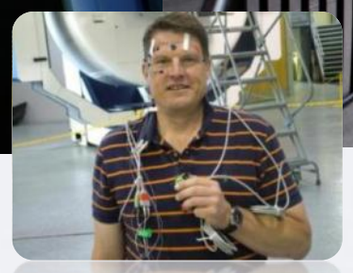
National AeroSpace Training & Research Center

The National AeroSpace Training And Research Center

The Premier Air & Space Training, Research, Educational Facility in the World.

TRAIN

Military | Civil | Space



TEST

Human Factors | Systems

EDUCATE

Students | Teachers

43 years physiology & simulation expertise in **87 countries** from ETC

First FAA Approved Center for Commercial Space Training

World-class, public access facility

Houses over **12 state-of-the-art** flight trainers

PARTNERS & CLIENTS

NASA

David Clark

utmb Health
Working together to work wonders.™

FEDERAL AVIATION ADMINISTRATION

BOSTON UNIVERSITY

NATIONAL SPACE BIOMEDICAL RESEARCH INSTITUTE
NSBRI

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

K'NEX

ISRAEL AIR FORCE

U.S. AIR FORCE

Massachusetts Institute of Technology

VIRTUOSO.
SPECIALISTS IN THE ART OF TRAVEL

JOHNS HOPKINS

PAKISTAN AIR FORCE ACADEMY

Virgin GALACTIC

UCF

SwRI®

GRUPO AÉREO DEL ORIENTE
FAC

DEPARTMENT OF THE NAVY
UNITED STATES OF AMERICA

BOY SCOUTS OF AMERICA

SIC ITUR AD ASTRA

Over 1500 People!

Altitude Chamber

Fixed Wing Trainer

Hyperbaric Lab

Night Vision Trainer

Rapid Decompression

Disaster Management Trainers

Spatial Disorientation Trainer (GYROLAB)

Space Module

Ejection Seat Trainer

Water Survival Trainer (off-site)

Commercial Aircraft Trainer

F-15 Tactical Module

General Aviation Trainer

EQUIPMENT

NASTAR Center Concept

- One-Stop-Shop, Turn-Key Facility
- Supports trng, res, edu. and/or Ent markets
- Located on/near to Air/spaceport

- Crew Health & Medical Research Areas
- Training Bays & Classroom Space
- Lab & Payload Testing /Prep Areas
- Interactive Exhibits & Education

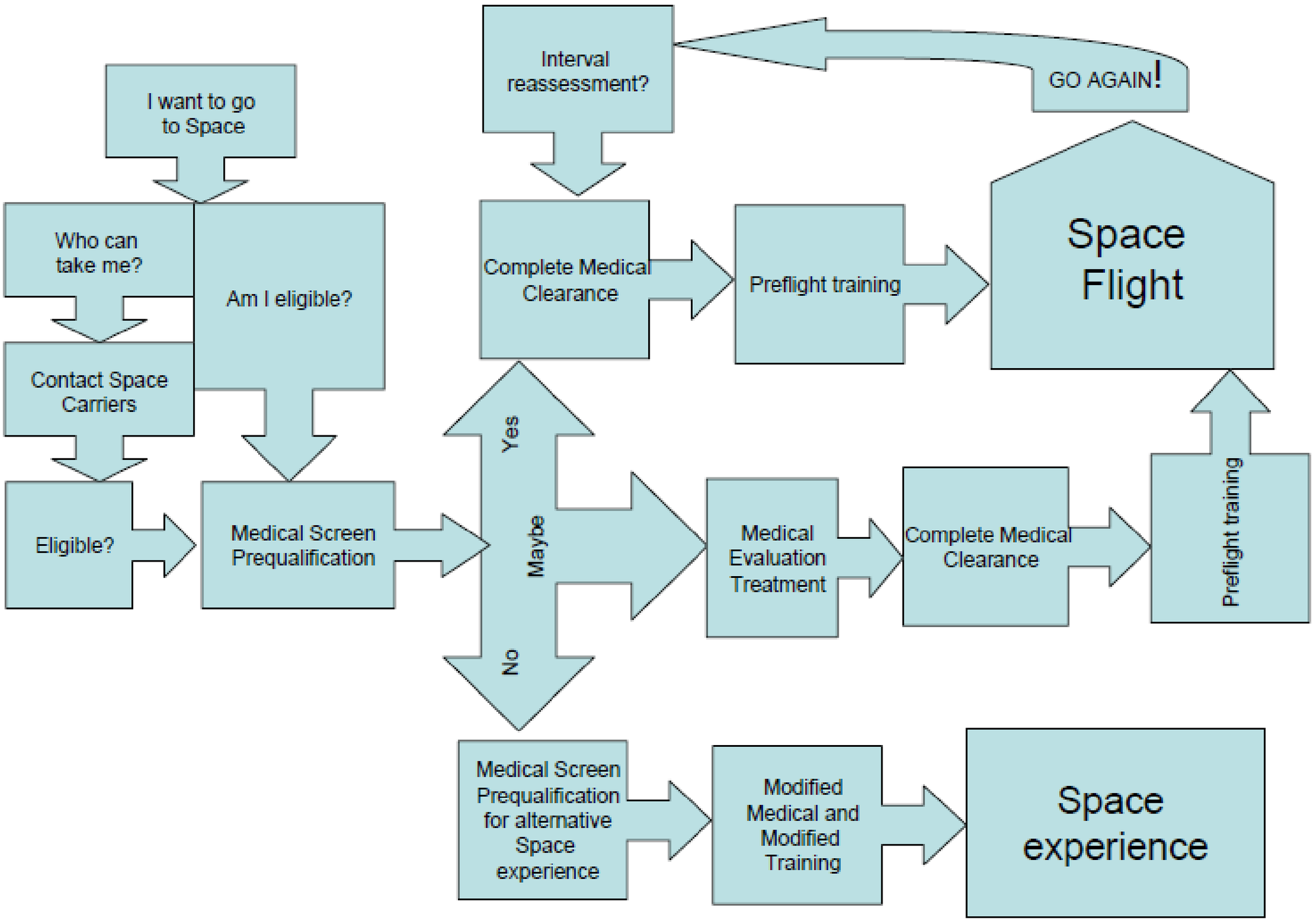
NASTAR® CENTER

www.nastarcenter.com

SPACE FLIGHT

The “Right Stuff” – Next Generation

Commercial Space Paradigm



OVERVIEW & OUTLOOK

Challenges & opportunities within the Commercial Space Industry

Going Commercial

1. **First-time, civilian access** to space; (fighter pilot → grandpa)
2. **New high performance rocket** vehicles (Pinto→ Ferrari)
3. Suborbital to start **2013;** Orbital to start **~2015/16**
4. Useful for **research**, **education**, **tourism**, **point-to-point transport**
5. **Cool Factor**: never been done, **thrilling, beautiful, dangerous, memorable, *once-in-a-lifetime experience!!***
6. **Unknown Factors**: human **health risks**, **human safety**, **training preparation** needed (what skills, lessons, emergencies to prepare for?), Gov regulations

Commercial Space More Complex

Suborbital Challenges

- Environment: Up to 360,000 ft; Mach 3+
- 6Gx and -4Gz on reentry for passengers; 4.5Gz for pilots
- Medical history unknowns for “average” passengers
- Cockpit management approaches
- Human-Machine Interaction
- Medical and Health considerations
- Frequent collaborative Training (mixed crews

Orbital Challenges

- 17,580 miles/hr; Mach 24+
- 6 degrees of freedom vehicle attitude
- Min mission duration (1 orbit)=90 minutes
- Communication based on ground site coverage small % of total time in orbit
- NO immediate emergency landing opportunities
- Only ONE opportunity at safe deorbit
- Cockpit management approaches
- Human-Machine Interaction
- Medical and Health considerations
- Frequent collaborative Training (mixed crews

Commercial (Human-Rated) Space Landscape - Next 5 years

Suborbital Vehicles

- Virgin Galactic
- XCor
- Armadillo Aerospace
- Blue Origin
- Rocketcrafters
- Booster
- Skylon

Orbital Vehicle Providers

- Space X
- Sierra Nevada Corp
- ATK
- Boeing
- Blue Origin
- Excalibur Almaz
- Liberty

Who will go? Pilots, Crew, Payload Specialists, Participants
→ ALL will need CREW and FLIGHT CONTROLLER training

LANDSCAPE

Roles/ Duties Involved:

- Pilots, Crews, Researchers, Participants, Mission Controllers, Ground Operations, Emergency Responders

Categories of Vehicles:

- Orbital vs. Sub-orbital
- Lifting vs. Non-lifting
- Vertical vs. Horizontal

Human Risk & Training:

- (no info on risks to general human population) How much do they NEED to know? Which skill sets are critical?

Training Preparation Areas:

- Medical Screening, Safety, Survival, Flight Training, Team/Group Dynamics, Life Support Systems, Payloads, Ground Emergency Response, Operations, Expectation Management & Enjoyment

Why is Training Important?

1. Increases Knowledge & Understanding
2. Decreases Stress & Anxiety
3. Teaches Safety & Lifesaving Techniques
4. Group Dynamics Issues Resolved Prior to Flight
5. Expectation Management
6. Enhances Actual Flight Enjoyment
7. Increases Chances for Purchase Repeatability (of spaceflight)
8. Increases Personal Endurance & Skill
9. Increased Occupant and On-Ground Personnel Safety
10. Provides Greater Industry Awareness & Support

FAA & REGULATIONS

Challenges & opportunities within the Commercial Space Industry

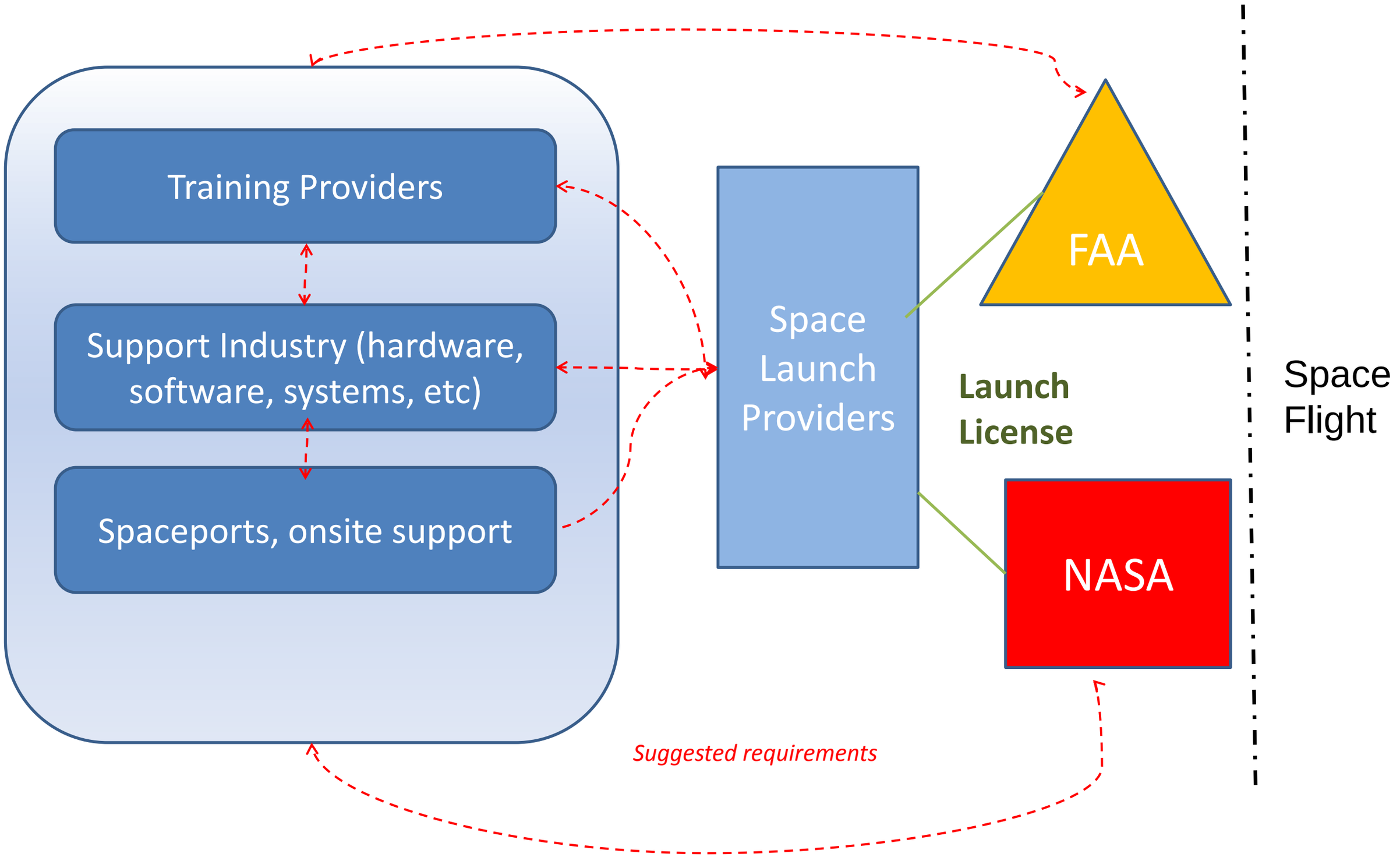
NASS & FAA REGULATION

NASA & FAA joint efforts to regulate Human Commercial Spaceflight.
NASA→advance the interests of NASA-certified U.S. commercial launch operators responsible for transporting U.S. and U.S. operating segment astronauts to the ISS
FAA AST→ensure protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch or reentry activities, and to encourage, facilitate, and promote U.S. commercial space transportation.

FAA Office of Commercial Space Transportation issued 14 C.F.R. Part 460.5

*Trainees "must **demonstrate** an ability to withstand the stresses of space flight, which may **include high acceleration or deceleration**, microgravity, and vibration" in a "method **or device that simulates flight**" in order to "withstand any **physical stress factors, such as acceleration,** vibration, and noise."*

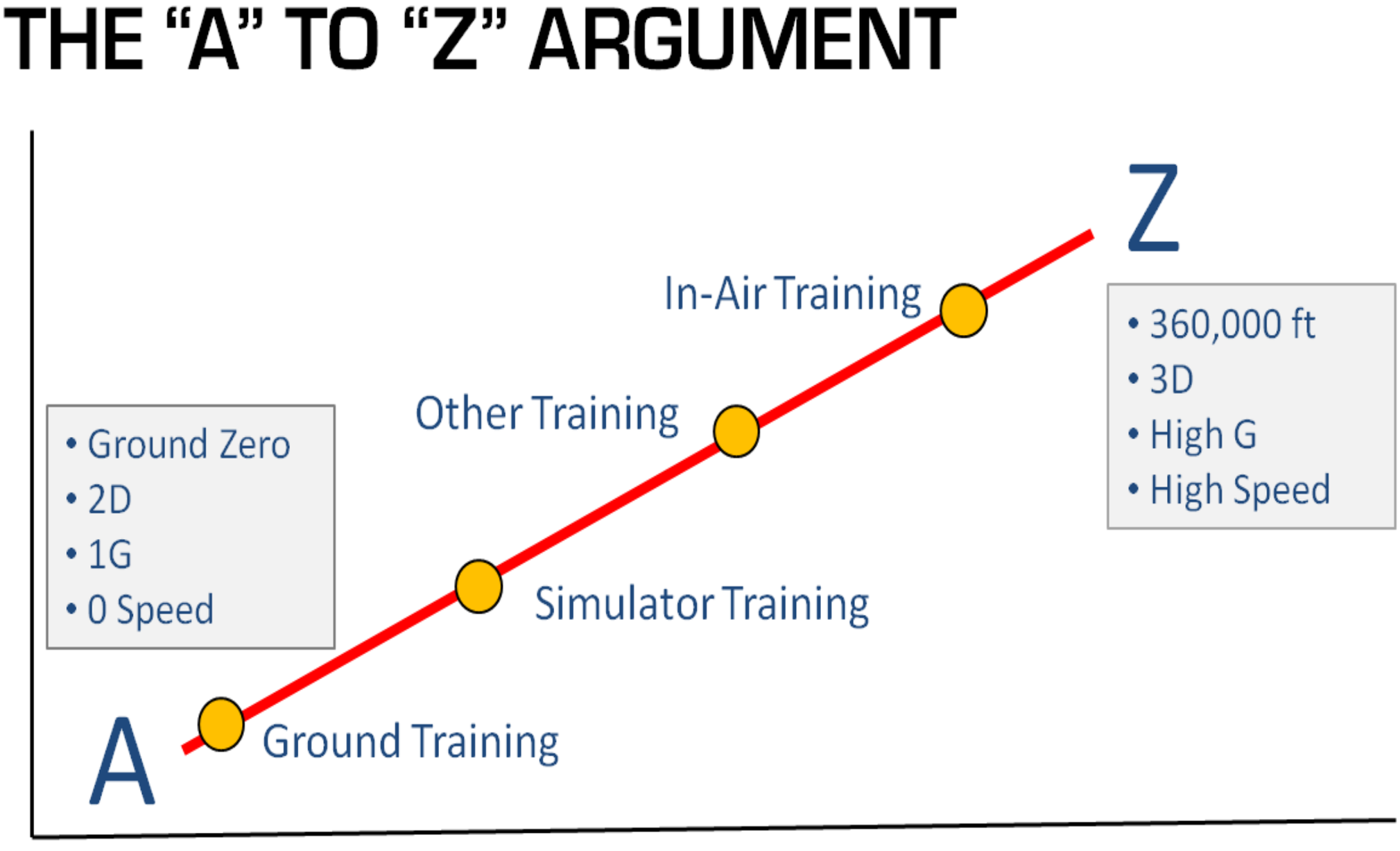
How it “Works”


Training Providers
Support Industry (hardware, software, systems, etc)
Spaceports, onsite support
Space Launch Providers
FAA
Launch License
NASA
Space Flight
Suggested requirements

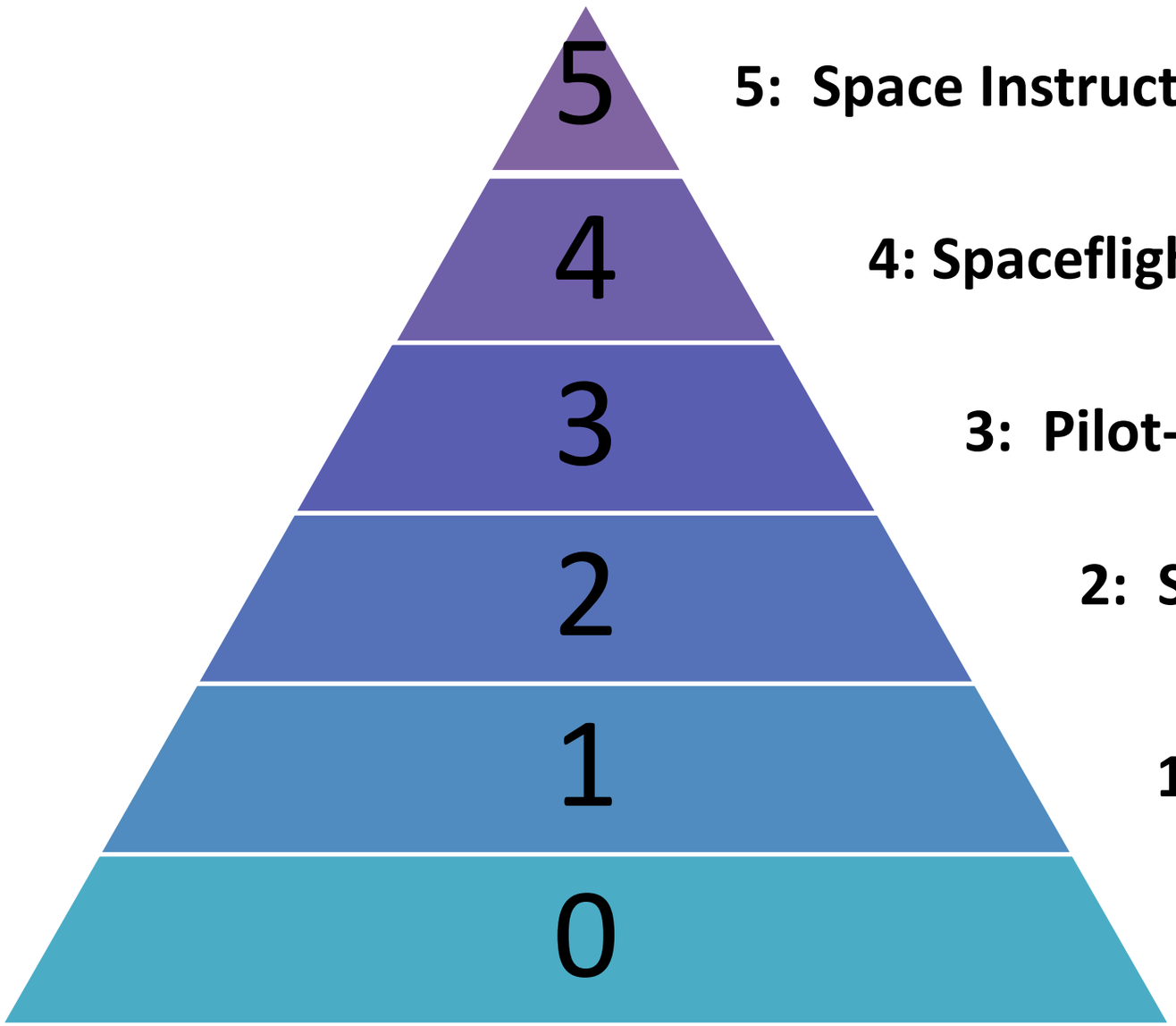
TRAINING SUGGESTIONS

Challenges & opportunities within the Commercial Space Industry

Training is Needed; More is Better



Types of Trainees & Programs



5: Space Instructor Training

4: Spaceflight Physician Training

3: Pilot-Astronaut Training

2: Space Researcher Training

1: Spaceflight Participant Training

0: Public Programs – no training

Other Category: Ground Teams & Emergency Response

Training Needs (list in development)

Primary Launch Vehicle Operations Training (Taught By Launch Provider)

1. Vehicle Systems & Hardware
2. Normal/Off-nominal Operations & Procedures (launch to land and recovery)
3. Vehicle Operational Limits
4. Safety, Egress & Abort (nominal & emergency)

Ancillary Hands-On Flight Training (Taught by Support Industry)

1. Preflight Fitness & Mental Health
2. G-force Launch to Reentry
3. Microgravity
4. High Altitude & Hypoxia Training
5. Situational Awareness (SA) & Spatial Disorientation (SD)
6. Life Support Systems & Operation
7. Egress & Abort (nominal & emergency)
8. Land/Water Survival Training
9. In-Flight First Aid & Emergency Medicine

Ancillary Hands-On Flight Training (Taught by Support Industry)

1. Crew Resource Management (CRM)
2. Group Dynamics & Planning
3. Safety Procedures
4. Radiation
5. Space Geography & Orientation
6. Payloads & Management

Training Areas

Passengers| Researchers| Pilots/Crew | Physicians

TOPIC AREAS	POTENTIAL PLAYERS
Medical Screening & Selection	
Pre-flight Fitness & Mental Health	
Group Dynamics/Crew Interactions	
High G Flight Training (launch to land)	
Spatial Disorientation & Situational Awareness	
Egress & Abort	
Microgravity	
Land/Water Survival	
Life Support Systems	
Operations, Procedures & Plans	
Emergency Medicine & In-flight First Aid	

The National AeroSpace Training And Research Center

NASTAR® CENTER

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