

# The Scope of Aerospace

To gain an overview and a comprehensive understanding of aerospace, it must first be defined both as an environment and as a field of activity.

As an environment . . . aerospace includes that total expanse extending upward and outward from the surface of Earth . . . including atmosphere, space, and the transition zone between.

As a field of activity . . . it includes both aeronautics and astronautics . . . with national and international commitments and resources being channeled into three major areas of emphasis, with obvious overlap among them:

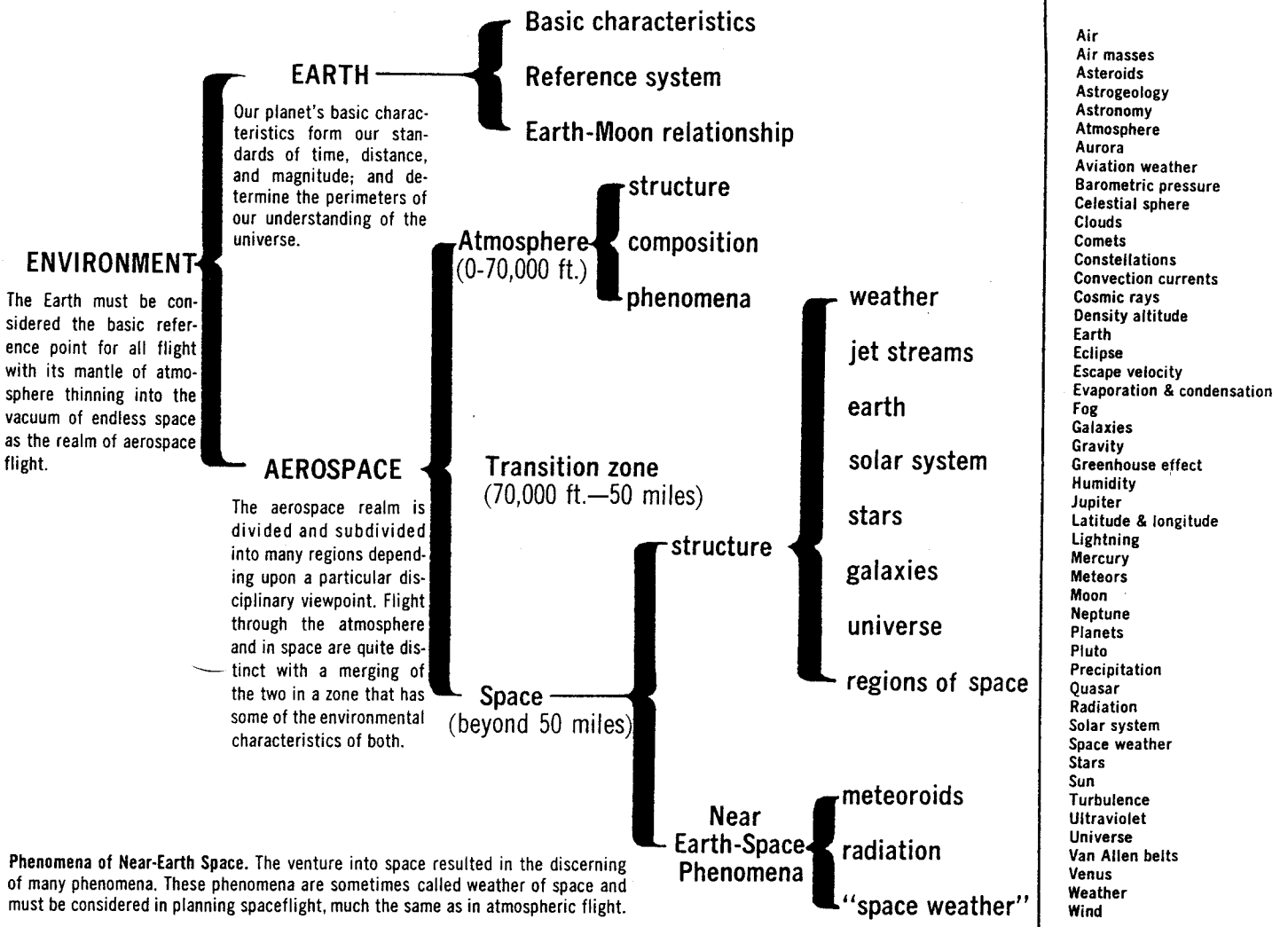
- 1) *national security*—pertains to the military and other governmental agencies concerned with the welfare and defense of nations.
- 2) *space exploration*—pertains to the scientific research into a new environment and the application of this research to our daily lives.
- 3) *worldwide transportation and communications network*—pertains to the attempt to bring all peoples of the world into close proximity through the use of commercial airlines and the advancement of private aviation.

The editors of *Above and Beyond, The Encyclopedia of Aviation and Space Sciences*, were faced with the task of creating a comprehensive reference work which would be of value to the classroom teacher. The basic organization of this project required breaking down the broad spectrum of aerospace into a manageable form and unifying context. Research in close cooperation with major agencies and several recognized authorities led to the establishment of ten functional categories which describe the field. The close interrelationship between astronautics and aeronautics makes it necessary to treat them as a continuum within each category.

These ten definitive categories are:

- The environment
- The basic sciences in aerospace
- People and events in aerospace development
- Man in flight
- Aerospace vehicles
- Aviation and space operations
- The art of flight
- Communications and control
- Manufacturing and facilities
- Aerospace and society

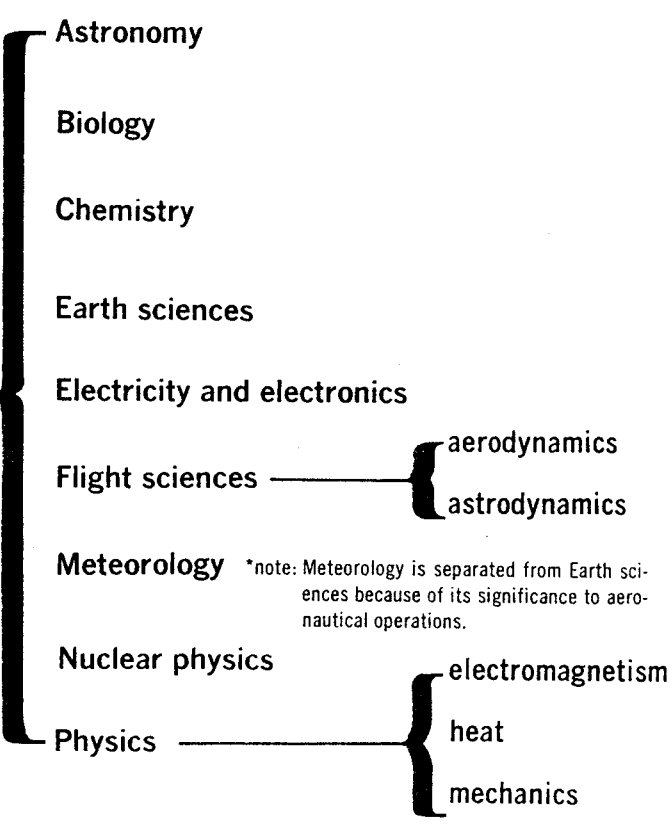
The charts on the following pages broadly outline the subject areas of each category. Position in the chart does not necessarily indicate the relative significance or magnitude of a specific subject, but rather its context. To the right of each chart appears an alphabetical list of some typical related topics as they appear in the encyclopedia. These same topics are also shown in a typical curriculum-area context in a section following the charts.



- Air
- Air masses
- Asteroids
- Astrogeology
- Astronomy
- Atmosphere
- Aurora
- Aviation weather
- Barometric pressure
- Celestial sphere
- Clouds
- Comets
- Constellations
- Convection currents
- Cosmic rays
- Density altitude
- Earth
- Eclipse
- Escape velocity
- Evaporation & condensation
- Fog
- Galaxies
- Gravity
- Greenhouse effect
- Humidity
- Jupiter
- Latitude & longitude
- Lightning
- Mercury
- Meteors
- Moon
- Neptune
- Planets
- Pluto
- Precipitation
- Quasar
- Radiation
- Solar system
- Space weather
- Stars
- Sun
- Turbulence
- Ultraviolet
- Universe
- Van Allen belts
- Venus
- Weather
- Wind

**BASIC SCIENCES IN AEROSPACE**

The basic sciences underlie all the activities of aerospace. They are often applied in new and unconventional ways and have forced the emergence of obscure branches of a basic science into surprising prominence, even to the point of creating new career fields. One interesting example is cryogenics.



- Acoustics
- Airfoil
- Astrophysics
- Atoms
- Bernoulli's principle
- Binary numbers
- Bird flight
- Boyle's law
- Celestial mechanics
- Chemical energy
- Cryogenics
- Crystallography
- Doppler effect
- Dynamic soaring
- Elements
- Energy
- Extraterrestrial life
- Fluid mechanics
- Gases
- Heat energy
- Infrared radiation
- Lasers
- Light
- Matter
- Measurement of power
- Metals and metallurgy
- Newton's laws
- Noise
- Nuclear energy
- Orbits and trajectories
- Parabola
- Photosynthesis
- Plasma
- Quantum theory
- Radio astronomy
- Relativity theory
- Semiconductors
- Shock waves
- Solar cells
- Solid-state physics
- Space biology
- Spaceflight principles
- Temperature scales
- X-rays

**Aerospace Education Defined**

Should be distinguished from meteorology as the reporting, interpretation and evaluation of weather relating to the use of aircraft.

**THE ART and TECHNIQUES OF FLIGHT**

Aeronautical skills have grown from the trial and error techniques of pioneering aviators to precise control of today's sophisticated aircraft. The term "interface" has been coined to describe the interrelationship of a man, with his knowledge and capability, and the functioning of his vehicles. The two are a functioning unit. Astronautics and aeronautics form a continuum. Conceptually, navigation, communications, environmental control, instrumentation, etc., are similar in both; but the degree of advancement and sophistication in astronautics is considerable.

**Aviation Weather**

**Aeronautical skills**

**Astronautical skills**

**Aids to flight**

**Related activities**

- Pilot training
- Flight technique and management
- Navigation
- Maneuvers
- Flight planning

- Astronaut training
- Mission simulation
- Mission planning
- Mission activities

- Maps and charts
- Pilot equipment
- Manuals
- Reference materials

- Test piloting
- Aerobatics
- Exhibition and demonstration flying
- Skydiving

- Aviation weather
- Bank
- Bush flying
- Celestial navigation
- Charts
- Compasses
- Course plotting
- Dead reckoning
- Flight computers
- Flight instruction
- Flight management
- Flight plan
- Flying safety
- High-altitude flight training
- Instrument flight techniques
- Lunar charts
- Magnetic course
- Maneuvers
- Maps and mapping
- Mountain, desert, and jungle flying
- Navigation techniques
- Pilotage
- Pilot and crew wings
- Pilots and pilot certificates
- Pilot training
- Power management
- Preflight training
- Spaceflight principles
- Test pilots and test flying
- Weather maps and charts
- Weight and balance

**COMMUNICATIONS and CONTROL**

The expanding use of aircraft coupled with their increasing speeds and flight capability require an air traffic control system which can provide precise inflight and terminal area guidance. This task would be hopeless without the aid of electronics. The enormous capacity of electronic computers is becoming increasingly vital to the process of keeping man ahead of his inflight machines.

Spaceflight presents far more sophisticated problems in communications and control related to the precision maneuvers required and the sheer magnitude of speeds and distances encountered. Without advanced electronics interfaced with computers, today's spaceflight programs would be virtually impossible.

**Aviation**

**Radar**

**Radio Communications Data Acquisition**

**Space**

**Cybernetics**

- Avionics
- Air Traffic Control
- National Airspace System

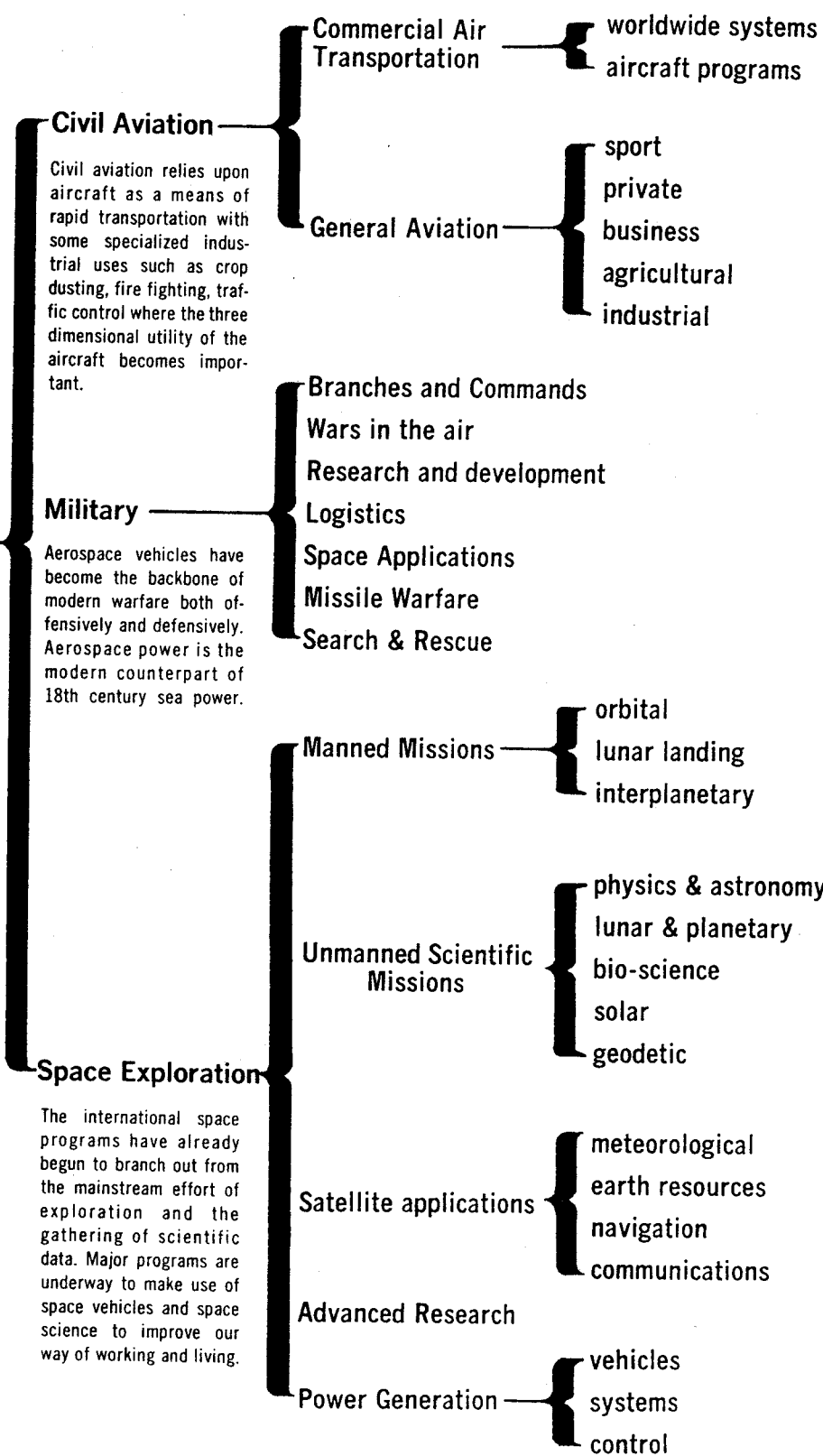
- Astrionics
- Tracking system
- Guidance and Command

- Science of Control and Communication Processes in Man and Machines

- Air traffic control
- Attitude control
- Automatic landing
- Avionics
- Bearing
- Communications satellites
- Computers
- Cybernetics
- Data acquisition and processing
- Doppler navigation
- Electronics
- Electromagnetism
- Flight plan
- Ground control approach
- Guidance and control systems
- Gyroscope
- Inertial guidance
- Information systems
- Instrument Flight Rules
- Lasers
- Microwave
- Morse code
- National Airspace System
- Navigation systems
- Navigation satellites
- Phonetic alphabet
- Radar
- Radio
- Radio communications
- Spaceflight principles
- Telemetry
- Television
- Tracking systems and networks
- Visual Flight Rules

**AVIATION and SPACE OPERATIONS**

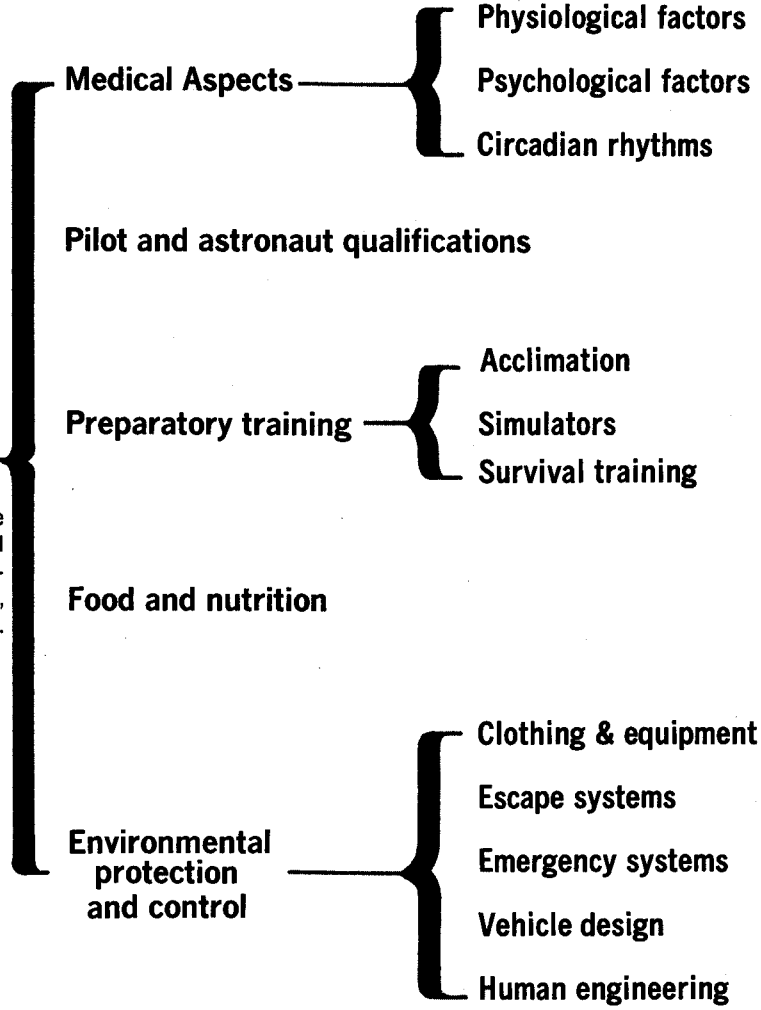
The operational activities of the three major divisions of aerospace are distinctive yet have a considerable degree of inter-relationship.



- Aerial photography
- Agricultural aviation
- Air defense systems
- Air forces of the world
- Air raid
- Air traffic control
- Air taxis
- Apollo
- Applications Technology
- Satellites
- Army aviation
- Bush flying
- Business aviation
- Charter flying
- Coast Guard aviation
- Commercial airlines
- Communications satellites
- Cloud seeding
- Crash investigation
- Crop dusting
- Demonstration teams
- DEW line
- Discoverer
- Environmental research satellites
- European aerospace activities
- Explorer satellites
- Fighter aircraft
- Flight (as passenger)
- Flight test programs
- Flying doctor services
- Forest fire control
- Gemini
- General aviation
- Geodetic satellites
- Gliding
- International Flying Farmers
- Interplanetary travel
- Launching
- Lunar exploration
- Manned spaceflight
- Marine Corps aviation
- Mariner probes
- Mercury program
- Military aviation
- Military space program
- Mountain, desert, and jungle flying
- Naval aviation
- Navigation satellites
- NORAD
- Oceanographic research
- Orbiting observatories
- Photography
- Photogrammetry
- Polar flights
- Police and fire services
- Preventive maintenance
- Reconnaissance
- Re-entry vehicles
- Refueling
- Rendezvous and docking
- Rockets and rocketry
- Rescue and recovery service
- Search and rescue
- Sport flying
- Strategic Air Command
- Technological projections
- Telescopes
- U.S. Air Force
- U.S.S.R aerospace activities
- Utility aviation

**MAN IN FLIGHT  
(AEROSPACE MEDICINE)**

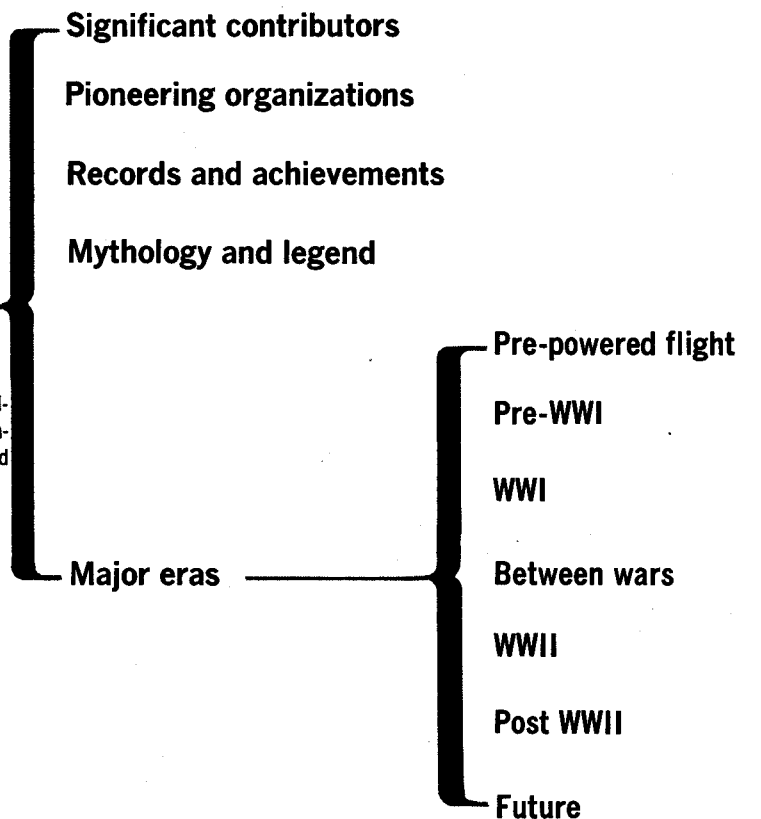
Man has a very limited ability to adapt to the changing conditions as he flies higher and faster into an increasingly hostile environment which quickly requires a self-contained, artificially created atmosphere to sustain life.



- Acceleration
- Aerospace medicine
- Animals in space
- Apollo
- Astronauts
- Aviation medicine
- Bends
- Biosatellites
- Circadian rhythm
- Closed ecological system
- Cosmonauts
- Crash investigation
- Cybernetics
- Decompression
- Drug effects
- Environmental control systems
- Environmental simulators
- Escape systems
- Flight (as passenger)
- Flight physical
- Flight simulators
- Food and nutrition
- Gemini
- High-altitude flight training
- Human engineering
- Hydroponics
- Hypoxia
- Interplanetary travel
- Life-support systems
- Man in flight
- Manned spaceflight
- Mercury program
- Parachutes
- Pilots and pilot certificates
- Pressurization
- Psychological factors of flight
- Sensory deprivation
- Space biology
- Spaceflight training
- Space medicine
- Spacesuits
- Technological projections
- Temperature control
- Walk in space
- Weightlessness

**PEOPLE and EVENTS  
IN DEVELOPMENT  
OF AEROSPACE**

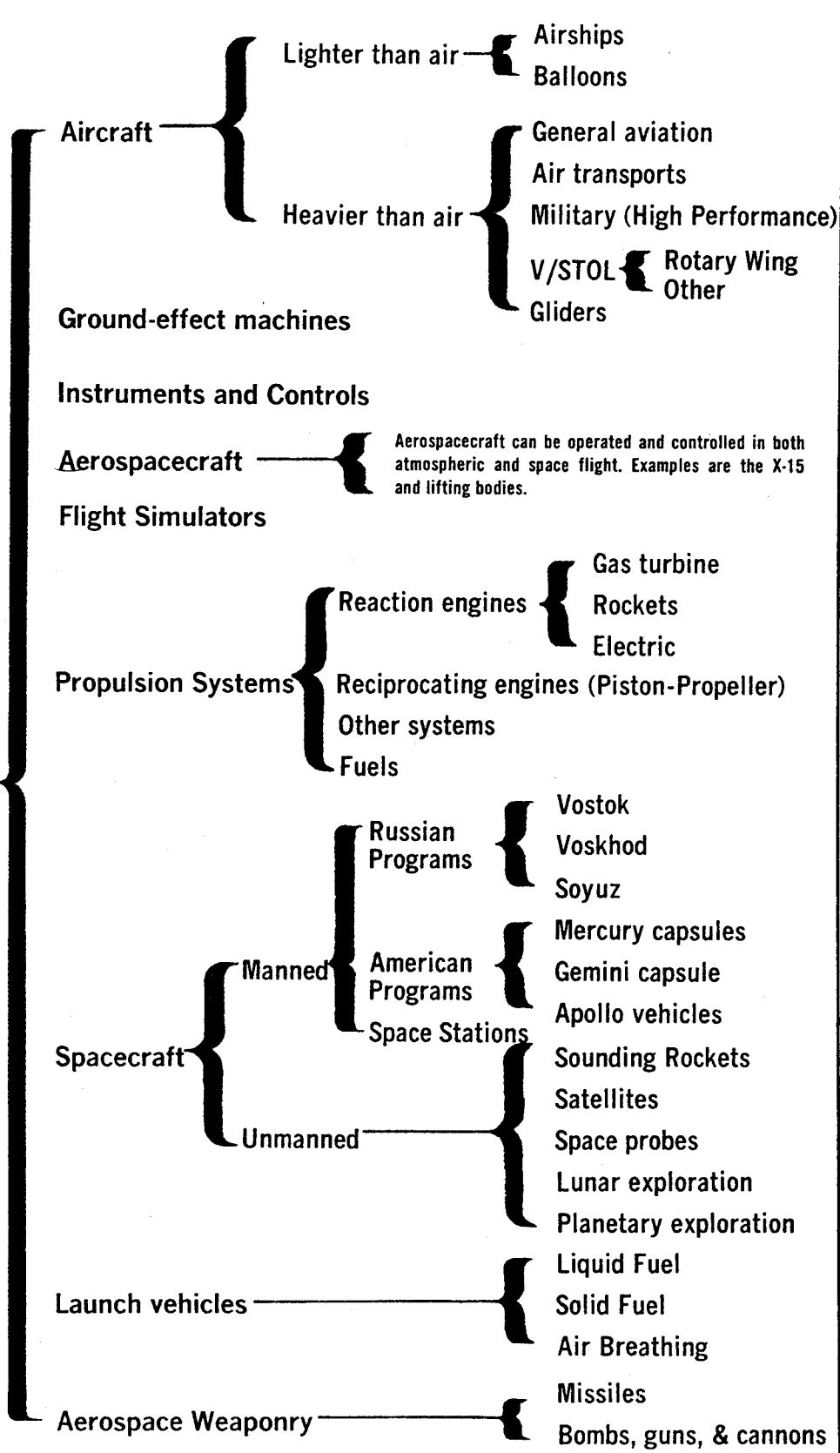
Modern aerospace has its roots in mythology and legend; however, its role as a meaningful part of our society has only developed during the past few decades.



- Ace
- Airmail
- Altitude records
- Balloons
- Barnstormers
- Battle of Britain
- Berlin Airlift
- Biographies
- Commercial airlines
- Da Vinci, Leonardo
- Distance records
- Endurance records
- First World War aircraft
- Flying Circus
- International Geophysical Year
- International Years of the Quiet Sun
- Israeli-Arab Conflict—1967
- Kamikaze
- Korean War
- Luftwaffe
- Man-powered flight
- Medals and decorations
- Military aviation
- Mythology
- National Advisory Council for Aeronautics
- Peenemuende
- Rheims Air Meet
- Rockets and rocketry
- Science fiction
- Speed records
- Trophies and awards
- Women in aerospace
- World War I
- World War II

**AEROSPACE VEHICLES**

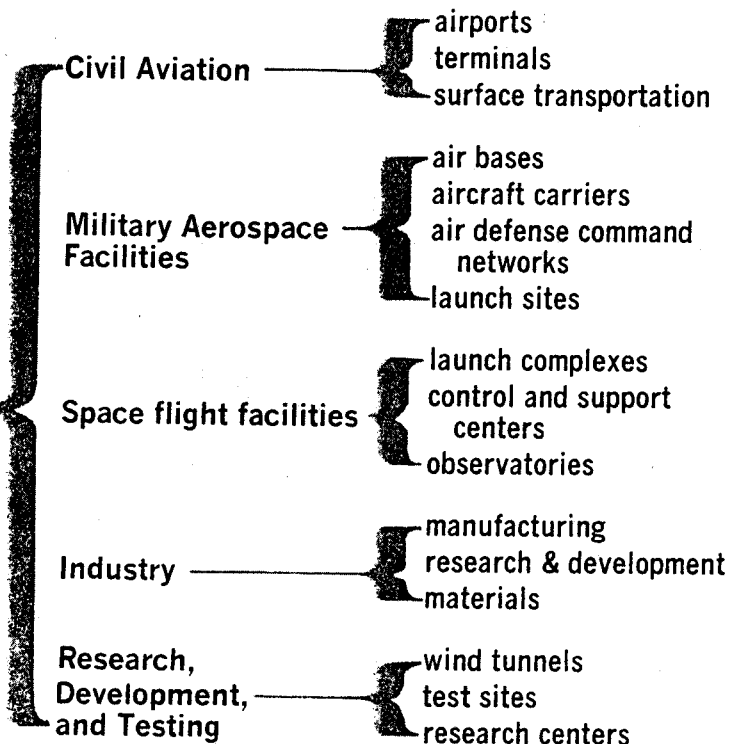
The hardware of aerospace is the great variety of aircraft, launch vehicles, spacecraft, weapons and related onboard equipment designed to perform specific tasks.



- Aircraft propulsion systems
- Airplane
- Airships
- Airspeed indicator
- Apollo
- Applications Technology
- Satellites
- Area rule
- Atlas missile
- Autogiros
- Balloons
- Bomber aircraft
- Bombs
- Carburetion
- Cargo aircraft
- Center of gravity
- Commercial air transports
- Communications satellites
- Dirigibles
- Engines
- Fighter aircraft
- Flight simulators
- Fuels
- Gas turbine engines
- Gemini
- General aviation aircraft
- Generators and alternators
- Gliders
- Ground-effect machines
- Heat shields
- Helicopters
- High-lift devices
- Homebuilt aircraft
- Hydraulic systems
- Hypersonic flight
- Instrument panel
- Interiors of aircraft
- Jet aircraft
- Jumbo jets
- Kites
- Kosmos satellites
- Launch vehicles
- Lubricants
- Manned Orbiting Laboratory
- Mercury program
- Missiles
- Model aircraft
- Nuclear propulsion
- Pitot-static system
- Propellants
- Ranger
- Reciprocating engines
- Reconnaissance satellites
- Re-entry vehicles
- Robots
- Rockets and rocketry
- Rotating combustion engines
- Sailplanes
- Satellites
- Saturn rockets
- Second World War aircraft
- Solar cells
- Sounding rockets
- Spacecraft design
- Space propulsion systems
- Space stations
- Supersonic flight
- Supersonic transports
- Surveyor
- Temperature control
- V/STOL aircraft
- Weaponry
- Weather satellites
- Wings
- X-series aircraft

**MANUFACTURING and FACILITIES**

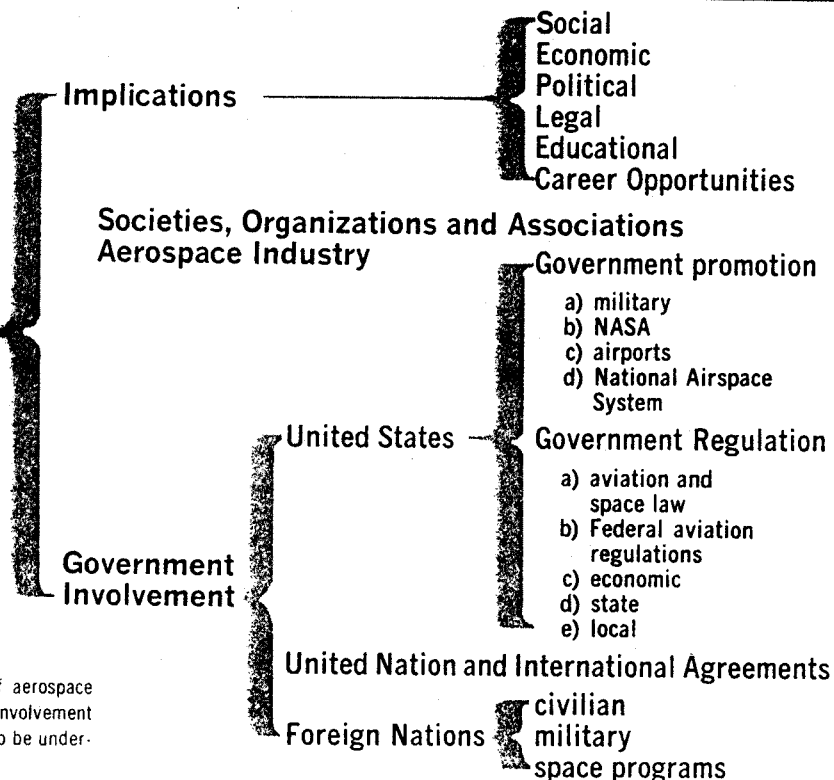
A vast industrial complex is necessary to support the research, development, and manufacture of aerospace craft. The functional use of these vehicles is dependent upon complex worldwide supporting facilities.



- Aeronautical Center (FAA)
- Aerospace industry
- Aircraft carriers
- Airports
- Alloys
- Blockhouse
- Certification procedures
- Computers
- DEW line
- Environmental simulators
- Fabrics
- Fixed base operation
- Flight service stations
- Ground antennas
- Ground service and maintenance
- Hangars
- Heliports
- High-speed surface transportation
- Interiors of aircraft
- Kennedy Space Center
- Launch facilities
- Lunar bases
- Manufacturing
- Materials
- Metals and metallurgy
- Observatories
- Planetariums
- Production techniques
- Program management
- Refueling
- Runways
- Testing
- Wind tunnels

**AEROSPACE and SOCIETY**

The technological achievements of aerospace must be viewed in the context of involvement and effect upon the world society to be understood in proper perspective.



- Air Commerce Act
- Australia's aviation
- Careers
- Civil Aeronautics Board
- Commemorative stamps and medals
- Crash investigation
- Economic implications
- Educational implications
- Eurospace
- FAA
- FAI
- FAR
- Five Freedoms
- Government contracts
- Government in aerospace
- Information systems
- Insignia
- Insurance
- International agreements
- International Agricultural Aviation Centre
- International Flying Farmers
- Legal implications
- Military implications
- NASA
- Objects of art
- Occupations
- Patents
- Pilots and pilot certificates
- Political implications
- Program management
- Registration of aircraft
- Safety statistics
- Social implications
- Space law
- Stewards and stewardesses
- Systems engineering
- Technological projections
- Terminology of aerospace
- UFO's