An email from AAHPERD. Then a missed phone call from an unrecognized number from Houston? Could this really be happening? There was no problem…it was NASA, of the Johnson Space Center-kind…in Houston! How that unforgettable call unfolded…. NASA: Hi! Yes! This is NASA. We’re inviting you for an all expenses-paid week to work alongside our scientists and astronauts for the first ever HEALTH & FITNESS Physical Education Week. We hope you’ll join us. Are you interested? Me: Really! (awkward pause). Let me get this right…you’re inviting me to NASA to write curriculum!? Wow! Well, I need to check my schedule… (who tells NASA…you need to check your schedule?…what are you thinking?) Minutes later…. Me: Mom…is dad home? You’re not going to believe this…NASA just called! Mom: Really! Me: YES! They’re inviting me for a week-long visit as part of the “Health & Fitness Week” to write content that includes students with disabilities in their Train Like an Astronaut (TLA) /Mission X program activities. Mom: Oh my! I’m not sure what all that means but tell me you said yes! Me: I said (oh no)… I needed to check my schedule! Receiving such a phone call; any educator simply doesn’t ever imagine happening in one’s career. As one of seven selected national and/or district AAHPERD Teachers of the Year; I knew this was something special. This was a one of a kind invitation; a very rare opportunity with fellow AAHPERD members for a chance to travel to the National Aeronautics and Space Administration (NASA) at the Johnson Space Center (JSC) in Houston to take part in the first ever “Health & Fitness” Week. As invitees, we were to serve as the external experts in physical education, fitness, and health to help develop new content by NASA’s Human Research Program Education and Outreach (HRPEO) staff, Train Like an Astronaut (TLA)/Mission X Program. It is the purpose of this article to provide an overview of an unprecedented, behind the scenes week of escorted tours through secured NASA facilities; of opportunities to speak directly with NASA scientists; and to teach alongside NASA astronauts preparing to travel to the International Space Center this September.

After the shock was over, and prior to the 2013 school year close, responsibilities to the project had already begun. Initial information regarding the TLA activities, tasks, and expectations for the week and project had been shared. Prior to arriving, the online lesson content was to be reviewed for page layout, content, and flow. Scheduled telecom phone calls occurred to offer briefings about the approaching week. With each call or communication, the Health and Fitness Week schedule came closer to fruition. Hotel and travel arrangements were finalized.

Following a completion of background and citizenship checks, definition of expected apparel and shoe wear, explanation of the strict safety and policy procedures, all invitees were provided a copy of the Health & Fitness Week 2013, NASA’s HRPEO Program, Train Like an Astronaut Project, handbook, commitment, and agreement. This agreement required my signature and as I signed I realized how surreal this opportunity was. Touted as a week of adventure and time for educational exchange, it certainly was not filled with typical tourist events. Human Research Program Education and Outreach (HRPEO) Project Goals

Guided by members of the NASA’s HRPEO team, the goals were targeted. The week schedule of activities were planned in such a way to assist in gaining knowledge of human space travel and scientific exploration and research and the space relevance of each of the TLA project content and future directions.

1. Assist NASA in content development for Train Like an Astronaut
   a. Develop new physical fitness, educational/health and/or adapted physical education content for students in Grades 3 to 6.

   b. Develop new physical fitness, educational/health and/or adapted physical education content for students in Grades 6 to 8 providing a smooth transition from the current offerings for students in Grades 3 to 6.

   c. In accordance with NASPE standards, add new flexibility modules for the physical activities offered for students in Grades 3 to 6.

2. Become familiar with the Train Like an Astronaut project and existing activities, found on: http://go.nasa.gov/SpaceFit

3. Enhance knowledge and understanding of the space relevance in the Train Like an Astronaut activities
   a. Tour unique NASA facilities and attend presentations on current projects and programs occurring at the

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Johnson Space Center

4. Assist in a coordinated student event with Astronaut Mike Hopkins
5. Continue work on the newly developed activities after the week is over
   a. Provide NASA a completed draft within the next school year
   b. Support any beta assessment and evaluation of the new content over the school year (Personal communication, C. Lloyd, 2013; Train Like an Astronaut Health and Fitness Week outline).

ITINERARY OVERVIEW (July 14-19, 2013)

Day One: Flight to Houston, Johnson Space Center NASA, TLA Week!

An opening reception and dinner to meet our NASA hosts and family members featured local and regional dishes of brisket, Louisiana sausage, baked chicken, fresh crab caught right off the NASA backyard bay waters, sweet corn bread, salads, fresh fruits, desserts, and drinks. It was a quite a beginning, marked by great food, shared excitement for the coming week’s events, and awesome hospitality. Prior to the real work getting underway, our first day at NASA’s TLA Week was reviewed emphasizing that Monday would mark the first of many early mornings. It was a perfect evening that welcomed us into the NASA family.

Day Two: The Sonny Carter Training Facility, Neutral Buoyancy Laboratory (NBL) and Pool

An early morning rendezvous in the hotel lobby at 7 am allowed us to turn in our release forms and make the short commute to the Johnson Space Center. Next stop, getting our ever-present NASA badges and then the work starts with our first tour of the NBL.

If you’ve ever wondered how an astronaut trains to walk in space, the training takes place in the NBL pool. This facility houses one of the world’s largest and perhaps most impressive indoor pools. The pool dimensions are 202 feet in length, 102 feet wide, and 40 feet 6 inches deep. It contains 6.2 million gallons of chlorinated fresh water with temperatures ranging from 84 to 86 degrees Fahrenheit (S. Townsend, personal communication, July 15, 2013). The massiveness of this facility was awe-inspiring. On the pool deck the multiple large scale cranes are not easily overlooked. These are used to move on-deck and in-water equipment as well as lower astronauts into the water. The cranes are across from the second level, enclosed control rooms on the opposite side of the pool. The control rooms are home to extensive video and audio components that capture the astronauts training sessions, oversee logistics, engineering, and technical support systems. The sheer size of the pool is overwhelming. It holds a full-size mock-up of the International Space Station (ISS) modules, payloads, and space flight vehicles from other invited countries.

Astronauts train for mission practice flight procedures and to verify feasibility and compatibility of mission specific hardware. Each astronaut is accompanied by three support divers that serve as escorts/assistants to the astronauts with underwater maneuvers while being ever attentive to each astronaut’s safety.

Neutral buoyancy and zero gravity weightlessness are not precisely alike. As seen through space flight footage, objects float when placed into space; whereas, objects in water rely on weight(s) to lower or remain submerged. Movement in water is slowed due to resistance or drag in the water, so even though the NBL does not offer a perfect replica of zero gravity atmospheres, training in the NBL is the closest to zero gravity movement for training on Earth (Neutral Buoyancy Laboratory Staff, personal communication, July 15, 2013). What an incredible first day!

Figure 1. NASA Astronauts Steven Swanson (right) and Reid Wiseman (left) in their ‘astronaut underwear’ suits on NBL pool deck.

Figure 2. NASA Neutral Buoyancy Laboratory Pool.

Figure 3. Astronaut Reid Wiseman with National APE TOY Linda Hilgenbrinck
**Day Two: Rocket Park**

Rocket Park (RP) is located close to the main entrance to NASA's Johnson Space Center. Touring this facility allowed a break from the work session and provided a great historical perspective of man’s effort to ‘launch’ into space. RP is home to the Saturn V, built to send astronauts to the moon, carried the Apollo program flights, and launched the Skylab station into space. While at the park, other rockets viewed included the Mercury-Redstone (unmanned) and the Little Joe II (L. Abadie, personal communication, July 15, 2013).

![Rocket Park, Saturn V](image1)

![Rocket Park, Saturn V rocket boosters](image2)

After the tour as we headed back to work on the TLA content. The day finished with our initial discussion and preliminary prepping for the TLA event with the astronauts at Gilruth Gym.

**Day Three: Astronaut Gym**

There cannot be a better way to grasp the training regimens of astronauts than to visit what was referred to as the “Astronaut Gym.” Each astronaut’s exercise routine is monitored, adjusted as needed based on scheduled mission tasks, monthly fitness assessment baseline data, and established routine exercise sessions. Within the confines of the Astronaut Gym, the Advanced Resistance Exercise Device (ARED), the Combined Operational Load-Bearing External Resistance Treadmill (COLBERT), and NASA’s version of a cycle can be found.

The Advanced Resistive Exercise Device (ARED) is comprised of pivotal vacuum cylinder resistant bars that can carry up to 600 pounds. ARED simulates free weight lifting exercises performed in a gym. Astronauts living on the International Space Station, for periods up to 6 months, are required to exercise two hours per day. It is essential for astronauts to exercise daily to maintain pre-mission, mission, and post-mission muscle strength, mass, and endurance. This apparatus has the capability to take an astronaut through a variety of resistive exercises targeting the major muscle groups for squats, dead lifts, heel lifts, calf raises, and others. These types of exercises assist astronauts in preventing muscle strength and mass, lessening bone loss, and endurance while in space and particularly on long missions. Without the ARED exercises, astronauts could potentially lose up to 15% of muscle volume, which is difficult to nearly impossible to recoup when back on Earth. (S. Townsend, C. Lloyd & Astronaut Gym Scientists, personal communication, 2013; www.nasa.gov/mission_pages/station/research/experiments/1001.html)

![Figure 6 & 7: NASA scientist demonstrating the Advanced Resistance Exercise Device (ARED)](image3)

The treadmill is named after the Comedian Stephen Colbert (Combined Operational Load-Bearing External Resistance Treadmill) and specially designed to allow astronauts to be held in place to the surface of the treadmill. A harness is worn over the shoulders and belted to rest at the hips providing the anchor by a combination of bungee cords and chains that connect to the base of the treadmill. This specialized harness keeps the astronauts from floating across the space station with each heel-strike and foot push off. Sensitive to body weight or load, the straps create the feeling of running while wearing a weighted vest or heavy backpack. At missions start, a load is set at approximately 60% of an astronaut’s body weight. As the mission lengthens, the astronaut attempts to load at a level of 85% to 100% body weight. As the load increases, an astronaut’s workout becomes more challenging. (S. Townsend, C. Lloyd & Astronaut Gym Scientists, personal communication, 2013; www.nasa.gov/mission_pages/station/behindscenes/colberttreadmill.html)

![Figure 8: National APE TOY Linda Hilgenbrinck receiving instruction on the COLBERT](image4)
als. Void of any seat, astronauts must stabilize themselves by holding on to the wall or another stabilized object.

Figure 9: NASA’s Bicycle Ergometer in Space

The tour of the Astronaut’s Gym was topped off with lunch at Building 3, the Astronaut Cafeteria. During lunch, members of the Space Food Systems Laboratory displayed packed foods ready for a mission deployment and discussed/demonstrated beverage containers’ design and function for space missions. Sample food items were offered to attendees to taste.

Day Four: Train Like an Astronaut/Mission X Student Event

Perhaps the most anticipated event for all of us as National TOYs was meeting the astronauts. On Day Four, we met Astronaut Mike Hopkins and his team of astronauts: Steven Swanson, Kate Rubins, and Tracey Caldwell Dyson and assisted them with the Gilruth Facility Summer Health and Fitness Camp. Hopkins, scheduled to travel to the International Space Station on September 25, 2013 highlighted a message of fitness and good health for everyone throughout their lives (Personal communication C. Lloyd, S. Townsend, 2013). In support of Hopkins message, the HRPEO TLA program will have exposure to his mission from PRE-Flight, IN-Fight, and POST-Flight fitness and health outcomes.

In preparation to lead four rotating groups in the selected TLA activities, the gym was filled with over 70 students, parents, media reporters, and cameras. Hopkins focused on the “Jump for the Moon” jump rope station - my assigned station! As an Adapted Physical Education Specialist assigned to the jump rope station, it was my responsibility to offer a variety of jumping options so ALL the students could find success. The “Jump for the Moon” gave witness to some incredible jumpers…with a role model like Mike Hopkins…is it any surprise? Day 4 was incredible!

Figure 10: National APE TOY Linda Hilgenbrinck, Astronaut Mike Hopkins, headed to the International Space Station, September 25th, and AAHPERD Senior Director of NASPE Programs, Cheryl Richardson

Figure 11: National APE TOY Linda Hilgenbrinck and Astronaut Mike Hopkins, at the “Jump for the Moon” station, Train Like an Astronaut Student Event, NASA’s Gilruth Facility

Figure 12: Train Like an Astronaut Student Event, NASA’s Gilruth Facility, National and District TOYs 2012, forming “X” for Mission X, identifying Astronauts (in blue tee-shirts) from left to right: Kate Rubins, Mike Hopkins, Steven Swanson, and Tracey Caldwell Dyson

Day Five: Neuroscience Sensorimotor Adaptability Team Laboratory

With the Train Like an Astronaut Student Event concluded, the focus shifted to one of writing as much new content as possible with the remaining time at NASA. Just as the others, this final day started with an early rise to get started. A day filled with tours and each as fascinating as the other. Each tour continued emphasized the potential of new development to target physical fitness, health, and nutrition activity lesson content.

Space Food Systems Laboratory

Scientists worked feverishly to offer a wide array of food items for each astronaut to consume while in space. Constant feedback solicited from the astronauts regarding food quality and taste is an ongoing process. Astronauts are invited in for food/meal tastings prior to each mission. Each astronaut gets to selected desired food items to sustain them while in space. New dietary food choices are under constant development. Nutritional value of consumed food is vital to each astronaut’s personal expenditure of calories and nutrients and particularly important in recouping of muscle mass, endurance, and physical recovery.
Figure 13: Space Food Systems Laboratory lecture

Mission Control Centers (MCC)

Located in Building 30 North, the historic Mission Control Center, is identified on the United States National Registry Historic Place site. This site is commonly referred to as the Apollo Mission Control Center, for the Apollo 13 mission crisis and safe return of the astronauts. The Building 30 South, the New Mission Control Center, oversees all current space vehicle flights, from lift-off to landing or mission’s completion. We toured each facility.

Figure 14 & 15: Apollo Mission Control Center (right); New Mission Control Center (left)

Space Vehicle Mock-up Facility

Building 9 North East serves as home to staggering displays of NASA’s current day space vehicle mission mockups and poignantly gives tribute to lost astronaut crews. Every module on the International Space Station is there and used during routine astronaut training for systems familiarization. On the day of our tour, astronauts were nearby on the floor of the facility completing scheduled training.

Figure 16: Space Shuttle Mock-up

Day Six: Departure from NASA. Train Like an Astronaut/Mission X

The Train Like an Astronaut (TLA) lessons were created for educators to implement NASA specific content targeting scientific and physical approach to human health and fitness on Earth and in space. The TLA lessons were intended for student’s ages 8 to 12 years and include both physical (10) and educational (3) activities replicating actual physical tasks and skills astronauts perform while on a mission in space. Students gain an understanding of the science behind physical fitness and nutrition by participating in structured hands-on activities that relate to physical Earth-based needs and to the requirements of exploring space (Personal communication, C. Lloyd, 2013; Train Like an Astronaut unpublished manual activities, 2013). For each of the physical activities, students are to write reflectively and enter their observation in the Mission Journal. The physical activities as well as the educational activities can be located on this link and content was summarized and included in Table 1: http://www.nasa.gov/audience/foreducators/trainlikeanastronaut/home/index.html

References


National Aeronautics and Space Administration. (n.d.). Have You Ever Wondered What it is Like to Train Like an Astronaut? Received unpublished spiral bound manual July 14, 2013, from the Human Research Program Education and Outreach Program.


Table 1: Train Like an Astronaut (TLA) Activity

<table>
<thead>
<tr>
<th>TLA Titles</th>
<th>Student Task Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agility-Astro Course</td>
<td>• complete an agility course as quickly and accurately as possible to improve</td>
</tr>
<tr>
<td></td>
<td>agility, coordination and speed</td>
</tr>
<tr>
<td></td>
<td>• comment on agility in the Mission Journal</td>
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<tr>
<td>Building an Astronaut Core</td>
<td>• perform Commander Crunch and Pilot Plank exercises to improve strength in</td>
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<td></td>
<td>abdominal and back muscles</td>
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<tr>
<td></td>
<td>• record your observations about improvements in core muscle strength in the</td>
</tr>
<tr>
<td></td>
<td>Mission Journal</td>
</tr>
<tr>
<td>Crew Assembly</td>
<td>• assemble a puzzle quickly/correctly to understand the importance of dexterity</td>
</tr>
<tr>
<td></td>
<td>and hand-eye coordination,</td>
</tr>
<tr>
<td></td>
<td>• practice communication and problem-solving skills</td>
</tr>
<tr>
<td></td>
<td>• record observations about dexterity and hand-eye coordination in the Mission</td>
</tr>
<tr>
<td>Explore and Discover</td>
<td>• carry weighted objects safely from the Exploration Area back to your Base</td>
</tr>
<tr>
<td></td>
<td>Station to improve aerobic and anaerobic fitness</td>
</tr>
<tr>
<td></td>
<td>• record observations about improvements in aerobic and anaerobic fitness in</td>
</tr>
<tr>
<td></td>
<td>the Mission Journal</td>
</tr>
</tbody>
</table>
| Speed of Light | • perform a time reaction activity using a ruler to practice your hand-eye reaction time and improve concentration  
• collect, record, and analyze data during the skill-based experience in the Mission Journal |
| Living Bones, Strong Bones | • observe bones, comparing bone size relative to the living being in which the bones are found  
• design a bone model, compare and contrast the weight bearing capacity of the bone model, make inference about bone structure, weight bearing bones, and the effects of different environments on bones |
| Energy of an Astronaut | • investigate the Myplate diagram to learn the basic foods of a well balanced diet  
• learn how different foods are categorized in the Myplate diagram  
• examine Nutrition Facts labels including serving sizes and calories  
• determine daily energy needs  
• design a five-day menu based on the Myplate recommendations |
| Base Station Walk-Back | • perform a walk, progressing to 1600 m (1 mi) to improve lung, heart, and other muscle endurance  
• record observations about improvements in walk-back physical endurance experience in the Mission Journal |
| Crew Station Training | • perform body-weight squats, push-ups to develop upper and lower body strength in muscles and bones  
• record observations about improvements in strength training in the Mission Journal |
| Do a Spacewalk | • perform the “bear crawl” and “crab walk” to increase muscular strength, improve upper and lower body coordination  
• record observations about improvements in muscular strength, upper and lower body coordination in the Mission Journal |
| Jump for the Moon | • perform jump training with a rope, both stationary and moving to increase bone strength and improve heart and muscle endurance  
• record observations about improvements in stationary and moving jump training in the Mission Journal |
| Mission Control | • perform throwing and catching techniques on one foot to improve balance and spatial awareness  
• record observations about improvements in balance and spatial awareness in the Mission Journal |
| Hydration Station | • identify their own hydration levels by creating and analyzing simulated urine;  
• research hydration and create a visual web about hydration and the human body;  
• investigate simulated urine samples to determine the visual properties of urine during different levels of hydration; and  
• learn the importance for astronauts to drink plenty of fluid while in space to maintain a hydrated state while returning to Earth |

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