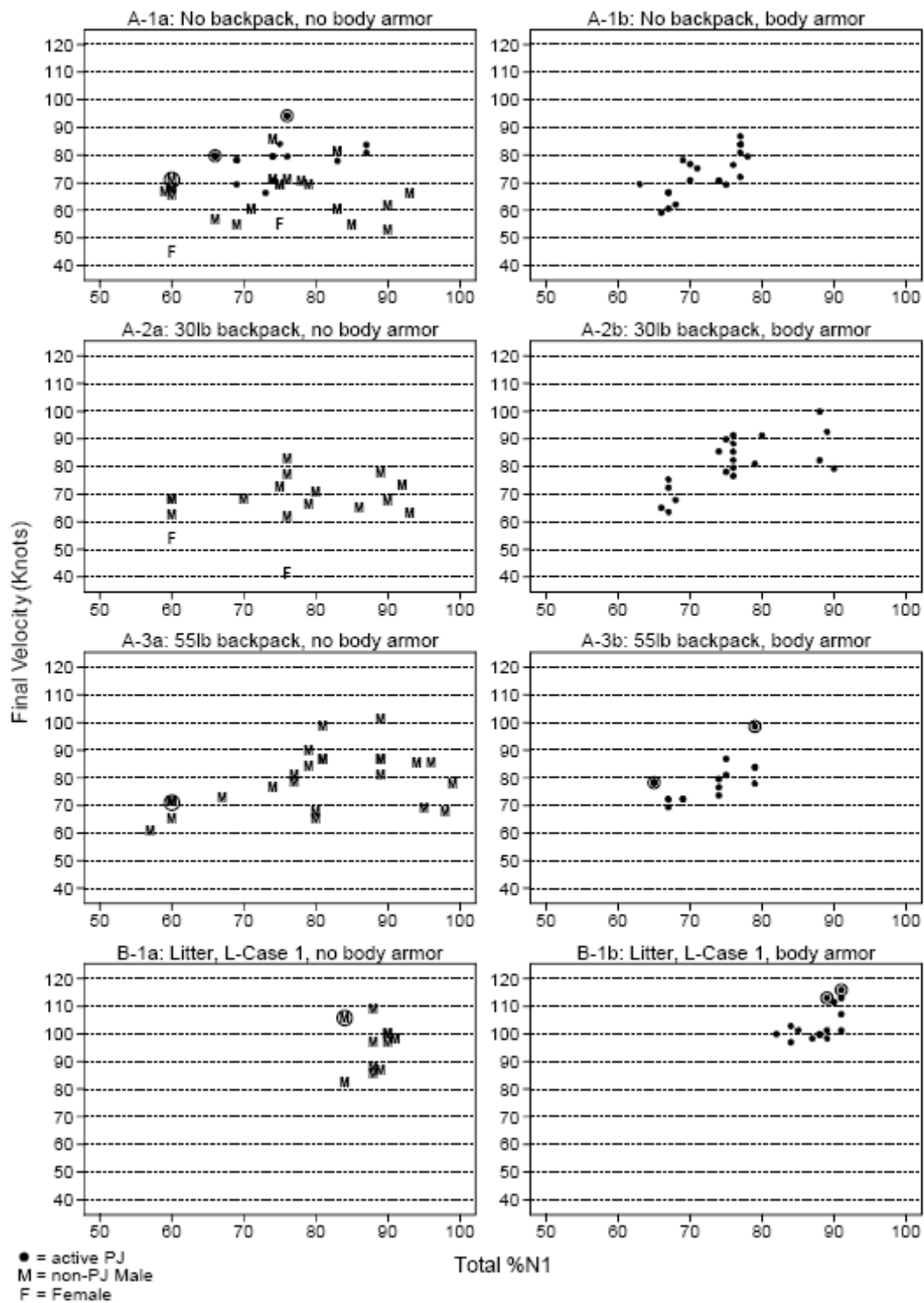


Final velocity for each cell, subject, and replication. PJ-1 was considered a non-PJ male. Final velocities with a final position = 5 ft are circled.

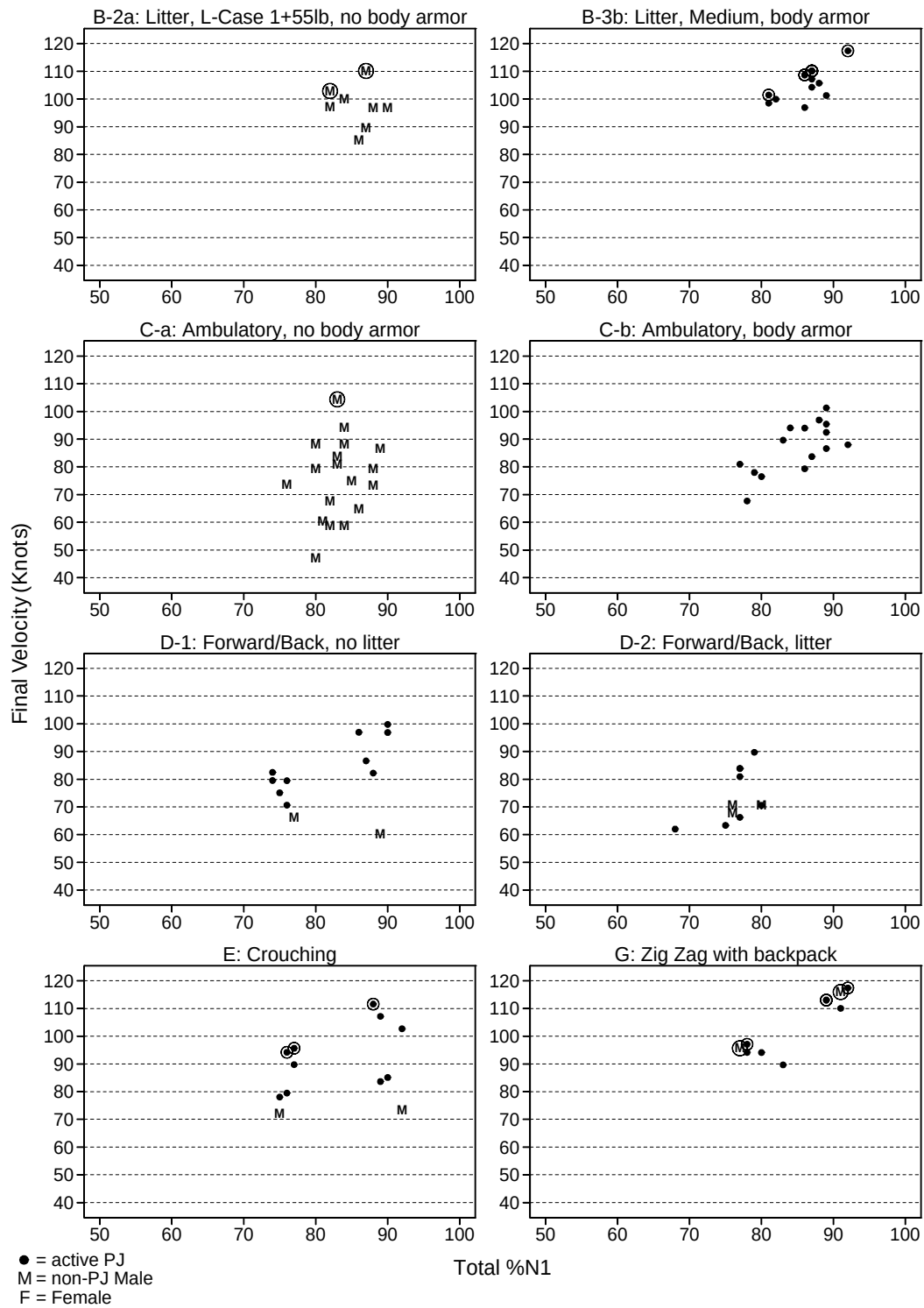


Final velocity for each cell, subject, and replication. PJ-1 was considered a non-PJ male. Final velocities with a final position = 5 ft are circled.

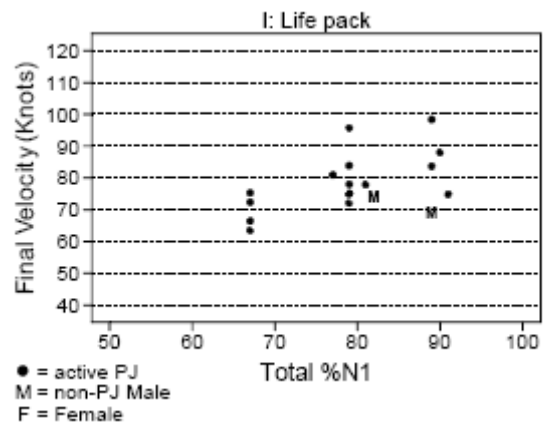




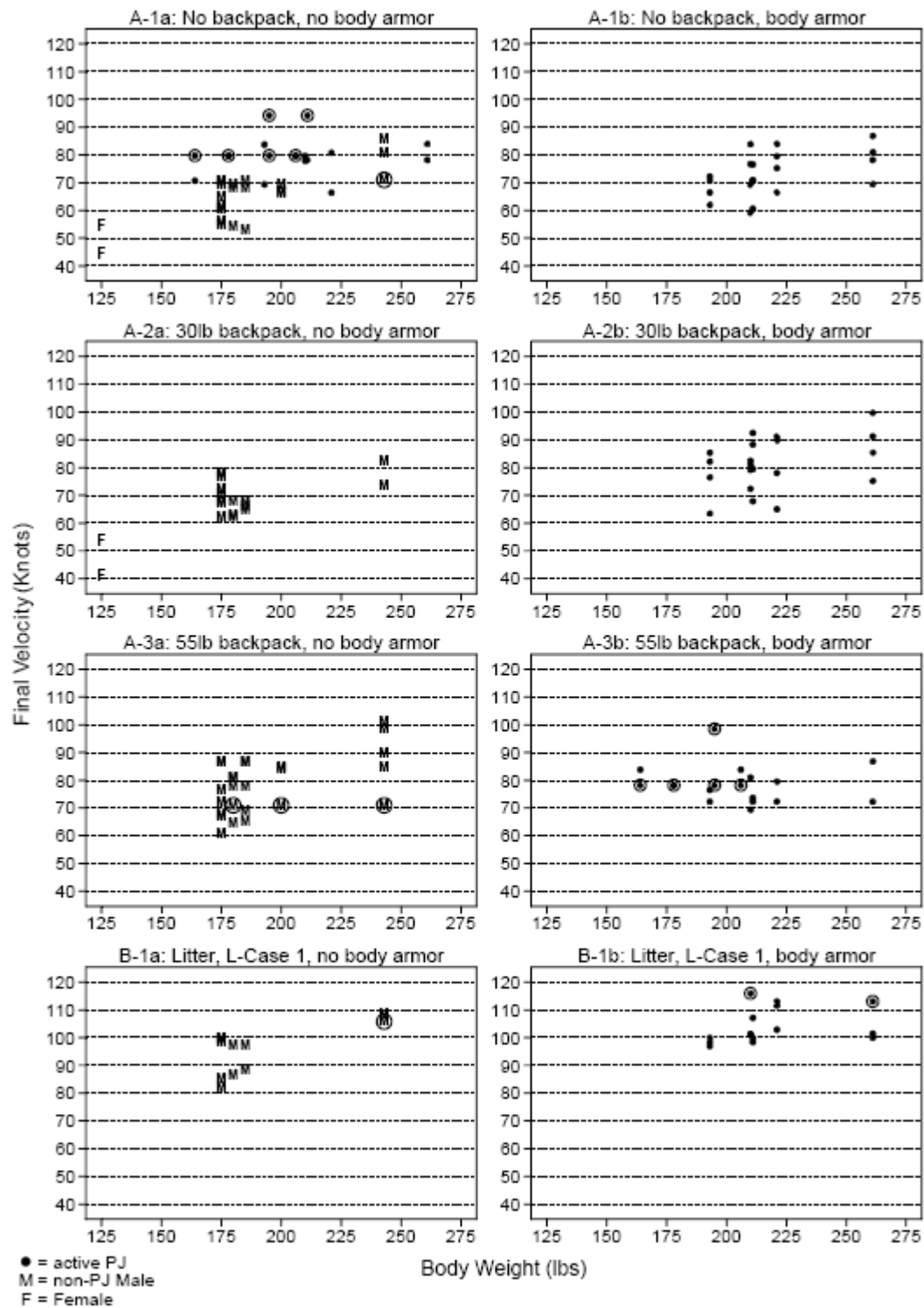
Final velocity for each cell, subject, and replication. PJ-1 was considered a non-PJ male. Final velocities with a final position = 5 ft are circled.



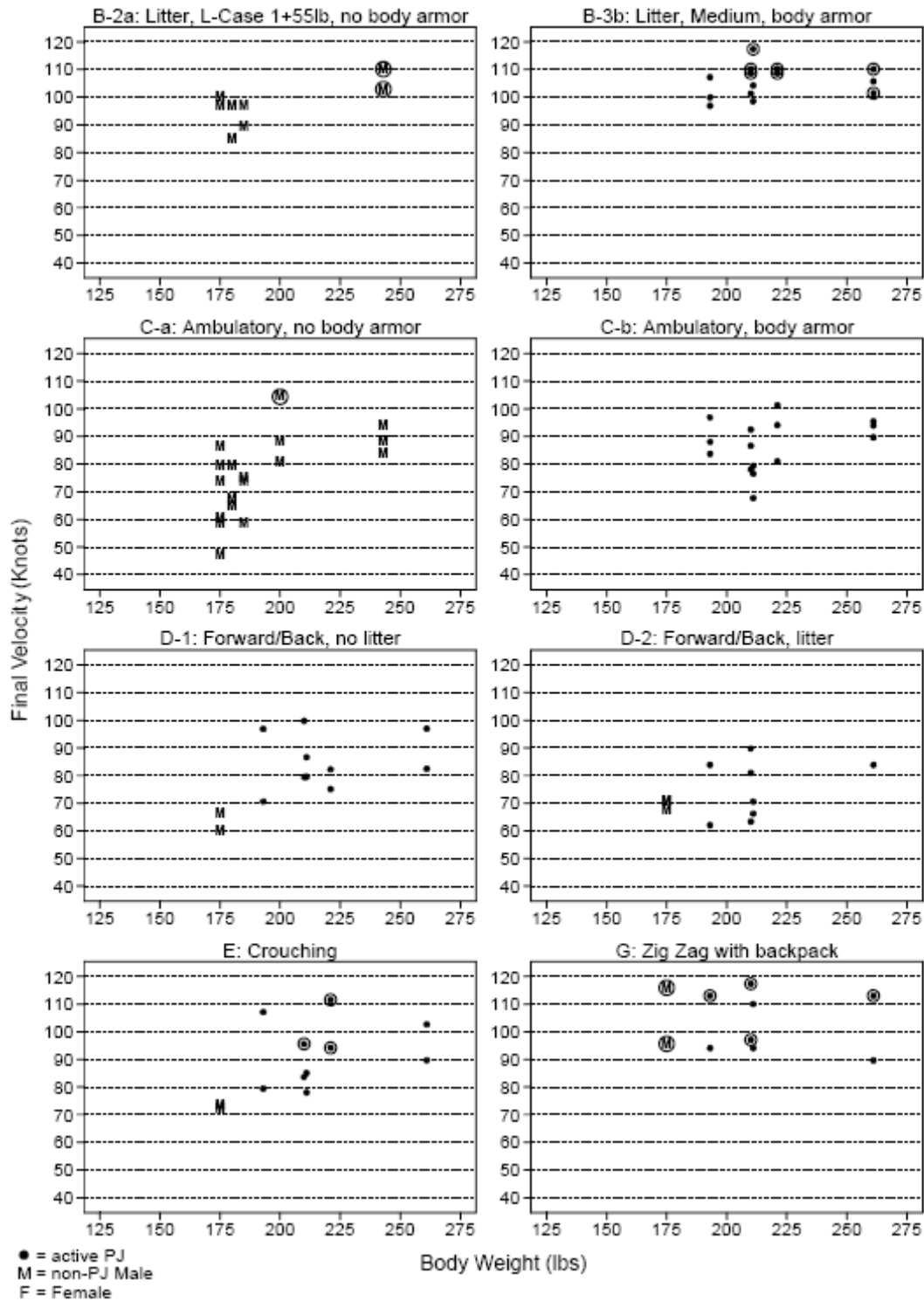
Final velocity for each cell, subject, and replication. PJ-1 was considered a non-PJ male. Final velocities with a final position = 5 ft are circled.



Final velocity for each cell, subject, and replication. PJ-1 was considered a non-PJ male. Final velocities with a final position = 5 ft are circled.



Final velocity for each cell, subject, and replication. PJ-1 was considered a non-PJ male. Final velocities with a final position = 5 ft are circled.



Final velocity for each cell, subject, and replication. PJ-1 was considered a non-PJ male. Final velocities with a final position = 5 ft are circled.



Final velocity for each cell, subject, and replication. PJ-1 was considered a non-PJ male. Final velocities with a final position = 5 ft are circled.

| Test Number | Cell | Nominal Exit Velocity | Total Engine %N1 | Subject1 | Subject Type | Back pack Wt (lb) | Test Wt (lbs) | Body Armor | Subject2 | Subject Type2 | Back pack Wt2 (lb) | Patient | Surface Conditions | Date      | Time | Temp (deg F) | Relative Humidity (%) | Baro Press (InHg) | Final Position (ft) | Final Velocity 3ft above ground |
|-------------|------|-----------------------|------------------|----------|--------------|-------------------|---------------|------------|----------|---------------|--------------------|---------|--------------------|-----------|------|--------------|-----------------------|-------------------|---------------------|---------------------------------|
| 1           | T-1a | 80                    | 60               | PJ-1     | Human-M      | None              | 185           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 931  | 57.1         | 66.2                  | 28.78             | 11                  | 69.32                           |
| 2           | T-1a | 80                    | 71               | PJ-1     | Human-M      | None              | 185           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 929  | 55.3         | 67.5                  | 28.78             | 11                  | 69.32                           |
| 3           | T-1a | 100                   | 83               | PJ-1     | Human-M      | None              | 185           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 934  | 53.6         | 74.8                  | 28.77             | 18                  | 66.14                           |
| 4           | T-1a | 80                    | 60               | SI-1     | Human-M      | None              | 248           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 938  | 54.6         | 72.2                  | 28.77             | 8                   | 62.19                           |
| 5           | T-1a | 80                    | 72               | SI-1     | Human-M      | None              | 248           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 940  | 53.6         | 73.3                  | 28.77             | 13                  | 64.89                           |
| 6           | T-1a | 100                   | 84               | SI-1     | Human-M      | None              | 248           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 941  | 53.3         | 73.8                  | 28.77             | 14                  | 79.35                           |
| 7           | T-1a | 120                   | 100              | SI-1     | Human-M      | None              | 248           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 944  | 52.7         | 74.2                  | 28.78             | 19                  | 87.85                           |
| 8           | T-1b | 80                    | 60               | S-39     | Human-F      | None              | 130           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 951  | 53.5         | 74.8                  | 28.77             | 10                  | 56.31                           |
| 9           | T-1a | 80                    | 70               | S-39     | Human-F      | None              | 130           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 957  | 53.5         | 74.9                  | 28.77             | 22                  | 35.53                           |
| 10          | T-1a | 80                    | 60               | P-14     | Human-M      | None              | 245           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1025 | 55           | 76.9                  | 28.77             | 7                   | 65.13                           |
| 11          | T-1a | 80                    | 73               | P-14     | Human-M      | None              | 245           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1027 | 54.3         | 76.3                  | 28.78             | 9                   | 78.1                            |
| 12          | T-1a | 100                   | 85               | P-14     | Human-M      | None              | 245           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1029 | 53.3         | 76.6                  | 28.78             | 12                  | 86.68                           |
| 13          | T-1a | 80                    | 70               | P-14     | Human-M      | 35                | 280           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1033 | 54.6         | 76.8                  | 28.78             | 7                   | 79.63                           |
| 14          | T-1a | 100                   | 85               | PJ-5     | Human-M      | 35                | 262           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1036 | 53.53        | 77.3                  | 28.78             | 15                  | 77.86                           |
| 15          | T-1b | 80                    | 72               | PJ-1     | Human-M      | None              | 200           | Yes        | None     | None          | None               | None    | Wet                | 2/14/2005 | 1041 | 55.3         | 77                    | 28.78             | 16                  | 56.07                           |
| 16          | T-2b | 80                    | 70               | PJ-1     | Human-M      | 35                | 235           | Yes        | None     | None          | None               | None    | Wet                | 2/14/2005 | 1044 | 54.6         | 77.5                  | 28.78             | 15                  | 56.11                           |
| 17          | A-1a | 80                    | 75               | PJ-1     | Human-M      | None              | 185           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1317 | 54           | 66.5                  | 28.78             | 13                  | 69.24                           |
| 18          | A-1a | 100                   | 90               | R-27     | Human-M      | None              | 180           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1323 | 52           | 73                    | 28.8              | 23                  | 61.59                           |
| 19          | A-1a | 80                    | 74               | SI-1     | Human-M      | None              | 248           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1327 | 52.8         | 73.5                  | 28.8              | 7                   | 85.43                           |
| 20          | A-1a | 60                    | 60               | S-39     | Human-F      | None              | 130           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1331 | 51.2         | 74.3                  | 28.8              | 14                  | 44.55                           |
| 21          | A-1a | 80                    | 74               | R-27     | Human-M      | None              | 180           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1335 | 51.1         | 74                    | 28.8              | 12                  | 70.73                           |
| 22          | A-1a | 100                   | 83               | SI-1     | Human-M      | None              | 248           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1336 | 51.1         | 75                    | 28.8              | 13                  | 80.84                           |
| 23          | A-1a | 60                    | 60               | PJ-1     | Human-M      | None              | 185           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1341 | 51.5         | 73.1                  | 28.8              | 6                   | 68.07                           |
| 24          | A-1a | 60                    | 60               | R-27     | Human-M      | None              | 180           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1343 | 51.5         | 72.8                  | 28.79             | 7                   | 65.13                           |
| 25          | A-1a | 80                    | 75               | S-39     | Human-F      | None              | 248           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1345 | 51.5         | 72.8                  | 28.8              | 5                   | 71.01                           |
| 26          | A-1a | 80                    | 75               | SI-1     | Human-M      | None              | 130           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1348 | 51.4         | 72                    | 28.8              | 18                  | 54.54                           |
| 27          | A-1a | 100                   | 85               | PJ-1     | Human-M      | None              | 185           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1357 | 51.4         | 72                    | 28.8              | 23                  | 54.34                           |
| 28          | A-1a | 80                    | 76               | C-32     | Human-M      | None              | 190           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1402 | 51.5         | 72.6                  | 28.8              | 13                  | 70.69                           |
| 29          | A-1a | 60                    | 60               | C-32     | Human-M      | None              | 190           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1405 | 51.9         | 75.2                  | 28.8              | 6                   | 68.07                           |
| 30          | A-2a | 100                   | 80               | C-32     | Human-M      | None              | 190           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1406 | 51.4         | 79.2                  | 28.8              | 26                  | 52.77                           |
| 31          | A-2a | 100                   | 93               | PJ-1     | Human-M      | 35                | 220           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1425 | 51.5         | 74.6                  | 28.81             | 24                  | 63                              |
| 32          | A-2a | 100                   | 90               | R-27     | Human-M      | 35                | 215           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1431 | 50.3         | 78.2                  | 28.81             | 21                  | 67.47                           |
| 33          | A-2a | 80                    | 76               | SI-1     | Human-M      | 35                | 283           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1437 | 49.7         | 82                    | 28.81             | 9                   | 82.45                           |
| 33          | A-2a | 80                    | 60               | C-32     | Human-M      | 35                | 225           | No         | None     | None          | None               | None    | Wet                | 2/14/2005 | 1440 | 49.9         | 82                    | 28.81             | 6                   | 68.07                           |



|          |     |         |         |      |         |      |         |      |               |      |           |      |      |      |       |    |        |
|----------|-----|---------|---------|------|---------|------|---------|------|---------------|------|-----------|------|------|------|-------|----|--------|
| 85 B-2a  | 80  | 90 R-27 | Human-M | None | 180 No  | PJ-1 | Human-M | None | L-Case 1+55lb | Dry  | 2/16/2005 | 802  | 39.3 | 73   | 29.13 | 11 | 96.87  |
| 86 B-2a  | 80  | 86 PJ-1 | Human-M | None | 185 No  | C-32 | Human-M | None | L-Case 1+55lb | Dry  | 2/16/2005 | 904  | 39.5 | 72.7 | 29.13 | 13 | 95.19  |
| 87 B-2a  | 80  | 87 C-32 | Human-M | None | 190 No  | SI-1 | Human-M | None | L-Case 1+55lb | Dry  | 2/16/2005 | 907  | 40.1 | 71.4 | 29.13 | 12 | 89.58  |
| 88 B-2a  | 80  | 82 SI-1 | Human-M | None | 248 No  | R-27 | Human-M | None | L-Case 1+55lb | Dry  | 2/16/2005 | 909  | 40   | 71.3 | 29.13 | 5  | 102.91 |
| 89 B-2a  | 80  | 82 PJ-1 | Human-M | None | 185 No  | R-27 | Human-M | None | L-Case 1+55lb | Dry  | 2/16/2005 | 911  | 40   | 70.9 | 29.13 | 7  | 97.03  |
| 90 B-2a  | 80  | 84 R-27 | Human-M | None | 180 No  | SI-1 | Human-M | None | L-Case 1+55lb | Dry  | 2/16/2005 | 914  | 39.9 | 70.4 | 29.13 | 7  | 99.93  |
| 91 B-2a  | 80  | 88 C-32 | Human-M | None | 190 No  | PJ-1 | Human-M | None | L-Case 1+55lb | Dry  | 2/16/2005 | 917  | 39.6 | 71.3 | 29.13 | 10 | 98.91  |
| 92 B-2a  | 80  | 87 SI-1 | Human-M | None | 248 No  | C-32 | Human-M | None | L-Case 1+55lb | Dry  | 2/16/2005 | 919  | 39.9 | 71.4 | 29.13 | 5  | 110.16 |
| 93 A-3a  | 80  | 77 PJ-1 | Human-M | 60   | 245 No  | None | None    | None | None          | None | 2/16/2005 | 953  | 39.7 | 70.5 | 29.14 | 10 | 80.96  |
| 94 A-3a  | 100 | 89 PJ-1 | Human-M | 60   | 245 No  | None | None    | None | None          | None | 2/16/2005 | 955  | 39.7 | 70.5 | 29.14 | 16 | 80.72  |
| 95 A-3a  | 80  | 81 R-27 | Human-M | 60   | 240 No  | None | None    | None | None          | None | 2/16/2005 | 958  | 40   | 74.3 | 29.14 | 10 | 86.76  |
| 96 A-3a  | 100 | 89 R-27 | Human-M | 60   | 240 No  | None | None    | None | None          | None | 2/16/2005 | 959  | 40   | 74.3 | 29.14 | 14 | 86.6   |
| 97 A-3a  | 80  | 81 SI-1 | Human-M | 60   | 308 No  | None | None    | None | None          | None | 2/16/2005 | 1003 | 39.3 | 69.2 | 29.14 | 6  | 98.52  |
| 98 A-3a  | 100 | 89 SI-1 | Human-M | 60   | 308 No  | None | None    | None | None          | None | 2/16/2005 | 1004 | 38.3 | 69.2 | 29.14 | 9  | 101.3  |
| 99 A-3a  | 80  | 81 C-32 | Human-M | 60   | 250 No  | None | None    | None | None          | None | 2/16/2005 | 1007 | 39.3 | 70.4 | 29.14 | 10 | 86.76  |
| 100 A-3a | 100 | 89 C-32 | Human-M | 60   | 250 No  | None | None    | None | None          | None | 2/16/2005 | 1009 | 39.3 | 70.4 | 29.14 | 14 | 86.6   |
| 101 T-1a | 80  | 60 GT   | Human-M | None | 180 No  | None | None    | None | None          | None | 3/7/2005  | 903  | 51.9 | 59   | 28.64 | 14 | 44.55  |
| 102 T-1a | 80  | 65 GT   | Human-M | None | 180 No  | None | None    | None | None          | None | 3/7/2005  | 905  | 53.2 | 60   | 28.64 | 18 | 40.04  |
| 103 T-1b | 100 | 73 PJ-2 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 906  | 53.2 | 60   | 28.64 | 17 | 54.58  |
| 104 T-1b | 60  | 60 PJ-2 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 908  | 53.5 | 60.7 | 28.63 | 10 | 56.31  |
| 105 T-1b | 80  | 65 PJ-2 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 910  | 53.4 | 60.4 | 28.63 | 10 | 63.56  |
| 106 T-1b | 100 | 74 PJ-2 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 911  | 53.6 | 61.4 | 28.63 | 14 | 64.85  |
| 107 T-1b | 60  | 60 PJ-3 | Human-M | None | 233 Yes | None | None    | None | None          | None | 3/7/2005  | 912  | 53.2 | 60.9 | 28.63 | 13 | 47.49  |
| 108 T-1b | 80  | 66 PJ-3 | Human-M | None | 233 Yes | None | None    | None | None          | None | 3/7/2005  | 913  | 53.5 | 59   | 28.63 | 12 | 59.13  |
| 109 T-1b | 100 | 75 PJ-3 | Human-M | None | 233 Yes | None | None    | None | None          | None | 3/7/2005  | 914  | 53.5 | 58.2 | 28.63 | 13 | 69.24  |
| 110 T-1b | 60  | 60 PJ-4 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 915  | 53.5 | 58.8 | 28.63 | 9  | 59.25  |
| 111 T-1b | 80  | 67 PJ-4 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 916  | 53.3 | 57.4 | 28.63 | 12 | 60.58  |
| 112 T-1b | 100 | 75 PJ-4 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 916  | 53.5 | 58.2 | 28.62 | 12 | 72.18  |
| 113 T-1b | 60  | 60 PJ-5 | Human-M | None | 242 Yes | None | None    | None | None          | None | 3/7/2005  | 917  | 53.4 | 58.1 | 28.62 | 11 | 53.37  |
| 114 T-1b | 80  | 66 PJ-5 | Human-M | None | 242 Yes | None | None    | None | None          | None | 3/7/2005  | 918  | 53.2 | 58   | 28.62 | 11 | 62.07  |
| 115 T-1b | 100 | 75 PJ-5 | Human-M | None | 242 Yes | None | None    | None | None          | None | 3/7/2005  | 919  | 53.5 | 58.3 | 28.62 | 11 | 75.12  |
| 116 T-1b | 60  | 60 PJ-6 | Human-M | None | 300 Yes | None | None    | None | None          | None | 3/7/2005  | 920  | 53.5 | 58.5 | 28.63 | 8  | 62.18  |
| 117 T-1b | 80  | 65 PJ-6 | Human-M | None | 300 Yes | None | None    | None | None          | None | 3/7/2005  | 921  | 53.6 | 58   | 28.63 | 8  | 69.44  |
| 118 T-1b | 100 | 76 PJ-6 | Human-M | None | 300 Yes | None | None    | None | None          | None | 3/7/2005  | 922  | 53.6 | 57.7 | 28.63 | 10 | 79.51  |
| 119 T-2b | 80  | 66 GT   | Human-M | None | 215 No  | None | None    | None | None          | None | 3/7/2005  | 924  | 53.5 | 57.4 | 28.63 | 12 | 59.13  |
| 120 T-2b | 80  | 66 PJ-2 | Human-M | 35   | 266 Yes | None | None    | None | None          | None | 3/7/2005  | 927  | 52.3 | 59.6 | 28.63 | 12 | 59.13  |
| 121 T-2b | 80  | 67 PJ-3 | Human-M | 35   | 268 Yes | None | None    | None | None          | None | 3/7/2005  | 930  | 53.2 | 58.4 | 28.64 | 12 | 60.58  |
| 122 T-2b | 80  | 67 PJ-4 | Human-M | 35   | 266 Yes | None | None    | None | None          | None | 3/7/2005  | 932  | 53.9 | 58   | 28.62 | 8  | 72.34  |
| 123 T-2b | 80  | 65 PJ-5 | Human-M | 35   | 277 Yes | None | None    | None | None          | None | 3/7/2005  | 934  | 53.6 | 59   | 28.63 | 10 | 63.56  |
| 124 T-2b | 80  | 67 PJ-6 | Human-M | 35   | 335 Yes | None | None    | None | None          | None | 3/7/2005  | 935  | 54   | 57.6 | 28.62 | 9  | 69.4   |
| 125 A-1b | 80  | 68 PJ-2 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 1002 | 55   | 57.1 | 28.62 | 12 | 62.03  |
| 126 A-1b | 80  | 67 PJ-4 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 1004 | 54.9 | 58   | 28.62 | 12 | 60.58  |
| 127 A-1b | 80  | 63 PJ-6 | Human-M | None | 300 Yes | None | None    | None | None          | None | 3/7/2005  | 1005 | 55   | 56.3 | 28.62 | 7  | 69.48  |
| 128 A-1b | 80  | 66 GT   | Human-M | None | 180 No  | None | None    | None | None          | None | 3/7/2005  | 1006 | 55.3 | 58   | 28.62 | 13 | 56.18  |
| 129 A-1b | 100 | 74 PJ-2 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 1007 | 55.6 | 56.8 | 28.62 | 12 | 70.73  |
| 130 A-1b | 80  | 66 PJ-3 | Human-M | None | 233 Yes | None | None    | None | None          | None | 3/7/2005  | 1008 | 55.5 | 57   | 28.62 | 12 | 59.13  |
| 131 A-1b | 100 | 74 PJ-4 | Human-M | None | 231 Yes | None | None    | None | None          | None | 3/7/2005  | 1009 | 55.3 | 57.1 | 28.62 | 12 | 70.73  |

|     |      |     |    |      |         |      |     |     |      |         |      |          |          |          |      |      |       |       |       |        |
|-----|------|-----|----|------|---------|------|-----|-----|------|---------|------|----------|----------|----------|------|------|-------|-------|-------|--------|
| 132 | A-1b | 80  | 67 | PJ-5 | Human-M | None | 242 | Yes | None | None    | None | Dry      | 3/7/2005 | 1010     | 55.8 | 62.2 | 28.62 | 10    | 66.46 |        |
| 133 | A-1b | 100 | 77 | PJ-6 | Human-M | None | 300 | Yes | None | None    | None | Dry      | 3/7/2005 | 1011     | 55.5 | 57.9 | 28.61 | 10    | 80.96 |        |
| 134 | A-1a | 100 | 75 | GT   | Human-M | None | 180 | No  | None | None    | None | Dry      | 3/7/2005 | 1012     | 55.4 | 57.7 | 28.61 | 13    | 69.24 |        |
| 135 | A-1b | 100 | 75 | PJ-3 | Human-M | None | 233 | Yes | None | None    | None | Dry      | 3/7/2005 | 1013     | 55.4 | 57.6 | 28.61 | 13    | 69.24 |        |
| 136 | A-1b | 100 | 78 | PJ-5 | Human-M | None | 242 | Yes | None | None    | None | Dry      | 3/7/2005 | 1014     | 56.1 | 56.5 | 28.61 | 11    | 79.47 |        |
| 137 | A-2b | 80  | 67 | PJ-2 | Human-M | 35   | 266 | Yes | None | None    | None | Dry      | 3/7/2005 | 1016     | 55.7 | 56.3 | 28.61 | 11    | 63.52 |        |
| 138 | A-2b | 80  | 68 | PJ-4 | Human-M | 35   | 266 | Yes | None | None    | None | Dry      | 3/7/2005 | 1018     | 55.4 | 57.8 | 28.61 | 10    | 67.91 |        |
| 139 | A-2b | 80  | 67 | PJ-6 | Human-M | 35   | 335 | Yes | None | None    | None | Dry      | 3/7/2005 | 1020     | 55.7 | 57.1 | 28.6  | 7     | 75.28 |        |
| 140 | A-2a | 80  | 70 | GT   | Human-M | 35   | 215 | No  | None | None    | None | Dry      | 3/7/2005 | 1021     | 56.1 | 56.9 | 28.61 | 11    | 67.87 |        |
| 141 | A-2b | 100 | 76 | PJ-2 | Human-M | 35   | 266 | Yes | None | None    | None | Dry      | 3/7/2005 | 1023     | 55.3 | 57.3 | 28.61 | 11    | 76.57 |        |
| 142 | A-2b | 80  | 67 | PJ-3 | Human-M | 35   | 268 | Yes | None | None    | None | Dry      | 3/7/2005 | 1024     | 55.7 | 57.1 | 28.61 | 8     | 72.34 |        |
| 143 | A-2b | 100 | 76 | PJ-4 | Human-M | 35   | 266 | Yes | None | None    | None | Dry      | 3/7/2005 | 1026     | 55.9 | 56.6 | 28.61 | 10    | 79.51 |        |
| 144 | A-2b | 80  | 66 | PJ-5 | Human-M | 35   | 277 | Yes | None | None    | None | Dry      | 3/7/2005 | 1028     | 55.7 | 56.5 | 28.61 | 10    | 65.01 |        |
| 145 | A-2b | 100 | 74 | PJ-6 | Human-M | 35   | 335 | Yes | None | None    | None | Dry      | 3/7/2005 | 1029     | 55.9 | 56.8 | 28.61 | 7     | 85.43 |        |
| 146 | A-2a | 100 | 75 | GT   | Human-M | 35   | 215 | No  | None | None    | None | Dry      | 3/7/2005 | 1031     | 56.1 | 56.4 | 28.6  | 12    | 72.18 |        |
| 147 | A-2b | 100 | 79 | PJ-3 | Human-M | 35   | 268 | Yes | None | None    | None | Dry      | 3/7/2005 | 1033     | 56.1 | 56.4 | 28.6  | 11    | 80.82 |        |
| 148 | A-2b | 100 | 75 | PJ-5 | Human-M | 35   | 277 | Yes | None | None    | None | Dry      | 3/7/2005 | 1034     | 56.1 | 56.4 | 28.6  | 10    | 78.08 |        |
| 149 | A-3b | 80  | 69 | PJ-2 | Human-M | 60   | 291 | Yes | None | None    | None | Dry      | 3/7/2005 | 1037     | 55.7 | 56.5 | 28.6  | 9     | 72.3  |        |
| 150 | A-3b | 80  | 67 | PJ-4 | Human-M | 60   | 291 | Yes | None | None    | None | Dry      | 3/7/2005 | 1038     | 55.6 | 57.1 | 28.6  | 8     | 72.34 |        |
| 151 | A-3b | 80  | 67 | PJ-6 | Human-M | 60   | 360 | Yes | None | None    | None | Dry      | 3/7/2005 | 1040     | 55.4 | 57.7 | 28.6  | 8     | 72.34 |        |
| 152 | A-3a | 80  | 67 | GT   | Human-M | 60   | 240 | No  | None | None    | None | Dry      | 3/7/2005 | 1042     | 55.4 | 57.7 | 28.6  | 8     | 72.34 |        |
| 153 | A-3b | 100 | 74 | PJ-2 | Human-M | 60   | 291 | Yes | None | None    | None | Dry      | 3/7/2005 | 1043     | 55.7 | 57.3 | 28.6  | 10    | 76.61 |        |
| 154 | A-3b | 80  | 67 | PJ-3 | Human-M | 60   | 293 | Yes | None | None    | None | Dry      | 3/7/2005 | 1045     | 55.9 | 57.4 | 28.6  | 9     | 69.4  |        |
| 155 | A-3b | 100 | 74 | PJ-4 | Human-M | 60   | 291 | Yes | None | None    | None | Dry      | 3/7/2005 | 1046     | 56.2 | 56.2 | 28.59 | 11    | 73.67 |        |
| 156 | A-3b | 80  | 69 | PJ-5 | Human-M | 60   | 302 | Yes | None | None    | None | Dry      | 3/7/2005 | 1048     | 56.2 | 56.8 | 28.6  | 9     | 72.3  |        |
| 157 | A-3b | 100 | 75 | PJ-6 | Human-M | 60   | 360 | Yes | None | None    | None | Dry      | 3/7/2005 | 1049     | 56.4 | 56.8 | 28.6  | 7     | 86.88 |        |
| 158 | A-3a | 100 | 74 | GT   | Human-M | 60   | 240 | No  | None | None    | None | Dry      | 3/7/2005 | 1051     | 56.7 | 56.4 | 28.6  | 10    | 76.61 |        |
| 159 | A-3b | 100 | 75 | PJ-3 | Human-M | 60   | 293 | Yes | None | None    | None | Dry      | 3/7/2005 | 1053     | 56.6 | 56.7 | 28.59 | 9     | 81    |        |
| 160 | A-3b | 100 | 74 | PJ-5 | Human-M | 60   | 302 | Yes | None | None    | None | Dry      | 3/7/2005 | 1054     | 56.7 | 56.7 | 28.6  | 9     | 79.55 |        |
| 161 | B-1a | 120 | 90 | GT   | Human-M | None | 180 | No  | PJ-6 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1323 | 56.5 | 56.5  | 28.55 | 10    | 99.81  |
| 162 | B-1b | 120 | 84 | PJ-2 | Human-M | None | 231 | Yes | GT   | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1326 | 56.1 | 56.1  | 28.54 | 8     | 96.09  |
| 163 | B-1b | 120 | 89 | PJ-3 | Human-M | None | 233 | Yes | PJ-2 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1329 | 57   | 57    | 28.54 | 9     | 101.3  |
| 164 | B-1b | 120 | 88 | PJ-4 | Human-M | None | 242 | Yes | PJ-3 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1331 | 60.6 | 56    | 28.54 | 9     | 99.85  |
| 165 | B-1b | 120 | 90 | PJ-5 | Human-M | None | 242 | Yes | PJ-4 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1334 | 60.4 | 56.6  | 28.55 | 6     | 111.57 |
| 166 | B-1b | 120 | 82 | PJ-6 | Human-M | None | 300 | Yes | PJ-5 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1336 | 60.4 | 57.4  | 28.54 | 6     | 99.97  |
| 167 | B-1a | 120 | 90 | GT   | Human-M | None | 180 | No  | PJ-2 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1340 | 60.4 | 56    | 28.54 | 10    | 99.81  |
| 168 | B-1b | 120 | 89 | PJ-2 | Human-M | None | 231 | Yes | PJ-3 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1343 | 62.1 | 55.6  | 28.53 | 10    | 98.36  |
| 169 | B-1b | 120 | 91 | PJ-3 | Human-M | None | 233 | Yes | PJ-4 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1346 | 61.1 | 55.2  | 28.53 | 10    | 101.28 |
| 170 | B-1b | 120 | 87 | PJ-4 | Human-M | None | 231 | Yes | PJ-5 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1348 | 60.8 | 55.8  | 28.53 | 9     | 98.4   |
| 171 | B-1b | 120 | 84 | PJ-5 | Human-M | None | 242 | Yes | PJ-6 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1350 | 60.6 | 55.4  | 28.53 | 6     | 102.87 |
| 172 | B-1b | 120 | 91 | PJ-4 | Human-M | None | 231 | Yes | GT   | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1353 | 61.1 | 55.3  | 28.53 | 8     | 107.14 |
| 173 | B-1b | 120 | 91 | PJ-5 | Human-M | None | 242 | Yes | PJ-2 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1355 | 61.3 | 56    | 28.53 | 6     | 113.02 |
| 174 | B-1a | 120 | 91 | GT   | Human-M | None | 180 | No  | PJ-4 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1358 | 61.4 | 56    | 28.53 | 11    | 98.32  |
| 175 | B-1b | 120 | 89 | PJ-6 | Human-M | None | 300 | Yes | PJ-3 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1400 | 61.6 | 55.9  | 28.53 | 5     | 113.06 |
| 176 | B-1b | 120 | 88 | PJ-2 | Human-M | None | 231 | Yes | PJ-5 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1402 | 61.3 | 55.7  | 28.53 | 9     | 99.85  |
| 177 | B-1b | 120 | 91 | PJ-3 | Human-M | None | 233 | Yes | PJ-6 | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1404 | 61.9 | 55.2  | 28.53 | 5     | 115.96 |
| 178 | B-1b | 120 | 85 | PJ-6 | Human-M | None | 300 | Yes | GT   | Human-M | 60   | L-Case 1 | Dry      | 3/7/2005 | 1407 | 62.1 | 54.4  | 28.54 | 7     | 101.38 |

|          |     |         |         |      |         |      |         |      |               |     |          |      |      |      |       |    |        |
|----------|-----|---------|---------|------|---------|------|---------|------|---------------|-----|----------|------|------|------|-------|----|--------|
| 178 B-3a | 120 | 82 GT   | Human-M | None | 180 No  | PJ-6 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1421 | 62.4 | 58   | 28.52 | 5  | 102.91 |
| 180 B-3b | 120 | 87 PJ-2 | Human-M | None | 231 Yes | GT   | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1423 | 62.4 | 55.4 | 28.53 | 6  | 107.22 |
| 181 B-3b | 120 | 89 PJ-3 | Human-M | None | 233 Yes | PJ-2 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1425 | 61.8 | 55   | 28.53 | 9  | 101.3  |
| 182 B-3b | 120 | 81 PJ-4 | Human-M | None | 231 Yes | PJ-3 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1427 | 61.8 | 55.5 | 28.53 | 6  | 98.52  |
| 183 B-3b | 120 | 86 PJ-5 | Human-M | None | 242 Yes | PJ-4 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1429 | 61.7 | 56.3 | 28.52 | 5  | 108.71 |
| 184 B-3b | 120 | 87 PJ-6 | Human-M | None | 300 Yes | PJ-5 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1431 | 61.3 | 57.4 | 28.53 | 5  | 110.16 |
| 185 B-3a | 120 | 87 GT   | Human-M | None | 180 No  | PJ-2 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1433 | 62.6 | 55.7 | 28.52 | 8  | 101.34 |
| 186 B-3b | 120 | 86 PJ-2 | Human-M | None | 233 Yes | PJ-3 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1435 | 61.6 | 55.9 | 28.52 | 9  | 96.95  |
| 187 B-3b | 120 | 86 PJ-3 | Human-M | None | 233 Yes | PJ-4 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1437 | 61.5 | 56.1 | 28.52 | 6  | 108.71 |
| 188 B-3b | 120 | 92 PJ-4 | Human-M | None | 231 Yes | PJ-5 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1439 | 61.8 | 55.3 | 28.52 | 5  | 117.41 |
| 189 B-3b | 120 | 87 PJ-5 | Human-M | None | 242 Yes | PJ-6 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1441 | 61.3 | 55.8 | 28.52 | 5  | 110.16 |
| 190 B-3b | 120 | 87 PJ-4 | Human-M | None | 231 Yes | GT   | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1443 | 61.8 | 55.6 | 28.52 | 7  | 104.28 |
| 191 B-3b | 120 | 87 PJ-5 | Human-M | None | 242 Yes | PJ-2 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1445 | 62.3 | 56.2 | 28.52 | 5  | 110.16 |
| 192 B-3a | 120 | 87 GT   | Human-M | None | 180 No  | PJ-4 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1447 | 62.3 | 57.4 | 28.52 | 6  | 107.22 |
| 193 B-3b | 120 | 81 PJ-6 | Human-M | None | 300 Yes | PJ-3 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1451 | 61.9 | 56   | 28.52 | 5  | 101.46 |
| 194 B-3b | 120 | 82 PJ-2 | Human-M | None | 231 Yes | PJ-5 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1453 | 62.1 | 55.6 | 28.52 | 6  | 99.97  |
| 195 B-3b | 120 | 87 PJ-3 | Human-M | None | 233 Yes | PJ-6 | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1455 | 62.3 | 55.9 | 28.52 | 5  | 110.16 |
| 196 B-3b | 120 | 88 PJ-6 | Human-M | None | 300 Yes | GT   | Human-M | 60   | 50%ile mankin | Dry | 3/7/2005 | 1457 | 61.9 | 56.1 | 28.51 | 7  | 105.73 |
| 197 C-a  | 120 | 89 GT   | Human-M | None | 180 No  | None | None    | None | PJ-6          | Dry | 3/7/2005 | 1508 | 62.1 | 57.8 | 28.51 | 14 | 86.6   |
| 198 C-b  | 120 | 87 PJ-2 | Human-M | None | 231 Yes | None | None    | None | PJ-1          | Dry | 3/7/2005 | 1511 | 62.7 | 55   | 28.51 | 14 | 83.7   |
| 199 C-b  | 120 | 89 PJ-3 | Human-M | None | 233 Yes | None | None    | None | PJ-2          | Dry | 3/7/2005 | 1512 | 63.5 | 55.5 | 28.51 | 12 | 92.48  |
| 200 C-b  | 120 | 76 PJ-4 | Human-M | None | 231 Yes | None | None    | None | PJ-3          | Dry | 3/7/2005 | 1513 | 62.7 | 55.8 | 28.51 | 15 | 67.71  |
| 201 C-b  | 120 | 77 PJ-5 | Human-M | None | 242 Yes | None | None    | None | PJ-4          | Dry | 3/7/2005 | 1515 | 62.8 | 55   | 28.51 | 10 | 80.96  |
| 202 C-b  | 120 | 83 PJ-6 | Human-M | None | 300 Yes | None | None    | None | PJ-5          | Dry | 3/7/2005 | 1515 | 62.3 | 54.1 | 28.51 | 10 | 89.66  |
| 203 C-a  | 120 | 76 GT   | Human-M | None | 180 No  | None | None    | None | PJ-2          | Dry | 3/7/2005 | 1517 | 61.9 | 56   | 28.51 | 12 | 73.63  |
| 204 C-b  | 120 | 89 PJ-2 | Human-M | None | 231 Yes | None | None    | None | PJ-3          | Dry | 3/7/2005 | 1518 | 61.9 | 56   | 28.51 | 15 | 88.01  |
| 205 C-b  | 120 | 89 PJ-3 | Human-M | None | 233 Yes | None | None    | None | PJ-4          | Dry | 3/7/2005 | 1520 | 61.9 | 56.2 | 28.51 | 14 | 86.6   |
| 206 C-b  | 120 | 86 PJ-4 | Human-M | None | 231 Yes | None | None    | None | PJ-5          | Dry | 3/7/2005 | 1521 | 61.5 | 56.6 | 28.51 | 15 | 79.31  |
| 207 C-b  | 120 | 89 PJ-5 | Human-M | None | 242 Yes | None | None    | None | PJ-6          | Dry | 3/7/2005 | 1522 | 62.3 | 54.9 | 28.51 | 9  | 101.3  |
| 208 C-b  | 120 | 80 PJ-4 | Human-M | None | 231 Yes | None | None    | None | PJ-1          | Dry | 3/7/2005 | 1524 | 61.9 | 55.1 | 28.51 | 13 | 76.49  |
| 209 C-b  | 120 | 84 PJ-5 | Human-M | None | 242 Yes | None | None    | None | PJ-2          | Dry | 3/7/2005 | 1525 | 61.9 | 53.5 | 28.5  | 9  | 94.05  |
| 210 C-a  | 120 | 80 GT   | Human-M | None | 180 No  | None | None    | None | PJ-4          | Dry | 3/7/2005 | 1526 | 61.5 | 56.1 | 28.51 | 12 | 79.43  |
| 211 C-b  | 120 | 86 PJ-6 | Human-M | None | 300 Yes | None | None    | None | PJ-3          | Dry | 3/7/2005 | 1527 | 61.5 | 56.2 | 28.51 | 10 | 94.01  |
| 212 C-b  | 120 | 88 PJ-2 | Human-M | None | 231 Yes | None | None    | None | PJ-5          | Dry | 3/7/2005 | 1529 | 61.6 | 55.9 | 28.51 | 10 | 96.91  |
| 213 C-b  | 120 | 78 PJ-3 | Human-M | None | 233 Yes | None | None    | None | PJ-6          | Dry | 3/7/2005 | 1530 | 61.5 | 56   | 28.51 | 12 | 77.98  |
| 214 C-b  | 120 | 89 PJ-6 | Human-M | None | 300 Yes | None | None    | None | PJ-1          | Dry | 3/7/2005 | 1531 | 61.1 | 56   | 28.51 | 11 | 95.42  |
| 215 A-1a | 100 | 69 PJ-2 | Human-M | None | 216 No  | None | None    | None | None          | Dry | 3/8/2005 | 937  | 29.4 | 57.3 | 28.88 | 10 | 69.36  |
| 216 A-1a | 100 | 69 PJ-4 | Human-M | None | 216 No  | None | None    | None | None          | Dry | 3/8/2005 | 938  | 29.4 | 57.3 | 28.88 | 7  | 78.18  |
| 217 A-1a | 100 | 69 PJ-6 | Human-M | None | 285 No  | None | None    | None | None          | Dry | 3/8/2005 | 939  | 29.4 | 57.3 | 28.88 | 7  | 78.18  |
| 218 A-1a | 100 | 69 GT   | Human-M | None | 180 No  | None | None    | None | None          | Dry | 3/8/2005 | 939  | 29.4 | 57.3 | 28.88 | 15 | 54.66  |
| 219 A-1a | 120 | 87 PJ-2 | Human-M | None | 216 No  | None | None    | None | None          | Dry | 3/8/2005 | 941  | 29.4 | 57.3 | 28.88 | 14 | 83.7   |
| 220 A-1a | 100 | 74 PJ-3 | Human-M | None | 218 No  | None | None    | None | None          | Dry | 3/8/2005 | 943  | 29.9 | 57.3 | 28.88 | 8  | 79.55  |
| 221 A-1a | 120 | 73 PJ-4 | Human-M | None | 216 No  | None | None    | None | None          | Dry | 3/8/2005 | 944  | 29.1 | 56.1 | 28.88 | 5  | 94.21  |
| 222 A-1a | 100 | 73 PJ-5 | Human-M | None | 227 No  | None | None    | None | None          | Dry | 3/8/2005 | 946  | 28   | 56.1 | 28.88 | 13 | 66.34  |
| 223 A-1a | 120 | 75 PJ-6 | Human-M | None | 285 No  | None | None    | None | None          | Dry | 3/8/2005 | 947  | 28.9 | 55.8 | 28.88 | 8  | 83.94  |
| 224 A-1a | 120 | 83 GT   | Human-M | None | 180 No  | None | None    | None | None          | Dry | 3/8/2005 | 949  | 28.9 | 55.8 | 28.88 | 20 | 60.26  |
| 225 A-1a | 120 | 83 PJ-3 | Human-M | None | 218 No  | None | None    | None | None          | Dry | 3/8/2005 | 950  | 28.9 | 55.8 | 28.88 | 14 | 77.9   |

|          |     |         |         |      |         |      |      |      |      |          |      |      |       |       |    |        |
|----------|-----|---------|---------|------|---------|------|------|------|------|----------|------|------|-------|-------|----|--------|
| 226 A-1a | 120 | 87 PJ-5 | Human-M | None | 227 No  | None | None | None | None | 3/8/2005 | 951  | 28.2 | 28.2  | 28.88 | 15 | 80.76  |
| 227 A-1b | 100 | 67 PJ-2 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 953  | 28.9 | 28.2  | 28.88 | 10 | 66.46  |
| 228 A-1b | 100 | 70 PJ-4 | Human-M | None | 230 Yes | None | None | None | None | 3/8/2005 | 954  | 30.6 | 28.2  | 28.88 | 10 | 70.81  |
| 229 A-1b | 100 | 69 PJ-6 | Human-M | None | 301 Yes | None | None | None | None | 3/8/2005 | 955  | 29.1 | 28.2  | 28.88 | 7  | 78.18  |
| 230 A-1a | 100 | 71 GT   | Human-M | None | 180 No  | None | None | None | None | 3/8/2005 | 956  | 29.1 | 28.2  | 28.88 | 14 | 60.5   |
| 231 A-1b | 120 | 77 PJ-2 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 957  | 29.1 | 28.2  | 28.88 | 13 | 72.14  |
| 232 A-1b | 100 | 70 PJ-3 | Human-M | None | 233 Yes | None | None | None | None | 3/8/2005 | 958  | 29.5 | 28.2  | 28.88 | 8  | 76.69  |
| 233 A-1b | 120 | 76 PJ-4 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 959  | 28.2 | 28.2  | 28.88 | 11 | 76.57  |
| 234 A-1b | 100 | 71 PJ-5 | Human-M | None | 242 Yes | None | None | None | None | 3/8/2005 | 1000 | 29.8 | 28.2  | 28.88 | 9  | 75.2   |
| 235 A-1b | 120 | 77 PJ-6 | Human-M | None | 300 Yes | None | None | None | None | 3/8/2005 | 1001 | 29.1 | 28.2  | 28.88 | 8  | 86.84  |
| 236 A-1a | 120 | 78 GT   | Human-M | None | 180 No  | None | None | None | None | 3/8/2005 | 1001 | 28.1 | 28.2  | 28.88 | 14 | 70.65  |
| 237 A-1b | 120 | 77 PJ-3 | Human-M | None | 233 Yes | None | None | None | None | 3/8/2005 | 1002 | 28.5 | 28.2  | 28.88 | 9  | 83.9   |
| 238 A-1b | 120 | 76 PJ-2 | Human-M | None | 242 Yes | None | None | None | None | 3/8/2005 | 1003 | 28.9 | 57.1  | 28.88 | 9  | 83.9   |
| 239 A-2b | 100 | 76 PJ-2 | Human-M | 35   | 266 Yes | None | None | None | None | 3/8/2005 | 1034 | 38   | 57.1  | 28.89 | 8  | 85.38  |
| 240 A-2b | 100 | 76 PJ-4 | Human-M | 35   | 266 Yes | None | None | None | None | 3/8/2005 | 1035 | 37.1 | 36.43 | 28.89 | 7  | 88.33  |
| 241 A-2b | 100 | 76 PJ-6 | Human-M | 35   | 335 Yes | None | None | None | None | 3/8/2005 | 1036 | 33.9 | 36.43 | 28.89 | 6  | 91.27  |
| 242 A-2a | 100 | 76 GT   | Human-M | 35   | 215 No  | None | None | None | None | 3/8/2005 | 1036 | 35.5 | 38.43 | 28.89 | 11 | 76.57  |
| 243 A-2a | 120 | 88 PJ-2 | Human-M | 35   | 266 Yes | None | None | None | None | 3/8/2005 | 1037 | 35.3 | 38.7  | 28.89 | 15 | 82.21  |
| 244 A-2b | 100 | 76 PJ-3 | Human-M | 35   | 268 Yes | None | None | None | None | 3/8/2005 | 1039 | 33.4 | 39.9  | 28.89 | 9  | 82.45  |
| 245 A-2b | 120 | 89 PJ-4 | Human-M | 35   | 266 Yes | None | None | None | None | 3/8/2005 | 1040 | 31.3 | 41    | 28.89 | 12 | 82.48  |
| 246 A-2b | 100 | 76 PJ-5 | Human-M | 35   | 277 Yes | None | None | None | None | 3/8/2005 | 1041 | 30.7 | 41    | 28.89 | 6  | 89.82  |
| 247 A-2b | 120 | 88 PJ-6 | Human-M | 35   | 335 Yes | None | None | None | None | 3/8/2005 | 1042 | 30.1 | 41    | 28.89 | 8  | 99.85  |
| 248 A-2a | 120 | 89 GT   | Human-M | 35   | 215 No  | None | None | None | None | 3/8/2005 | 1043 | 31   | 41    | 28.89 | 17 | 77.78  |
| 249 A-2b | 120 | 90 PJ-3 | Human-M | 35   | 268 Yes | None | None | None | None | 3/8/2005 | 1044 | 30.5 | 41    | 28.89 | 17 | 79.23  |
| 250 A-2b | 120 | 80 PJ-5 | Human-M | 35   | 277 Yes | None | None | None | None | 3/8/2005 | 1045 | 29.9 | 41    | 28.89 | 8  | 91.19  |
| 251 D-1  | 100 | 74 PJ-2 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 1046 | 30.4 | 41    | 28.89 | 13 | 70.69  |
| 252 D-1  | 100 | 74 PJ-4 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 1047 | 30.9 | 41    | 28.89 | 9  | 79.55  |
| 253 D-1  | 100 | 77 GT   | Human-M | None | 300 Yes | None | None | None | None | 3/8/2005 | 1048 | 30.9 | 41    | 28.89 | 8  | 82.49  |
| 254 D-1  | 100 | 74 PJ-6 | Human-M | None | 180 No  | None | None | None | None | 3/8/2005 | 1049 | 30.9 | 41    | 28.89 | 15 | 66.26  |
| 255 D-1  | 120 | 90 PJ-2 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 1050 | 30.5 | 41    | 28.89 | 10 | 79.51  |
| 256 D-1  | 120 | 87 PJ-4 | Human-M | None | 233 Yes | None | None | None | None | 3/8/2005 | 1051 | 30.3 | 43.3  | 28.89 | 13 | 86.64  |
| 257 D-1  | 100 | 75 PJ-5 | Human-M | None | 242 Yes | None | None | None | None | 3/8/2005 | 1052 | 30.9 | 43.3  | 28.89 | 11 | 75.12  |
| 258 D-1  | 120 | 86 PJ-6 | Human-M | None | 300 Yes | None | None | None | None | 3/8/2005 | 1053 | 30.1 | 43.3  | 28.89 | 9  | 96.95  |
| 259 D-1  | 120 | 88 GT   | Human-M | None | 180 No  | None | None | None | None | 3/8/2005 | 1054 | 29.6 | 43.3  | 28.89 | 23 | 60.14  |
| 260 D-1  | 120 | 80 PJ-3 | Human-M | None | 233 Yes | None | None | None | None | 3/8/2005 | 1055 | 30.4 | 43.3  | 28.89 | 10 | 99.81  |
| 261 D-1  | 120 | 88 PJ-5 | Human-M | None | 242 Yes | None | None | None | None | 3/8/2005 | 1057 | 33.8 | 43.3  | 28.89 | 15 | 82.21  |
| 262 D-1  | 100 | 76 PJ-2 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 1058 | 33.2 | 43.3  | 28.89 | 10 | 79.51  |
| 263 E    | 100 | 75 PJ-4 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 1059 | 32.6 | 43.3  | 28.89 | 10 | 78.06  |
| 264 E    | 100 | 77 PJ-6 | Human-M | None | 300 Yes | None | None | None | None | 3/8/2005 | 1100 | 31.9 | 43.3  | 28.89 | 7  | 89.78  |
| 265 E    | 100 | 75 GT   | Human-M | None | 180 No  | None | None | None | None | 3/8/2005 | 1101 | 31.9 | 41.9  | 28.9  | 12 | 72.18  |
| 266 E    | 120 | 89 PJ-2 | Human-M | None | 231 Yes | None | None | None | None | 3/8/2005 | 1103 | 31.3 | 41.9  | 28.9  | 7  | 107.18 |
| 267 E    | 100 | 90 PJ-4 | Human-M | None | 233 Yes | None | None | None | None | 3/8/2005 | 1104 | 30.7 | 41.9  | 28.9  | 5  | 95.66  |
| 268 E    | 120 | 76 PJ-5 | Human-M | None | 242 Yes | None | None | None | None | 3/8/2005 | 1105 | 31.3 | 41.9  | 28.9  | 15 | 85.11  |
| 269 E    | 100 | 92 PJ-6 | Human-M | None | 300 Yes | None | None | None | None | 3/8/2005 | 1106 | 31.5 | 41.9  | 28.9  | 5  | 94.21  |
| 270 E    | 120 | 92 GT   | Human-M | None | 180 No  | None | None | None | None | 3/8/2005 | 1108 | 30.9 | 41.9  | 28.9  | 10 | 102.71 |
| 271 E    | 120 | 92 GT   | Human-M | None | 180 No  | None | None | None | None | 3/8/2005 | 1109 | 30.6 | 41.9  | 28.9  | 20 | 73.31  |

|         |     |         |         |      |         |      |      |      |     |          |      |      |      |       |    |        |
|---------|-----|---------|---------|------|---------|------|------|------|-----|----------|------|------|------|-------|----|--------|
| 273 E   | 120 | 89 PJ-3 | Human-M | None | 233 Yes | None | None | None | Dry | 3/8/2005 | 1110 | 30.7 | 41.9 | 28.8  | 15 | 83.66  |
| 274 E   | 120 | 88 PJ-5 | Human-M | None | 242 Yes | None | None | None | Dry | 3/8/2005 | 1111 | 30.9 | 41.9 | 28.8  | 5  | 111.61 |
| 275 D-2 | 100 | 80 GT   | Human-M | None | 180 No  | None | None | None | Dry | 3/9/2005 | 914  | 27   | 46.5 | 29.13 | 15 | 70.61  |
| 276 D-2 | 100 | 68 PJ-2 | Human-M | None | 231 Yes | None | None | None | Dry | 3/9/2005 | 916  | 28   | 45   | 29.13 | 12 | 62.03  |
| 277 D-2 | 100 | 77 PJ-3 | Human-M | None | 233 Yes | None | None | None | Dry | 3/9/2005 | 917  | 28   | 45   | 29.13 | 10 | 80.96  |
| 278 D-2 | 100 | 80 PJ-4 | Human-M | None | 231 Yes | None | None | None | Dry | 3/9/2005 | 918  | 28   | 45   | 29.13 | 15 | 70.61  |
| 281 D-2 | 100 | 76 GT   | Human-M | None | 180 No  | None | None | None | Dry | 3/9/2005 | 920  | 28   | 44   | 29.13 | 14 | 67.75  |
| 282 D-2 | 100 | 77 PJ-2 | Human-M | None | 231 Yes | None | None | None | Dry | 3/9/2005 | 921  | 28   | 44   | 29.13 | 9  | 83.9   |
| 283 D-2 | 100 | 75 PJ-3 | Human-M | None | 233 Yes | None | None | None | Dry | 3/9/2005 | 922  | 28   | 44   | 29.13 | 15 | 63.36  |
| 286 D-2 | 100 | 77 PJ-4 | Human-M | None | 231 Yes | None | None | None | Dry | 3/9/2005 | 923  | 27.7 | 47   | 29.13 | 15 | 66.26  |
| 288 D-2 | 100 | 76 GT   | Human-M | None | 180 No  | None | None | None | Dry | 3/9/2005 | 925  | 27.7 | 47   | 29.13 | 13 | 70.69  |
| 289 D-2 | 100 | 78 PJ-6 | Human-M | None | 300 Yes | None | None | None | Dry | 3/9/2005 | 929  | 27.7 | 47   | 29.13 |    |        |
| 291 D-2 | 100 | 77 PJ-3 | Human-M | None | 233 Yes | None | None | None | Dry | 3/9/2005 | 926  | 27.7 | 47   | 29.13 | 8  | 89.74  |
| 292 D-2 | 100 | 77 PJ-6 | Human-M | None | 300 Yes | None | None | None | Dry | 3/9/2005 | 927  | 27.7 | 47   | 29.13 | 9  | 83.9   |
| 293 F-1 |     | 79 GT   | Human-M | None | 180 No  | None | None | None | Dry | 3/9/2005 | 931  | 27.7 | 47   | 29.13 |    |        |
| 294 F-1 |     | 79 PJ-2 | Human-M | None | 231 Yes | None | None | None | Dry | 3/9/2005 | 933  | 27.7 | 47   | 29.13 |    |        |
| 295 F-1 |     | 78 PJ-3 | Human-M | None | 233 Yes | None | None | None | Dry | 3/9/2005 | 935  | 27   | 45   | 29.13 |    |        |
| 296 F-1 |     | 78 PJ-4 | Human-M | None | 231 Yes | None | None | None | Dry | 3/9/2005 | 938  | 27   | 45   | 29.13 |    |        |
| 298 F-1 |     | 78 PJ-6 | Human-M | None | 300 Yes | None | None | None | Dry | 3/9/2005 | 939  | 27   | 45   | 29.13 |    |        |
| 299 F-2 |     | 81 GT   | Human-M | 35   | 215 No  | None | None | None | Dry | 3/9/2005 | 942  | 27   | 45   | 29.13 |    |        |
| 300 F-2 |     | 82 PJ-2 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 945  | 27   | 45   | 29.13 |    |        |
| 301 F-2 |     | 90 PJ-3 | Human-M | 35   | 268 Yes | None | None | None | Dry | 3/9/2005 | 948  | 27   | 45   | 29.13 |    |        |
| 302 F-2 |     | 88 PJ-4 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 951  | 27   | 45   | 29.13 |    |        |
| 304 F-2 |     | 90 PJ-6 | Human-M | 35   | 335 Yes | None | None | None | Dry | 3/9/2005 | 954  | 29   | 44   | 29.12 |    |        |
| 305 G   | 100 | 80 PJ-2 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1038 | 29   | 44   | 29.12 | 7  | 94.13  |
| 306 G   | 100 | 83 PJ-6 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1040 | 29   | 44   | 29.12 | 6  | 94.17  |
| 307 G   | 100 | 77 GT   | Human-M | 35   | 230 Yes | None | None | None | Dry | 3/9/2005 | 1044 | 34   | 33   | 29.12 | 5  | 95.66  |
| 308 G   | 100 | 89 PJ-2 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1046 | 34   | 33   | 29.12 | 5  | 113.06 |
| 309 G   | 100 | 89 PJ-3 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1047 | 34   | 33   | 29.12 | 5  | 110.08 |
| 310 G   | 100 | 91 PJ-4 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1048 | 33   | 36   | 29.11 | 7  | 110.08 |
| 311 G   | 100 | 89 PJ-6 | Human-M | 35   | 335 Yes | None | None | None | Dry | 3/9/2005 | 1051 | 33   | 36   | 29.11 | 5  | 113.06 |
| 313 G   | 100 | 81 GT   | Human-M | 35   | 230 Yes | None | None | None | Dry | 3/9/2005 | 1053 | 33   | 36   | 29.11 | 5  | 115.96 |
| 314 G   | 100 | 92 PJ-3 | Human-M | 35   | 268 Yes | None | None | None | Dry | 3/9/2005 | 1055 | 33   | 36   | 29.11 | 5  | 117.41 |
| 315 G   | 100 | 76 GT   | Human-M | 35   | 230 Yes | None | None | None | Dry | 3/9/2005 | 1057 | 33   | 36   | 29.11 |    |        |
| 317 H   | 100 | 78 PJ-2 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1100 | 33   | 36   | 29.11 |    |        |
| 318 H   | 100 | 80 PJ-3 | Human-M | 35   | 268 Yes | None | None | None | Dry | 3/9/2005 | 1102 | 33   | 36   | 29.11 |    |        |
| 319 H   | 100 | 76 PJ-4 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1104 | 32   | 37   | 29.11 |    |        |
| 320 H   | 100 | 79 GT   | Human-M | 35   | 230 Yes | None | None | None | Dry | 3/9/2005 | 1105 | 32   | 37   | 29.11 |    |        |
| 323 H   | 100 | 81 PJ-2 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1107 | 32   | 37   | 29.11 |    |        |
| 324 H   | 100 | 78 PJ-3 | Human-M | 35   | 268 Yes | None | None | None | Dry | 3/9/2005 | 1109 | 32   | 37   | 29.11 |    |        |
| 325 H   | 100 | 80 PJ-4 | Human-M | 35   | 266 Yes | None | None | None | Dry | 3/9/2005 | 1111 | 32   | 37   | 29.11 |    |        |
| 328 H   | 100 | 81 GT   | Human-M | 35   | 230 Yes | None | None | None | Dry | 3/9/2005 | 1113 | 32   | 37   | 29.11 |    |        |
| 330 H   | 100 | 78 PJ-6 | Human-M | 35   | 335 Yes | None | None | None | Dry | 3/9/2005 | 1115 | 32   | 37   | 29.11 |    |        |
| 331 H   | 100 | 76 PJ-3 | Human-M | 35   | 268 Yes | None | None | None | Dry | 3/9/2005 | 1117 | 33   | 39   | 29.11 |    |        |
| 333 H   | 100 | 79 PJ-6 | Human-M | 35   | 335 Yes | None | None | None | Dry | 3/9/2005 | 1120 | 33   | 39   | 29.11 |    |        |
| 334 H   | 100 | 81 PJ-2 | Human-M | 35   | 296 Yes | None | None | None | Dry | 3/9/2005 | 1122 | 33   | 39   | 29.11 | 13 | 77.94  |

|     |      |     |    |       |         |    |     |     |      |      |      |     |           |      |    |    |       |    |       |
|-----|------|-----|----|-------|---------|----|-----|-----|------|------|------|-----|-----------|------|----|----|-------|----|-------|
| 336 | I    | 100 | 79 | PJ-4  | Human-M | 35 | 296 | Yes | None | None | None | Dry | 3/9/2005  | 1124 | 33 | 39 | 29.11 | 13 | 75.04 |
| 337 | I    | 100 | 79 | PJ-6  | Human-M | 35 | 365 | Yes | None | None | None | Dry | 3/9/2005  | 1125 | 33 | 39 | 29.11 | 6  | 95.62 |
| 338 | I    | 100 | 82 | GT    | Human-M | 35 | 245 | No  | None | None | None | Dry | 3/9/2005  | 1127 | 33 | 30 | 29.11 | 15 | 73.51 |
| 339 | I    | 120 | 81 | PJ-2  | Human-M | 35 | 296 | Yes | None | None | None | Dry | 3/9/2005  | 1128 | 33 | 39 | 29.11 | 19 | 74.8  |
| 340 | I    | 100 | 77 | PJ-3  | Human-M | 35 | 298 | Yes | None | None | None | Dry | 3/9/2005  | 1130 | 33 | 38 | 29.11 | 10 | 80.96 |
| 341 | I    | 120 | 89 | PJ-4  | Human-M | 35 | 296 | Yes | None | None | None | Dry | 3/9/2005  | 1131 | 33 | 38 | 29.11 | 15 | 83.66 |
| 343 | I    | 120 | 89 | PJ-6  | Human-M | 35 | 365 | Yes | None | None | None | Dry | 3/9/2005  | 1133 | 33 | 38 | 29.11 | 10 | 98.36 |
| 344 | I    | 120 | 89 | GT    | Human-M | 35 | 245 | No  | None | None | None | Dry | 3/9/2005  | 1135 | 33 | 38 | 29.11 | 20 | 66.96 |
| 345 | I    | 120 | 90 | PJ-3  | Human-M | 35 | 298 | Yes | None | None | None | Dry | 3/9/2005  | 1136 | 33 | 38 | 29.11 | 14 | 88.05 |
| 447 | A-1a | 100 | 66 | PJ-7  | Human-M | No | 178 | No  | None | None | None | Dry | 4/20/2005 | 1044 | 73 | 44 | 29.97 | 5  | 79.71 |
| 448 | A-1a | 100 | 66 | PJ-8  | Human-M | No | 194 | No  | None | None | None | Dry | 4/20/2005 | 1046 | 73 | 44 | 29.97 | 5  | 79.71 |
| 449 | A-1a | 100 | 66 | PJ-9  | Human-M | No | 219 | No  | None | None | None | Dry | 4/20/2005 | 1048 | 73 | 44 | 29.97 | 5  | 79.71 |
| 450 | A-1a | 100 | 66 | PJ-10 | Human-M | No | 217 | No  | None | None | None | Dry | 4/20/2005 | 1050 | 73 | 44 | 29.97 | 5  | 79.71 |
| 452 | A-1a | 120 | 74 | PJ-7  | Human-M | No | 178 | No  | None | None | None | Dry | 4/20/2005 | 1050 | 73 | 44 | 29.97 | 12 | 70.73 |
| 453 | A-1a | 120 | 74 | PJ-8  | Human-M | No | 184 | No  | None | None | None | Dry | 4/20/2005 | 1051 | 73 | 44 | 29.97 | 9  | 79.55 |
| 454 | A-1a | 120 | 76 | PJ-9  | Human-M | No | 218 | No  | None | None | None | Dry | 4/20/2005 | 1052 | 73 | 44 | 29.97 | 5  | 94.21 |
| 455 | A-1a | 120 | 76 | PJ-10 | Human-M | No | 217 | No  | None | None | None | Dry | 4/20/2005 | 1052 | 73 | 44 | 29.97 | 10 | 79.51 |
| 457 | A-3b | 100 | 65 | PJ-7  | Human-M | 35 | 228 | Yes | None | None | None | Dry | 4/20/2005 | 1057 | 73 | 44 | 29.97 | 5  | 78.26 |
| 458 | A-3b | 100 | 65 | PJ-8  | Human-M | 35 | 244 | Yes | None | None | None | Dry | 4/20/2005 | 1058 | 73 | 44 | 29.97 | 5  | 78.26 |
| 459 | A-3b | 100 | 65 | PJ-9  | Human-M | 35 | 269 | Yes | None | None | None | Dry | 4/20/2005 | 1059 | 73 | 44 | 29.97 | 5  | 78.26 |
| 460 | A-3b | 100 | 65 | PJ-10 | Human-M | 35 | 267 | Yes | None | None | None | Dry | 4/20/2005 | 1100 | 73 | 44 | 29.97 | 5  | 78.26 |
| 462 | A-3b | 120 | 79 | PJ-7  | Human-M | 35 | 228 | Yes | None | None | None | Dry | 4/20/2005 | 1101 | 73 | 44 | 29.97 | 10 | 83.86 |
| 463 | A-3b | 120 | 79 | PJ-8  | Human-M | 35 | 244 | Yes | None | None | None | Dry | 4/20/2005 | 1102 | 73 | 44 | 29.97 | 12 | 77.98 |
| 464 | A-3b | 120 | 79 | PJ-9  | Human-M | 35 | 269 | Yes | None | None | None | Dry | 4/20/2005 | 1102 | 73 | 44 | 29.97 | 5  | 98.56 |
| 465 | A-3b | 120 | 79 | PJ-10 | Human-M | 35 | 267 | Yes | None | None | None | Dry | 4/20/2005 | 1103 | 73 | 44 | 29.97 | 10 | 83.86 |
| 467 | I    | 100 | 67 | PJ-7  | Human-M | 35 | 258 | Yes | None | None | None | Dry | 4/20/2005 | 1105 | 73 | 44 | 29.97 | 7  | 75.28 |
| 468 | I    | 100 | 67 | PJ-8  | Human-M | 35 | 274 | Yes | None | None | None | Dry | 4/20/2005 | 1106 | 73 | 44 | 29.97 | 10 | 66.46 |
| 469 | I    | 100 | 67 | PJ-9  | Human-M | 35 | 299 | Yes | None | None | None | Dry | 4/20/2005 | 1107 | 73 | 44 | 29.97 | 11 | 63.52 |
| 470 | I    | 100 | 67 | PJ-10 | Human-M | 35 | 297 | Yes | None | None | None | Dry | 4/20/2005 | 1108 | 73 | 44 | 29.97 | 8  | 72.34 |
| 472 | I    | 120 | 79 | PJ-7  | Human-M | 35 | 258 | Yes | None | None | None | Dry | 4/20/2005 | 1109 | 73 | 44 | 29.97 | 13 | 75.04 |
| 473 | I    | 120 | 79 | PJ-8  | Human-M | 35 | 274 | Yes | None | None | None | Dry | 4/20/2005 | 1110 | 73 | 44 | 29.97 | 12 | 77.98 |
| 474 | I    | 120 | 79 | PJ-9  | Human-M | 35 | 299 | Yes | None | None | None | Dry | 4/20/2005 | 1111 | 73 | 44 | 29.97 | 14 | 72.1  |
| 475 | I    | 120 | 79 | PJ-10 | Human-M | 35 | 297 | Yes | None | None | None | Dry | 4/20/2005 | 1112 | 73 | 44 | 29.97 | 10 | 83.86 |
| 476 | A-1b | 60  | 61 | S-39  | Human-F | No | 145 | Yes | None | None | None | Dry | 4/21/2005 | 1000 | 51 | 71 | 30.04 |    |       |
| 477 | A-1b | 60  | 61 | D-18  | Human-F | No | 170 |     | None | None | None | Dry | 4/21/2005 | 1001 | 52 | 69 | 30.04 |    |       |
| 478 | A-1b | 80  | 69 | S-39  | Human-F | No | 145 | Yes | None | None | None | Dry | 4/21/2005 | 1003 | 53 | 69 | 30.04 |    |       |
| 479 | A-1b | 80  | 69 | D-18  | Human-F | No | 170 |     | None | None | None | Dry | 4/21/2005 | 1005 | 52 | 69 | 30.04 |    |       |
| 480 | A-3b | 60  | 61 | S-39  | Human-F | 35 | 180 | Yes | None | None | None | Dry | 4/21/2005 | 1008 | 52 | 69 | 30.04 |    |       |
| 481 | A-3b | 60  | 61 | D-18  | Human-F | 35 | 220 | Yes | None | None | None | Dry | 4/21/2005 | 1011 | 52 | 69 | 30.04 |    |       |
| 482 | A-3b | 80  | 70 | S-39  | Human-F | 35 | 180 | Yes | None | None | None | Dry | 4/21/2005 | 1014 | 52 | 69 | 30.04 |    |       |
| 483 | A-3b | 80  | 71 | D-18  | Human-F | 35 | 220 | Yes | None | None | None | Dry | 4/21/2005 | 1019 | 52 | 69 | 30.04 |    |       |
| 484 | I    | 60  | 61 | S-39  | Human-F | 35 | 210 | Yes | None | None | None | Dry | 4/21/2005 | 1022 | 52 | 69 | 30.04 |    |       |
| 485 | I    | 60  | 61 | D-18  | Human-F | 35 | 250 | Yes | None | None | None | Dry | 4/21/2005 | 1024 | 52 | 69 | 30.04 |    |       |
| 486 | I    | 80  | 69 | S-39  | Human-F | 35 | 210 | Yes | None | None | None | Dry | 4/21/2005 | 1027 | 52 | 69 | 30.04 |    |       |
| 487 | I    | 80  | 71 | D-18  | Human-F | 35 | 250 | Yes | None | None | None | Dry | 4/21/2005 | 1032 | 52 | 69 | 30.04 |    |       |