

## MISSION X: MISSION HANDOUT



### YOUR MISSION: **Mission: Control!**

You will perform throwing and catching techniques on one foot to improve balance and *spatial awareness*. You will also record observations about improvements in balance and *spatial awareness* during this physical experience in your Mission Journal.

All people need to have well-developed balance and *spatial awareness*. If not, we would all fall over constantly and have trouble walking around corners. Seeing our surroundings and being able to move around them is important so we do not bump into things and get hurt.

When you are participating in athletics, especially sports such as dancing, skateboarding, bowling, diving, and skiing, balance and *spatial awareness* are very important. Even jumping on a trampoline or riding a bicycle requires both!

**MISSION QUESTION:** How could you perform a physical activity that would improve balance and *spatial awareness*?



### MISSION ASSIGNMENT: **Balance Training**

#### ○ **Practice:**

- ⇒ Choose a smooth-surfaced solid wall, approved by an adult for use.
- ⇒ Bounce a tennis ball off the wall and try to catch it while balancing on one foot. Raise your foot up behind you, level with your knee.
- ⇒ Count how many seconds you can stand on one foot while throwing the tennis ball against the wall. Try not to let the ball or your foot touch the floor. Try to balance for at least 30 seconds without falling.
- ⇒ Continue to practice this activity over time until you can keep your balance for 60 seconds without having to start over.

#### ○ **Game:**

Divide into groups, each forming a circle. Each circle should contain at least 6 players. In your circle:

- ⇒ Space a distance more than arms length apart.
- ⇒ Try to balance on one foot while gently tossing a gym ball to a player across from you.
- ⇒ If a player loses balance and both feet touch the floor, he or she must hop on one foot, around the outside of the circle before rejoining the game.

- Record observations before and after this physical experience in your Mission Journal.

**Follow these instructions to train like an astronaut.**

**Spatial Awareness:**

Knowing where you are in your space compared to your surroundings.

**Agile:**

Being ready and able to move quickly and easily.

**Coordination:**

Using your muscles together to move your body the way you want it to.

**It's a Space Fact:**

During the first few days of space flight and after returning to Earth, astronauts experience a change in *spatial awareness* and may lose some sense of balance when they return to Earth. Research scientists from NASA's Neurosciences Laboratory closely monitor the crew members, who often report difficulty walking around corners and feeling like they are "tumbling" when they move their heads from side-to-side. Their brain has to relearn how to use information from their eyes, tiny balance organs in their inner ear, and their muscles to help control body movement. These problems are usually corrected after several weeks have passed and balance exercises are added to their fitness routine. Until then, they have to be extra careful; which means they may not be able to do some physical activities like fly a plane or drive a car.

**Fitness Accelerations**

- ☐ Bounce a tennis ball off a wall while balancing on one foot. Do this for 60 seconds. Without taking a break, change legs and balance on the opposite foot for 60 second. Take a 30 second break and repeat this routine five times.
- ☐ Conduct the above acceleration while balancing one foot on a small trampoline.
- ☐ Play the Balance Training Game with a partner by balancing one foot on a small trampoline. If a player loses their balance or drops a ball they should hop on one foot around both trampolines.



Improving your balance and *spatial awareness* will make you more *coordinated* and *agile*. It will decrease the chances of being hurt, or hurting someone else, due to a fall.

**Think Safety!**

- ☐ **While exploring, astronauts must watch out for rocks and craters in their paths to avoid tripping!**
- ☐ The area under your feet should be clear of all obstacles.
- ☐ Stay at least an arms distance from the wall and from others while doing this activity.
- ☐ Do not throw the ball too hard, nor use a ball that is too heavy.
- ☐ Remember that drinking plenty of water is important before, during, and after physical activities.

**Mission Explorations:**

- ☐ While standing still, stand on a soft surface and balance on one foot. Examples: towel, pillow, or cushion.
- ☐ Time yourself while trying to balance on two feet with your eyes closed. Open your eyes if you start to lose your balance.
- ☐ While practicing simple balance activities, you can also lift one foot to increase the difficulty.

**Status Check:** Have you updated your Mission Journal?



# Train Like an Astronaut: Adapted Physical Activity Strategies

## Mission Control

### YOUR MISSION

To improve balance and spatial awareness (one's understanding of themselves in relation to objects around them) you will perform throwing and catching techniques at the same time to maintain balance in challenging situations.

### LINK TO SKILLS AND STANDARDS

**APENS:** 2.01.06.01 Develop and implement programs that stimulate vestibular, visual, and proprioceptive senses (Perception of movement from within the body.)

**APENS:** 2.03.06.01 Structure tasks and activities involving the flight of objects to control for problems in timing that are evident in certain types of disabilities.

#### **Activity Specific Terms/Skills**

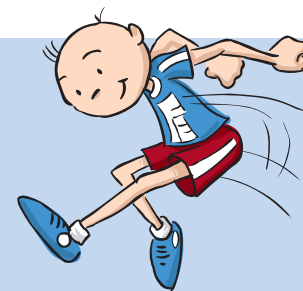
Balance, coordination, stability, hand-eye coordination, concentration, reaction time

### SPACE RELEVANCE

During and after space flight, astronauts have challenges with balance and spatial awareness. Through astronaut reconditioning, when they return to Earth, they relearn how to use their eyes, inner ear, and muscles to help control body movement.

### WARM-UP & PRACTICE

- ▲ Dead Bug (lay on the ground and put one arm and opposite leg in the air. Move opposite arms and legs back and forth like a bug)
- ▲ Bird dog (get on all fours and put one arm in the air and extend your opposite leg behind you).
- ▲ Wall walk
- ▲ Stretch arms, close eyes and touch nose
- ▲ Holding a table/bar, lift one foot at a time (marching)
- ▲ Tai Chi movement
- ▲ Bounce and catching a ball
- ▲ Balance on one foot for 1 sec., gradually increase time



#### SUGGESTED ADAPTED EQUIPMENT:

- ▲ BALLOON OR BEACH BALLS
- ▲ SAND OR BEAN BAG OR SQUISH BALL
- ▲ VELCRO GLOVES
- ▲ GARBAGE CAN



# Mission Control

## LET'S "TRAIN LIKE AN ASTRONAUT!"

Adjust steps and procedures as appropriate for participants

### Instructions for individual play:

- ▲ Bounce a tennis ball off the wall and try to catch it while balancing on one foot.
- ▲ Raise one foot up behind you, level with your knee.
- ▲ Count how many seconds you can stand on one foot while throwing the tennis ball against the wall. Try not to let the ball, or your foot, touch the floor. Try to balance for at least 30 seconds without falling.
- ▲ Continue to practice this activity over time until you can keep your balance for 60 seconds without having to start over.

### Instructions for group play:

- ▲ Divide into groups of 6 or more players, and stand to form a circle.
- ▲ In your circle: Space apart more than arms-length apart.
- ▲ Try to balance on one foot while gently tossing a gym ball to a player across from you.
- ▲ If a player loses balance and both feet touch the floor, he or she should hop on one foot around the outside of the circle before rejoining the game.
- ▲ Record observations of this physical experience in your Mission Journal.

## TRY THIS! *Some ideas for Adapted Activity*

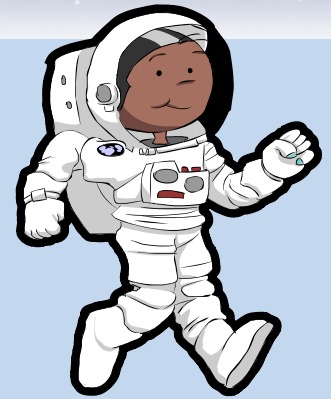
Divide into 3 missions (progress from 1 to 2 to 3):

Mission 1: Balance on one foot

Mission 2: Throwing and catching

Mission 3: Put Missions 1 and 2 together

- ▲ Vary the size of balls
- ▲ Velcro gloves (No Miss Mitts)
- ▲ Use chair, wall or bar to stabilize performer
- ▲ Throw ball to a target (on the floor, into a garbage can, on a wall, or Velcro)
- ▲ Using two hands to bounce or catch a beach ball
- ▲ Sand or bean bag drop
- ▲ Individual toss and catch between right and left hand
- ▲ Individually or in groups, isolate each skill in Mission 2; only throw or catch a ball
- ▲ Hold ball and squeeze and release
- ▲ Teach or review proper falling techniques in case they lose their balance







# MISSION: CONTROL!

## Learning Objectives

Students will

- perform throwing and catching techniques on one foot to improve balance and spatial awareness.
- record observations about improvements in balance and spatial awareness during this physical experience in the Mission Journal.

## Introduction

On Earth, we use a variety of cues to sense the position of our bodies, while stationary or moving. We use touch and pressure cues (such as weight on our feet) and visual cues (such as location of ceiling and floors) to determine orientation. On Earth, our sense of upright is determined by the pull of gravity as sensed by the balance organs of the inner ear. Our brains integrate all this sensory information to allow us to detect our body orientation and permit us to move within our environment.

However, in an environment with less gravity, the brain needs to relearn how to use these sensory signals. In space, astronauts free-float, so there are no pressure cues to the bottom of the feet. Their visual system can be fooled because there may be no distinct floor or ceiling in a spacecraft. In addition, information from the balance organs of the inner ear needs to be reinterpreted by the brain so astronauts can move in weightless or low gravity conditions. As the brain relearns how to interpret sensory information in space, astronauts sometimes experience disorientation and nausea at least for the first few days in space.

Even though crew members eventually become adapted to their weightless environment, at some point they must return to Earth. This requires relearning the cues given on Earth and limiting some physical activities such as driving a car or flying a plane, until their balance and spatial orientation is restored.

Balance and spatial awareness, along with overall fitness, can be improved by just practicing simple exercises involving balance and movement. Use the information below to help administer the Fit Explorer Mission Handout and help your students **train like an astronaut**.

## Administration

Follow the outlined procedure in the Mission: Control! Mission Handout. The duration of this physical activity can vary, but will average **15 minutes**. In order for students to perform at their maximum potential, positive reinforcement should be used throughout the activity.

## Location

This physical activity should be conducted on a flat, dry surface with access to a flat, solid wall, suitable for rebounding tennis balls.

## Set-up

Practice: Students should be at least arms length apart from the wall and each other.

Game:

- Students should be more than arms length apart.

- At least six players per group is optimal.

## Equipment

- Mission Journal and pencil
- Practice
  - tennis ball (one per student)
  - watch or stopwatch (one per student)
- Game: gym ball or similar sized/weighted ball (at least one per group)

*For physical activity, students should wear loose-fitting clothing that permits freedom of movement.*

## Safety

- Inform students of the importance of a safe environment when balancing.
- If dizziness is experienced, the activity should be stopped.
- Provide support for stability (i.e. hand support, back of chair) if necessary.
- Proper hydration is important before, during and after any physical activity.
- Be aware of the signs of overheating.
- A warm-up/stretching and cool-down period is always recommended.

*For information regarding warm-up/stretching and cool-down activities, reference the *Get Fit and Be Active Handbook (ages 6-17)* from the President's Council on Physical Fitness and Sports at <http://www.presidentschallenge.org/pdf/getfit.pdf>.*

## Monitoring/Assessment

Ask the Mission Question before students begin the physical activity. Have students use descriptors to verbally communicate their answers.

Use the following open-ended questions **before, during and after** practicing the physical activity to help students make observations about their own physical fitness level and their progress in this physical activity:

- How do you feel?
- How long were you able to balance?
- How hard or easy was it to balance?
- Did it get harder or easier as you practiced? Why?
- Did you ever lose your balance? Why?
- What organs do you use to help you gain your balance?
- What is an ideal setting to practice balancing? What setting is not ideal? Why?
- What might happen if you get really dizzy?
- Which of the following do you think is more difficult? Why?
  - One foot vs. two feet on the ground
  - Flat foot vs. raised foot
  - Head up vs. head tilted back
  - Eyes open vs. eyes closed
  - Touching nothing with your hands vs. touching the back of a chair

- Standing on a smooth, even surface vs. standing on a rough, uneven surface
- Do you think astronauts get dizzy in space?
- How come astronauts who stay in space a long time can't "practice" their balance until they return to Earth?

Some quantitative data for this physical activity may include:

- Practice
  - how many tries it took to balance 60 seconds
  - the improvement (in seconds) for each try
- Game: how many times the student was able to pass the ball

Some qualitative data for this physical activity may include:

- technique performance (foot raised behind at least level with knee)
- identifying amount of stability

## Collecting and Recording Data

Students should record observations about their physical experience with balance and spatial awareness in their Mission Journal before and after the physical activity. They should also record their physical activity goals and enter qualitative data for drawing conclusions.

- Monitor student progress throughout the physical activity by asking open-ended questions.
- Time should be allotted for the students to record observations about their experience in their Mission Journal before and after the physical activity.
- Graph the data collected in the Mission Journal on the graph paper provided, letting students interpret the data individually. Share graphs with the group.

## Fitness Accelerations

- Bounce a tennis ball off a wall while balancing on one foot. Do this for 60 seconds. Without taking a break, change legs and balance on the opposite foot for 60 second. Take a 30 second break and repeat this routine five times.
- Conduct the above acceleration while balancing one foot on a small trampoline. *If your school does not have small trampolines to work with please consider some of the alternative methods to create a balance challenge.*
  - *Students should use a balance beam by using a 2x4.*
  - *Students should balance on one foot by taking off their shoes.*
  - *Students should balance on the the ball of their foot*
- Play the Balance Training Game with a partner by balancing one foot on a small trampoline. If a player loses their balance or drops a ball they should hop on one foot around both trampolines. *The students will be balancing on one foot on a trampoline directly across from each other. Stress to the students that while their partner is hopping around both trampolines, they should continue to balance on their trampoline on one foot.*

## National Standards

National Physical Education Standards:

- Standard 1: Demonstrates competency in motor skills and movement patterns needed to perform a variety of physical activities.
- Standard 2: Demonstrates understanding of movement concepts, principles, strategies, and tactics as they apply to the learning and performance of physical activities.
- Standard 3: Participates regularly in physical activity.
- Standard 4: Achieves and maintains a health-enhancing level of physical fitness.
- Standard 5: Exhibits responsible personal and social behavior that respects self and others in physical activity settings
- Standard 6: Values physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.

National Health Education Standards (NHES) Second Edition (2006):

- Standard 1: Students will comprehend concepts related to health promotion and disease prevention to enhance health.
  - 1.5.1 Describe the relationship between healthy behaviors and personal health.
- Standard 4: Students will demonstrate the ability to use interpersonal communication skills to enhance health and avoid or reduce health risks.
  - 4.5.1. demonstrate effective verbal and non-verbal communication skills to enhance health.
- Standard 5: Students will demonstrate the ability to use decision-making skills to enhance health.
  - 5.5.4 Predict the potential outcomes of each option when making a health-related decision.
  - 5.5.6 Describe the outcomes of a health-related decision.
- Standard 6: Students will demonstrate the ability to use goal-setting skills to enhance health.
  - 6.5.1 Set a personal health goal and track progress toward its achievement.
- Standard 7: Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.
  - 7.5.2 Demonstrate a variety of healthy practices and behaviors to maintain or improve personal health.
- Standard 8: Students will demonstrate the ability to advocate for personal, family and community health.
  - 8.5.1 Express opinions and give accurate information about health issues.

## National Initiatives and Other Policies

Supports the *Local Wellness Policy*, Section 204 of the Child Nutrition and WIC Reauthorization Act of 2004 and may be a valuable resource for your Student Health Advisory Council in implementing nutrition education and physical activity.

## Resources

For more information about space exploration, visit [www.nasa.gov](http://www.nasa.gov).

To learn about exercise used during past and future space flight missions, visit <http://hacd/jsc.nasa.gov/projects/ecp.cfm>.



Access fitness-related information and resources at [www.fitness.gov](http://www.fitness.gov).

View programs on health and fitness:

Scifiles™ The Case of the Physical Fitness Challenge

<http://www.knowitall.org/nasa/scifiles/index.html>.

NASA Connect™ Good Stress: Building Better Bones and Muscles

<http://www.knowitall.org/nasa/connect/index.html>.

For more information on the neurovestibular system, visit:

NASA's Web of Life

- The Effects of Space Flight on the Human Vestibular System  
<http://weboflife.nasa.gov/learningResources/vestibularbrief.htm>

## Credits and Career Links

Lesson development by the NASA Johnson Space Center Human Research Program Education and Outreach team. Special thanks to the subject matter experts who contributed their time and knowledge to this project.

*National Aeronautics and Space Administration (NASA) contributors:*

David Hoellen, MS, ATC, LAT

Bruce Nieschwitz, ATC, LAT, USAW

Astronaut Strength, Conditioning & Rehabilitation (ASCR) Specialists

NASA Johnson Space Center

Jacob Bloomberg, Ph.D.

Neuroscience Laboratory

NASA Johnson Space Center

<http://hacd.jsc.nasa.gov/labs/neurosciences.cfm>

Linda H. Loerch, M.S.

Manager, Exercise Countermeasures Project

NASA Johnson Space Center

<http://hacd.jsc.nasa.gov/projects/ecp.cfm>

*President's Council on Physical Fitness and Sports (PCPFS) contributors:*

Thom McKenzie, Ph.D.

President's Council on Physical Fitness and Sports Science Board Member

Emeritus Professor of Exercise and Nutritional Sciences at San Diego State University

[http://www.presidentschallenge.org/advocates/science\\_board.aspx#Thom](http://www.presidentschallenge.org/advocates/science_board.aspx#Thom)

Christine Spain, M.A.

Director, Research, Planning, and Special Projects

President's Council on Physical Fitness and Sports, Washington, D.C.