### ACCESSION NUMBER RANGES

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NASA PATENT ABSTRACTS
BIBLIOGRAPHY

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SECTION 2 INDEXES
INTRODUCTION

Several thousand inventions result each year from the aeronautical and space research supported by the National Aeronautics and Space Administration. The inventions having important use in government programs or significant commercial potential are usually patented by NASA. These inventions cover practically all fields of technology and include many that have useful and valuable commercial application.

NASA inventions best serve the interests of the United States when their benefits are available to the public. In many instances, the granting of nonexclusive or exclusive licenses for the practice of these inventions may assist in the accomplishment of this objective. This bibliography is published as a service to companies, firms, and individuals seeking new, licensable products for the commercial market.

The NASA Patent Abstracts Bibliography (NASA PAB) is a semiannual NASA publication containing comprehensive abstracts and indexes of NASA-owned inventions covered by U.S. patents and applications for patent. The citations included in NASA PAB were originally published in NASA's Scientific and Technical Aerospace Reports (STAR) and cover STAR announcements made since May 1969.

For the convenience of the user, each issue of NASA PAB has a separately bound Abstract Section (Section 1) and Index Section (Section 2). Although each Abstract Section covers only the indicated six-month period, the Index Section is cumulative covering all NASA-owned inventions announced in STAR since 1969. Thus a complete set of NASA PAB would consist of the Abstract Sections of Issue 04 (January 1974) and Issue 12 (January 1978) and the Abstract Section for all subsequent issues and the Index Section for the most recent issue.

The 131 citations published in this issue of the Abstract Section cover the period July 1993 through December 1993. The Index Section references over 5500 citations covering the period May 1969 through December 1993.

ABSTRACT SECTION (SECTION 1)

This PAB issue includes 10 major subject divisions separated into 76 specific categories and one general category/division. (See Table of Contents for the scope note of each category, under which are grouped appropriate NASA inventions.) This scheme was devised in 1975 and revised in 1987 in lieu of the 34 category divisions which were utilized in PAB supplements (01) through (06) covering STAR abstracts from May 1969 through January 1974. Each entry in the Abstract Section consists of a STAR citation accompanied by an abstract and, when appropriate, a key illustration taken from the patent or application for patent. Entries are arranged by subject category in order of the ascending NASA Accession Number originally assigned for STAR to the invention. The range of NASA Accession Numbers within each issue is printed on the inside front cover.

Abstract Citation Data Elements: Each of the abstract citations has several data elements useful for identification and indexing purposes, as follows:

NASA Accession Number
NASA Case Number
Inventor's Name
Title of Invention
U.S. Patent Application Serial Number
U.S. Patent Number (for issued patents only)
U.S. Patent Office Classification Number(s)
(for issued patents only)

These data elements are identified in the Typical Citation and Abstract and in the indexes.
INDEX SECTION (SECTION 2)

The Index Section is divided into five indexes. These indexes are cross-indexed and are used to locate a single invention or groups of inventions.

**Subject Index:** Lists all inventions according to appropriate alphabetized technical term and indicates the related NASA Case Number, the Subject Category Number, and the Accession Number.

**Inventor Index:** Lists all inventions according to alphabetized names of inventors and indicates the related NASA Case Number, the Subject Category Number, and the Accession Number.

**Source Index:** Lists all inventions according to alphabetized source of invention (i.e., name of contractor or government installation where invention was made) and indicates the related NASA Case Number, the Subject Category Number, and the Accession Number.

**Number Index:** Lists inventions in order of ascending (1) NASA Case Number, (2) U.S. Patent Application Serial number, (3) U.S. Patent Classification Number, and (4) U.S. Patent Number and indicates the related Subject Category Number and the Accession Number.

**Accession Number Index:** Lists all inventions in order of ascending Accession Number and indicates the related Subject Category Number, the NASA Case Number, the U.S. Patent Application Serial Number, the U.S.Patent Classification Number, and the U.S. Patent Number.

HOW TO USE THIS PUBLICATION TO IDENTIFY NASA INVENTIONS

To identify one or more NASA inventions within a specific technical field or subject, several techniques are possible with the flexibility incorporated into the NASA PAB.

(1) **Using Subject Category:** To identify all NASA inventions in any one of the subject categories in this issue of NASA PAB, select the desired Subject Category in the Abstract Section (Section 1) and find the inventions abstracted thereunder.

(2) **Using Subject Index:** To identify all NASA inventions listed under a desired technical subject index term, (A) turn to the cumulative Subject Index in the Index Section and find the invention(s) listed under the desired technical subject term. (B) Note the indicated Accession Number and the Subject Category Number. (C) Using the indicated Accession Number, turn to the inside front cover of the Index Section to determine which issue of the Abstract Section includes the Accession Number desired. (D) To find the abstract of the particular invention in the issue of the Abstract Section selected, (1) use the Subject Category Number to locate the Subject Category and (2) use the Accession Number to locate the desired invention within the Subject Category listing.

(3) **Using Patent Classification Index:** To identify all inventions covered by issued NASA patents (not including applications for patent) within a desired Patent Classification, (A) turn to the Patent Classification Number in the Number Index of Section 2 and find the associated invention(s), and (B) follow the instructions outlined in (2)(B), and (D) above.
A virtual reality flight control system displays to the pilot the image of a scene surrounding a vehicle or pod having six degrees of freedom of acceleration or velocity control by the pilot and traveling through inertial space, the image itself including a superimposed figure providing the pilot an instant reference of orientation consisting of superimposed sets of geometric figures whose relative orientations provide the pilot an instantaneous feel or sense of orientation changes with respect to some fixed coordinate system. They include a first set of geometric figures whose orientations are fixed to the pilot's vehicle and a second set of geometric figures whose orientations are fixed with respect to a fixed or interstellar coordinate system. The first set of figures is a first set of orthogonal great circles about the three orthogonal axes of the flight vehicle or pod and centered at and surrounding the pilot's head, while the second set of figures is a second set of orthogonal great circles about the three orthogonal axes of a fixed or interstellar coordinate system, also centered at and surrounding the pilot's head.
Subject Categories
(1969-1973)

01 Aerodynamics
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft; and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft; e.g., ground effect machines, STOL, and VTOL; flight tests; operating problems; e.g., sonic boom; safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry
Includes chemical analysis and identification; e.g., spectroscopy. For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

08 Computers
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment
Includes electronic test equipment and maintainability; component parts; e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications; and 21 Navigation.

10 Electronics
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities; e.g., rocket engine test stands, shock tubes, and wind tunnels; test ranges; and tracking stations.

12 Fluid Mechanics
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic
Includes cermet; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

18 Materials, Nonmetallic
Includes corrosion; physical and mechanical properties of materials; e.g., plastics; and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.
19 Mathematics
Includes calculation methods and theory; and numerical
analysis. For applications see specific categories. For
related information see also: 08 Computers.

20 Meteorology
Includes climatology; weather forecasting; and visibility
studies. For related information see also: 13 Geophysics;
and 30 Space Sciences.

21 Navigation
Includes guidance; autopilots; star and planet tracking;
inertial platforms; and air traffic control. For related infor-
mation see also: 07 Communications.

22 Nuclear Engineering
Includes nuclear reactors and nuclear heat sources used
for propulsion and auxiliary power. For basic research
see: 24 Physics, Atomic, Molecular, and Nuclear. For
related information see also: 03 Auxiliary Systems; and
28 Propulsion Systems.

23 Physics, General
Includes acoustics, cryogenics, mechanics, and optics.
For astrophysics see: 30 Space Sciences. For geo-
physics and related information see also: 13 Geophysics;
20 Meteorology; and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear
Includes atomic, molecular and nuclear physics. For ap-
lications see: 22 Nuclear Engineering. For related infor-
mation see also: 29 Space Radiation.

25 Physics, Plasma
Includes magnetohydrodynamics. For applications see:
28 Propulsion Systems.

26 Physics, Solid-State
Includes semiconductor theory; and superconductivity.
For applications see: 16 Masers. For related information
see also: 10 Electronics.

27 Propellants
Includes fuels; igniters; and oxidizers. For basic research
see: 06 Chemistry; and 33 Thermodynamics and Com-
bustion. For related information see also: 28 Propulsion
Systems.

28 Propulsion Systems
Includes air breathing, electric, liquid, solid, and mag-
etohydrodynamic propulsion. For nuclear propulsion
see: 22 Nuclear Engineering. For basic research see: 23
Physics, General; and 33 Thermodynamics and Combus-
tion. For applications see: 31 Space Vehicles. For related
information see also: 27 Propellants.

29 Space Radiation
Includes cosmic radiation; solar flares; solar radiation;
and Van Allen radiation belts. For related information see
also: 13 Geophysics; and 24 Physics, Atomic, Molecular,
and Nuclear.

30 Space Sciences
Includes astronomy and astrophysics; cosmology; lunar
and planetary flight and exploration; and theoretical
analysis of orbits and trajectories. For related information
see also: 11 Facilities, Research and Support; and 31
Space Vehicles.

31 Space Vehicles
Includes launch vehicles; manned space capsules; clus-
tered and multistage rockets; satellites; sounding rockets
and probes; and operating problems. For basic research
see: 30 Space Sciences. For related information see
also: 28 Propulsion Systems; and 32 Structural
Mechanics.

32 Structural Mechanics
Includes structural element design and weight analysis;
fatigue; thermal stress; impact phenomena; vibration; flut-
ter; inflatable structures; and structural tests. For related
information see also: 17 Materials, Metallic; and 18 Mat-
erials, Nonmetallic.

33 Thermodynamics and Combustion
Includes ablation, cooling; heating, heat transfer, thermal
balance, and other thermal effects; and combustion
theory. For related information see also: 12 Fluid
Mechanics; and 27 Propellants.

34 General
Includes information of a broad nature related to industrial
applications and technology; and to basic research; de-
fense aspects; information retrieval; management; law
and related legal matters; and legislative hearings and
documents.
## TABLE OF CONTENTS
Revised Subject Categories
(Includes 1974 and 1987 revisions)

**AERONAUTICS** For related information see also **Astronautics.**

### 01 AERONAUTICS (GENERAL)

#### 02 AERODYNAMICS
Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery. For related information see also **34 Fluid Mechanics and Heat Transfer.**

#### 03 AIR TRANSPORTATION AND SAFETY
Includes passenger and cargo air transport operations; and aircraft accidents. For related information see also **16 Space Transportation and 85 Urban Technology and Transportation.**

#### 04 AIRCRAFT COMMUNICATIONS AND NAVIGATION
Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also **17 Space Communications, Spacecraft Communications, Command and Tracking and 32 Communications and Radar.**

#### 05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE
Includes aircraft simulation technology. For related information see also **18 Spacecraft Design, Testing and Performance** and **39 Structural Mechanics.** For land transportation vehicles see **85 Urban Technology and Transportation.**

#### 06 AIRCRAFT INSTRUMENTATION
Includes cockpit and cabin display devices; and flight instruments. For related information see also **19 Spacecraft Instrumentation and 35 Instrumentation and Photography.**

#### 07 AIRCRAFT PROPULSION AND POWER
Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also **20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.**

#### 08 AIRCRAFT STABILITY AND CONTROL
Includes aircraft handling qualities; piloting; flight controls; and autopilots. For related information see also **05 Aircraft Design, Testing and Performance.**

#### 09 RESEARCH AND SUPPORT FACILITIES (AIR)
Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands. For related information see also **14 Ground Support Systems and Facilities (Space).**

**ASTRONAUTICS** For related information see also **Aeronautics.**

### 12 ASTRONAUTICS (GENERAL)
For extraterrestrial exploration see **91 Lunar and Planetary Exploration.**

#### 13 ASTRODYNAMICS
Includes powered and free-flight trajectories; and orbital and launching dynamics.

#### 14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)
Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators. For related information see also **09 Research and Support Facilities (Air).**

#### 15 LAUNCH VEHICLES AND SPACE VEHICLES
Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles. For related information see also **20 Spacecraft Propulsion and Power.**

#### 16 SPACE TRANSPORTATION
Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also **03 Air Transportation and Safety and 18 Spacecraft Design, Testing and Performance.** For space suits see **54 Man/System Technology and Life Support.**

#### 17 SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING
Includes telemetry, space communications networks; astronavigation and guidance; and radio blackout. For related information see also **04 Aircraft Communications and Navigation and 32 Communications and Radar.**
18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE
Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. For life support systems see 54 Man/System Technology and Life Support. For related information see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation.

19 SPACECRAFT INSTRUMENTATION
For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography.

20 SPACECRAFT PROPULSION AND POWER
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also 07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion, and 15 Launch Vehicles and Space Vehicles.

CHEMISTRY AND MATERIALS

23 CHEMISTRY AND MATERIALS (GENERAL)

24 COMPOSITE MATERIALS
Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see 27 Nonmetallic Materials.

25 INORGANIC AND PHYSICAL CHEMISTRY
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry. For related information see also 77 Thermodynamics and Statistical Physics.

26 METALLIC MATERIALS
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.

28 PROPELLANTS AND FUELS
Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

29 MATERIALS PROCESSING
Includes space-based development of products and processes for commercial application. For biological materials see 55 Space Biology.

ENGINEERING For related information see also Physics.

31 ENGINEERING (GENERAL)
Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

32 COMMUNICATIONS AND RADAR
Includes radar; land and global communications; communications theory; and optical communications. For related information see also 04 Aircraft Communications and Navigation and 17 Space Communications, Spacecraft Communications, Command and Tracking. For search and rescue see 03 Air Transportation and Safety and 16 Space Transportation.

33 ELECTRONICS AND ELECTRICAL ENGINEERING
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry. For related information see also 60 Computer Operations and Hardware and 76 Solid-State Physics.

34 FLUID MECHANICS AND HEAT TRANSFER
Includes boundary layers; hydrodynamics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

35 INSTRUMENTATION AND PHOTOGRAPHY
Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Aircraft Instrumentation and 19 Spacecraft Instrumentation.

36 LASERS AND MASERS
Includes parametric amplifiers. For related information see also 76 Solid-State Physics.
37 MECHANICAL ENGINEERING
Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS
Includes structural element design and weight analysis; fatigue; and thermal stress. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

GEOSCIENCES For related information see also Space Sciences.

42 GEOSCIENCES (GENERAL)

43 EARTH RESOURCES AND REMOTE SENSING
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see 35 Instrumentation and Photography.

44 ENERGY PRODUCTION AND CONVERSION
Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.

45 ENVIRONMENT POLLUTION
Includes atmospheric, noise, thermal, and water pollution.

46 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see 93 Space Radiation.

47 METEOROLOGY AND CLIMATOLOGY
Includes weather forecasting and modification.

48 OCEANOGRAPHY
Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

LIFE SCIENCES

51 LIFE SCIENCES (GENERAL)

52 AEROSPACE MEDICINE
Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

53 BEHAVIORAL SCIENCES
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT
Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

55 SPACE BIOLOGY
Includes exobiology; planetary biology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

60 COMPUTER OPERATIONS AND HARDWARE
Includes hardware for computer graphics, firmware, and data processing. For components see 33 Electronics and Electrical Engineering.

61 COMPUTER PROGRAMMING AND SOFTWARE
Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

62 COMPUTER SYSTEMS
Includes computer networks and special application computer systems.
63 CYBERNETICS
Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also 54 Man/System Technology and Life Support.

64 NUMERICAL ANALYSIS
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS
Includes topology and number theory.

PHYSICS For related information see also Engineering.

70 PHYSICS (GENERAL)
For precision time and time interval (PTTI) see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

71 ACOUSTICS
Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution.

72 ATOMIC AND MOLECULAR PHYSICS
Includes atomic structure, electron properties, and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS
Includes elementary and nuclear particles; and reactor theory. For space radiation see 93 Space Radiation.

74 OPTICS
Includes light phenomena and optical devices. For lasers see 36 Lasers and Masers.

75 PLASMA PHYSICS
Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

76 SOLID-STATE PHYSICS
Includes superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

77 THERMODYNAMICS AND STATISTICAL PHYSICS
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

SOCIAL SCIENCES

80 SOCIAL SCIENCES (GENERAL)
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.

83 ECONOMICS AND COST ANALYSIS
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation. For related information see 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.
SPACE SCIENCES For related information see also Geosciences.

88 SPACE SCIENCES (GENERAL)

89 ASTRONOMY
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also 75 Plasma Physics.

91 LUNAR AND PLANETARY EXPLORATION
Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

92 SOLAR PHYSIC
Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

93 SPACE RADIATION
Includes cosmic radiation; and inner and outer earth's radiation belts. For biological effects of radiation see 52 Aerospace Medicine. For theory see 73 Nuclear and High-Energy Physics.

GENERAL
Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

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January 1994

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Automatic gain control system

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Automatic test equipment

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Welding wire pressure sensor assembly

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Method of growing a ribbon crystal particularly suited for deposition of thin films

Integrated control system for a gas turbine engine

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<td>Fluid flow valve and fluid flow system</td>
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In this table, the primary subjects include various types of valves, flow systems, and control systems with specific applications such as flow control for supersonic aircraft, fluid flow systems, and control systems for various applications. The patents and classifications are listed for each item, indicating the specific technologies and innovations covered by each patent.
CRYOGENIC FLUIDS

Cryogenic fluids are a critical component in various technologies, including space exploration, medical research, and industrial processes. They are characterized by their temperature below the boiling point of standard atmospheric pressure, typically near or below the triple point of water. The properties of cryogenic fluids make them indispensable in applications where extreme temperatures are required to maintain high performance or to perform specific tasks.

Cryogenic fluids are used in a wide range of applications, including:

- **Heat transfer**: Cryogenic fluids are used in heat exchangers to remove heat from a system. They are particularly effective in applications requiring very low temperatures, such as cooling in semiconductor manufacturing or cryogenic medicine.

- **Storage of high-energy density materials**: Cryogenic storage is used to store materials such as hydrogen and helium at low temperatures, enabling their transport and use in various applications.

- **Cryogenic engineering**: Cryogenic fluids are used in the design and operation of cryogenic systems, such as cryogenic tanks, cryogenic pumps, and cryogenic storage systems.

- **Cryogenic medicine**: Cryogenic fluids are used in cryosurgery, cryotherapy, and cryopreservation, where they can be used to freeze cells, tissues, or medical devices.

- **Cryogenic cooling**: Cryogenic fluids are used in cooling systems for superconducting magnets, accelerators, and other high-precision equipment.

- **Cryogenic propulsion**: Cryogenic fluids are used in rocket engines as fuel or oxidizer, providing high performance and specific impulse in space applications.

- **Cryogenic refrigeration**: Cryogenic fluids are used in refrigeration systems that operate at very low temperatures, which are necessary for the storage and transport of high-value materials.

- **Cryogenic storage tanks**: Cryogenic fluids are stored in tanks designed to maintain the desired temperature, ensuring the safety and reliability of the stored materials.

- **Cryogenic processing**: Cryogenic fluids are used in processing materials, such as semiconductor wafers, where controlled cooling is necessary for the desired properties.

Cryogenic fluids are also used in various technologies that rely on cryogenic performance, such as superconducting devices, cryogenic medical devices, and cryogenic storage systems. The properties of cryogenic fluids, including their low temperatures, high purity, and low thermal conductivity, make them essential in these applications.

In conclusion, cryogenic fluids play a critical role in many technological advancements, enabling innovations in a wide range of fields, from space exploration to medical research. Their unique properties make them indispensable in applications requiring extreme temperatures, making them a vital component of modern technology.
DATA ACQUISITION

Analog-to-digital conversion system Patent
[NASA-CASE-GSC-11182-1] c 15 N75-13007

DATA COMPRESSION

Method of encoding data with a minimum time delay
[NASA-CASE-ARC-11428-1] c 23 N86-24692

Smart accelerometer — vibration damage detection
[NASA-CASE-MSC-21105-1] c 35 N95-25513

DAMPING

Dynamic pressure damper for stabilizing spin stabilized vehicle
[NASA-CASE-EAC-10943-1] c 10 N73-26228

Apparatus for reducing hydraulic fluid flow
[NASA-CASE-GSC-10962-1] c 37 N78-23628

Arrangement for damping the resonance in a laser cavity
[NASA-CASE-NPO-15980-1] c 35 N85-30305

Composite passive damping struts for large precision structures
[NASA-CASE-MFS-28542-1] c 37 N86-20786

Composite passive damping struts for large precision structures
[NASA-CASE-NPO-17414-1] c 35 N95-24596

Data acquisition system for pressure
[NASA-CASE-GSC-11003-1] c 39 N70-16099

Analog signal and reconstruction system Patent
[NASA-CASE-NPO-10344-1] c 37 N81-27226

DATA TRANSMISSION

Cable-communication device for telephone line
[NASA-CASE-MSC-21844-1] c 34 N91-17088

Protocol for voice response Patent
[NASA-CASE-NPO-14324-1] c 72 N80-27163

Segmented tubular cushion springs and spring
[NASA-CASE-NPO-14325-1] c 37 N91-25305

CYSTOS

Cystoscopy apparatus for cystoscopy Patent
[NASA-CASE-GSC-11349-1] c 37 N86-20797

DATA TRANSMISSION

Remote platform power conserving system
[NASA-CASE-MSC-17112-1] c 15 N75-13007

DATA COMPRESSION

Data compression system with a minimum time delay
[NASA-CASE-NPO-11207-1] c 37 N81-27226

Simultaneous acquisition of tracking data from two stations
[NASA-CASE-NPO-13291-1] c 37 N81-27226

DATA ACQUISITION

Analog-to-digital conversion system Patent
[NASA-CASE-GSC-11182-1] c 15 N75-13007

DATA COMPRESSION

Data compression system with a minimum time delay
[NASA-CASE-GSC-11182-1] c 15 N75-13007

DATA ACQUISITION

Analog-to-digital conversion system Patent
[NASA-CASE-GSC-11182-1] c 15 N75-13007

DATA TRANSMISSION

Remote platform power conserving system
[NASA-CASE-MSC-11182-1] c 15 N75-13007

DATA COMPRESSION

Data compression system with a minimum time delay
[NASA-CASE-GSC-11182-1] c 15 N75-13007

DATA ACQUISITION

Analog-to-digital conversion system Patent
[NASA-CASE-GSC-11182-1] c 15 N75-13007

DATA TRANSMISSION

Remote platform power conserving system
[NASA-CASE-MSC-11182-1] c 15 N75-13007

DATA COMPRESSION

Data compression system with a minimum time delay
[NASA-CASE-GSC-11182-1] c 15 N75-13007

DATA ACQUISITION

Analog-to-digital conversion system Patent
[NASA-CASE-GSC-11182-1] c 15 N75-13007

DATA TRANSMISSION

Remote platform power conserving system
[NASA-CASE-MSC-11182-1] c 15 N75-13007

DATA COMPRESSION

Data compression system with a minimum time delay
[NASA-CASE-GSC-11182-1] c 15 N75-13007
DISTRIBUTED FEEDBACK LASERS
Multimode-periodic surface-emitting lasers
Brillouin multilayered (SLM) laser
[NASA-CASE-NPO-11428-1] C 26 N93-14703

DISTRIBUTED PROCESSING
Distributed multiprocessor memory architecture
[NASA-CASE-NPO-15845-1] C 60 N93-32342
Real-time simulation clock
Method of up-front load balancing for local memory parallel processors
Distributed computing system with dual independent communications paths between computers and employing split tokens
Dynamic resource allocation scheme for distributed heterogeneous computer systems
A space-time neural network for processing both spacial and temporal data

DISTRIBUTION (PROPERTY)
Thermionic energy converters

DISTRIBUTORS
High voltage distributor
[NASA-CASE-LAR-11194] C 33 N76-16332

DIVERGENT NOZZLES
Jet exhaust noise suppressor
[NASA-CASE-LAW-11286-1] C 05 N74-27490

DIVERTERS
Flow diverter value and slow diversion method
[NASA-CASE-LAW-11286-1] C 36 N70-32468

DIVIDERS
A synchronous binary array divider
[NASA-CASE-EPE-10810-1] C 60 N74-20836

DOCUMENT STORAGE
Slate marker Patent
[NASA-CASE-XLA-02705] C 04 N71-19598

DOMES (SPECIAL FORMS)
Airborne tracking sunphotometer apparatus and system
[NASA-CASE-ARC-11622-1] C 44 N86-14492

DOORS
Emergency escape system Patent
[NASA-CASE-MSC-12086-1] C 05 N71-12345

DOPANTS
A controlled remote window Patent
[NASA-CASE-MSC-12084-1] C 32 N82-31690

DOPED CRYSTALS
Sub-Kleen resistance thermometer

DOPES
Lithium counterpoised silicon solar cell

DOPPLER FREQUENCY OF TRANSMISSION
Doppler frequency spread correction device for multiplex transmission
[NASA-CASE-XGS-02724-1] C 07 N89-39978

DOPPLER EFFECT
Doppler Laser system for measuring three dimensional vector velocity Patent
[NASA-CASE-MSC-12086-1] C 21 N71-12345
Doppler compensation by shifting transmitted object frequency within limits
[NASA-CASE-GSC-10087-1] C 07 N73-20147
Doppler shift system -- system for measuring velocities of radiant intensities
[NASA-CASE-HGN-10740-1] C 72 N97-19310
Method and apparatus for Doppler frequency modulation of radiation
Servomechanism for Doppler shift compensation in optical correlator for synthetic aperture radar
Vibration-free Raman Doppler velocimeter
[NASA-CASE-LAR-12288-1] C 35 N87-14660
Efficient detection and signal parameter estimation with application to high dynamic GPS receiver
Doppler-corrected differential detection system
Doppler shift system -- system for measuring velocity of radiant intensities
[NASA-CASE-GSC-13403-1] C 38 N91-28557
Doppler shift compensation system for laser transmitters and receivers
[NASA-CASE-GSC-13194-1] C 36 N93-18287

DOPPLER RADAR
Cooperative Doppler radar system Patent
[NASA-CASE-LAR-12288-1] C 21 N71-11176
Doppler radar having phase modulation of both transmitted and reflected return signals
[NASA-CASE-MRC-15845-1] C 35 N85-22680
Doppler radar with multiphase modulation of transmitted and reflected signal
[NASA-CASE-MSC-18808-1] C 32 N89-26280
ELECTRIC DISCHARGES

Electrical discharge apparatus for forming Patent

| NASA-CASE-XMF-03075 | c 15 | N70-34249 |
| NASA-CASE-XMF-03024 | c 15 | N71-34314 |

Load insensitive gas discharge Patent

| NASA-CASE-XMF-03042 | c 15 | N71-34313 |

Pulse discharge to excite inert gases Patent

| NASA-CASE-XMF-03024 | c 15 | N71-34313 |

Electrical discharge apparatus for forming Patent

| NASA-CASE-XMF-03075 | c 15 | N70-34249 |

Ericd energy storage

- Electric equipment tests
- Rapidly pulsed, high intensity, incoherent light source
- Field ionization electrodes Patent

In the same volume, there is a section on electric generators:

- Linear magnetic motor/generator -- to generate electric energy using magnetic flux for spacecraft power supply
- Enhanced single layer multi-color or luminescent display
- Load-insensitive electrical device
- Rotary electric device
- Rotary electric device
ELECTROCHEMICAL WAVES

ELECTROCHEMICAL WAVEs
Proton exchange membrane patents
[ NASA-CASE-GSC-11368-1 ] c 44 N73-32108

ELECTROCATALYSTS
Electrocatalyst for oxygen reduction
[ NASA-HST-10007-1 ] c 06 N72-10385

ELECTROCHEMICAL WAVES
ELECTROACOUSTIC WAVES
Patent
[ NASA-CASE-LEW-11314-1 ] c 33 N80-20487

Electrolysis
Electrolysis of water for hydrogen generation
[ NASA-CASE-XGS-03505-I ] c 03 N71-10668

ELECTROCHEMICAL WAVEs
Electrode and insulator with shielded diode junction
[ NASA-CASE-XLE-03778 ] c 09 N69-21542

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ELECTRODE MATERIALS
[ NASA-CASE-GSC-11367-1 ] c 44 N74-19692

ELECTROHYDRAULIC FORMING
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[ NASA-CASE-LEW-11162-1 ] c 33 N74-12913

ELECTROCHEMICAL WAVES
ELECTRODE MATERIALS
[ NASA-CASE-GSC-11368-1 ] c 09 N73-32108

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ELECTROHYDRAULIC FORMING
[ NASA-CASE-LEW-11162-1 ] c 33 N74-12913

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[ NASA-CASE-XGS-04855 ] c 03 N74-12913

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SUBJECT INDEX
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Three-phase power factor controller with induced EM sensing

ELECTRON BEAM WELDING

Spool welding chamber Patent

ELECTRON BEAMS

Electronic gun for electron beam welding Patent

ELECTRON ENERGY

Low energy electron magnetometer using a monomagnetic electron beam

ELECTRON MICROSCOPES

Device for measuring electron-beam intensities and for subjecting materials to electron irradiation in an electron microscope

ELECTRON MICROSCOPY

Synchronized voltage contrast display analysis system

ELECTRON MICROSCOPES

Subjecting materials to electron irradiation in an electron microscope

ELECTRON MICROSCOPY

Synchronized voltage contrast display analysis system

ELECTRON SCATTERING

Thin-film analysis of scattered electrons in a merged electron-ion beam geometry

ELECTRON SOURCES

Electrode aperture system

ELECTRON TRANSFER

Process for reducing secondary electron emission Patent

ELECTRON TRANSITIONS

Diamond-integrated gasdynamic laser -- for producing different wavelengths

ELECTRON TUNNELING

Doped Josephson tunneling junction for use in a sensitive IR detector

ELECTRONIC FILTERS

Optimum predetection diversity receiving system

ELECTRONIC EQUIPMENT

Monopulse system with an electronic scanner

ELECTRONIC SYSTEMS

Self-tuning bandpass filter

ELECTRON ENERGY

Low energy electron magnetometer using a monomagnetic electron beam

ELECTRON ENERGY

Low energy electron magnetometer using a monomagnetic electron beam

ELECTRONIC SYSTEMS

Monopulse system with an electronic scanner

SUBJECT INDEX

Electronic system for high power load control -- solar arraying

Electronic system for high power load control -- solar arraying

Electronic equipment for high power load control -- solar arraying

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AAS CASE-NPO-10144

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AAS CASE-XAL-01170

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Flexible pressure-sensing gas bearing Patent
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AAS CASE-NPO-14011-3

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GAS COOLED REACTORS
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AAS CASE-LAR-14791-1

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AAS CASE-XAC-02877

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Gas core nuclear reactor Patent
AAS CASE-LEW-12501-5

GAS COOLING
Method and apparatus for determining the contents of contained gas samples
AAS CASE-GSC-11000-1

Gas core nuclear reactor Patent
AAS CASE-XNP-08877

GAS COOLING
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AAS CASE-LAR-14791-1

Two-stage gas measurement system Patent
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GAS DENSITY
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GAS BLENDING
Swivel support for gas bearings Patent
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GLASS ELECTRODES

Method of manufacturing bonded fiber flywheel —

Glass-to-metal seals comprising relatively high

GLASS ELECTRODES

Method of producing hybrid graphite composite

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Method of machining holes in composite materials

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Method of manufacturing bonded fiber flywheel —

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Method of producing hybrid graphite composite

GLASS ELECTRODES

Method of machining holes in composite materials

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Method of manufacturing bonded fiber flywheel —

Glass-to-metal seals comprising relatively high

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Method of machining holes in composite materials

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Method of manufacturing bonded fiber flywheel —

Glass-to-metal seals comprising relatively high
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- Impact damage quantitatively analyzing a structure for disbonds and/or cracks on a structure Patent
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- Magnetic electrical connectors for biomedical percutaneous implants
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INASMATIC SYSTEMS

- Electric storage battery
- Hybrid composite laminate structures

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- Magnetic electrical connectors for biomedical percutaneous implants
- Implantable electrical device

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- Magnetic electrical connectors for biomedical percutaneous implants
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- Magnetic electrical connectors for biomedical percutaneous implants
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PLASMA SPRAYING

Plasma spraying is a method of depositing a substance onto a surface by melting the material in a plasma jet and spraying it onto the substrate. This method is commonly used for the deposition of ceramic, metallic, and composite materials. It is particularly useful for the deposition of materials that are difficult to deposit using other methods, such as high-temperature materials or those that are sensitive to thermal exposure.

Advantages of plasma spraying include:
- High deposition rates
- Good adherence of the deposited material
- Ability to deposit a wide range of materials
- Flexibility in the shape and size of the deposits

Disadvantages include:
- High operating costs
- Risk of contamination
- Potential for material degradation due to high energy input

PLASMA TEMPERATURE

The temperature of the plasma plays a crucial role in determining the properties of the deposited material. The temperature can be controlled by adjusting the power input, gas composition, and plasma gas flow rate. The plasma temperature can vary from a few thousand degrees Celsius to over 100,000 degrees Celsius, depending on the specific plasma spraying process.

PLASMA SHEATHS

The plasma sheath is a region of high electric potential that surrounds the plasma jet. It is characterized by a high density of charged particles and a low particle density. The plasma sheath plays a key role in the deposition process by providing a source of charged particles that are necessary for the attachment of the molten particles to the substrate.

PLASMA Utilizing a plurality of sensing coils positioned in
plasma sheath formed around a space vehicle
surface of a model vehicle Patent

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Inorganic-organic separators for alkaline batteries

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PLASTIC INSULATORS

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and second objects Patent

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arines produced thereby Patent

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Inorganic-organic separators for alkaline batteries

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polymer compositions

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Method of bonding plasticized elastomer to metal and
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PLASMA SPRAYING

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PLASMA SPRAYING

Method for forming plastic materials Patent

PLASMA SPRAYING

Method of forming plastic materials Patent

PLASMA SPRAYING

Method of making polyimide film

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PLASMA SPRAYING

Method of making polyimide film
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- Bio-reactor probe
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- Material for use in electronic devices
- Excellent thermal stability

SILICON COMPOUNDS

- High purity materials
- Used in electronic devices

SILICON POLYMERS

- High thermal stability
- Used in electronic devices

SILICON CONTROLLERS

- Integrated circuits
- Used in electronic devices

SILICON DIODES

- High speed, high frequency
- Used in electronic devices

SILICON MOLDING

- Excellent dimensional stability
- Used in electronic devices

SILICON NITRIDE

- High thermal stability
- Used in electronic devices

SILICON NITRILES

- High stability
- Used in electronic devices

SILICON OXIDES

- High thermal stability
- Used in electronic devices

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- High thermal stability
- Used in electronic devices
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NASA-CASE-NPO-13862-1 c 35 N79-10391
Texturing polymer surfaces by transfer casting --- cardiovascular prosthesis

NASA-CASE-LEW-13120-1 c 27 N82-28440
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NASA-CASE-LEW-12919-1 c 24 N82-10117
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NASA-CASE-LEW-15250-1 c 35 N85-17060
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Parallel motion suspension device Patent

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NASA-CASE-XMS-05410-2 c 14 N71-22995
Optical projection spectrometer with means for stabilizing sample surface potential

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NASA-CASE-NPO-13904-1 c 25 N79-11152
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Intra-ocular pressure normalization technique and equipment

NASA-CASE-LEW-12955-1 c 52 N80-14684
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Floating electrodes Patent

NASA-CASE-NPO-13772-1 c 05 N78-27880
Surface texturing of fluoropolymers

NASA-CASE-NPO-13862-1 c 35 N79-10391
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Elastomer coated filter and composites thereof comprising at least 60% by weight of a hydrated filter and an elastomer containing an acid substrate

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SUSPENSION CRACKS
Elastomer coated filter and composites thereof comprising at least 60% by weight of a hydrated filter and an elastomer containing an acid substrate

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SUSPENSION CRACKS
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Floating two force component measuring device Patent

[NASA-CASE-XAC-04485] c 14 N71-23790

Transducer circuit and catheter transducer Patent

[NASA-CASE-ARC-10321-2] c 09 N71-24597

Method of attaching a cover glass to a silicon solar cell Patent

[NASA-CASE-XLE-09589] c 03 N71-24890

Antenna control system for sounding rockets Patent

[NASA-CASE-XGS-01514] c 31 N71-24750

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[NASA-CASE-NOE-0649] c 07 N71-24840

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[NASA-CASE-XNP-09771] c 08 N71-24841

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[NASA-CASE-MSC-12296] c 09 N71-24842

Apparatus for determining the deflection of an electron beam impinging on a target Patent

[NASA-CASE-XNP-06617] c 09 N71-24843

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[NASA-CASE-XNS-06178] c 08 N71-24890

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[NASA-CASE-XNP-09789] c 08 N71-24891

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[NASA-CASE-MSC-20340] c 35 N71-24903

Brushless direct current tachometer Patent

[NASA-CASE-MSC-20341] c 09 N71-24904

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[NASA-CASE-XMS-10660] c 15 N71-25795

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Apparatus for inspecting microfilm Patent

[NASA-CASE-MSC-20266] c 14 N71-26788

Apparatus for remote measurement of displacement of marks on a specimen undergoing a tensile test Patent

[NASA-CASE-XNP-10797] c 14 N71-26789

Optimum performance spacecraft solar cell system Patent

[NASA-CASE-SC-06991] c 03 N72-20031

Electric storage battery Patent

[NASA-CASE-XNP-11021] c 07 N72-20032

System for the measurement of ultra-low stray light levels Patent

[NASA-CASE-LEW-10301] c 14 N72-21624

Microwave interferometer and apparatus Patent

[NASA-CASE-HQH-10439] c 14 N72-21643

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[NASA-CASE-XGS-03230] c 14 N72-23790

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[NASA-CASE-XNP-23641] c 15 N72-23792

Non-tracking solar energy collector system Patent

[NASA-CASE-XSC-20564] c 15 N72-23793

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[NASA-CASE-XMF-23704] c 15 N72-25124

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Non-tracking solar energy collector system Patent

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[NASA-CASE-MFS-20649] c 14 N79-23481

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[NASA-CASE-MFS-23777] c 37 N80-32716

System for sterilizing objects — cleaning space vehicle systems Patent

[NASA-CASE-KSC-11005] c 54 N81-24724

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[NASA-CASE-LAR-13257] c 25 N84-32447

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natural turbulence electrical power generator — using waveforms or random motion.

WAVE ANTENNAS

Diffused feedback acoustic surface wave oscillator

WAVE FRONT RECONSTRUCTION

Focused feedback optics with wavefront compensation.

WAVE GENERATION

Tunnel antenna array oscillating apparatus

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WAVE REFLECTION

Microwave flow detector Antenna

WAVE PROPAGATION

Diffused feedback acoustic surface wave oscillator.

WAVE RESISTANCE

Reachless synthesized impedance bandpass amplifier.

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WEATHERPROOFING

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Fibrous felt yarn insertion and beatup method using inflatable membrane.

WEBS

Methods and apparatus for measuring web material wound on a reel.

WEIGHTS

Digital remote dead weight calibrator

WEIGHT (MASS)

Composite seal for turbomachinery

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Miniature remote dead weight calibrator

WEIGHT INDICATORS

Automatic force measuring system Patent

WEIGHTLESSNESS

Automatic force measuring system Patent.

WEBS (SHEETS)

Methods for gripping test specimens

WEBS (SUPPORTS)

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WEEDS

Method and apparatus for gripping test specimens.

WEIGHT INDICATORS

Device for monitoring a change in mass in varying gravimetric environments.

WEIGHT MEASUREMENT

Automatic force measuring system Patent.

WEIGHTLESSNESS

Hydraulic system for changing the direction of the flow of fluid.

WEEDS

Methods for gripping test specimens.

WEIGHT MEASUREMENT

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Hydraulic system for changing the direction of the flow of fluid.
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ZINC OXIDES
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Heat transfer device
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McDonnell-Douglas Astronautics Co., Santa Monica, CA.
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Microwave Research Corp.

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- Passive propellant system
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- McDonnell-Douglas Corp., Huntington Beach, CA.
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- Phase-locked servo system
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- McDonnell-Douglas Corp., Santa Monica, CA.
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- Prevention of hydrogen embrittlement of high strength steel by hydride compositions
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- Utilization of oxygen fluoride for synthesis of fluoropolymer
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- Thermally conductive polymers
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- Passive propellant system
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- Reduction of blood serum cholesterol Patent
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- Mellon Inst., Pittsburgh, PA.
- Instrument for measuring torsional creep and recovery Patent
- [NASA-CASE-XLE-01481] c 14 N71-10781
- Meijer, Inc., Falls Church, VA.
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- [NASA-CASE-XFR-03107] c 09 N71-19449
- Compact solar still Patent
- [NASA-CASE-XMS-05433] c 15 N71-23086
- McNeil, Inc., Salem, MA.
- Tuning arrangement for an electron discharge device of the like Patent
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- Methodist Hospital, Houston, TX.
- Snap-in compressible biomedical electrode
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- Microwave Research Corp., North Andover, MA.
- Highly efficient antenna system using a corrugated horn and scanning hyperbolic reflector
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Metal phosphonate intermediates for the preparation of polymers

Elastomer-modified phosphorus-containing imide resins

Visual accommodation trainer-tester

Sidelooking laser altimeter for a flight simulator

Method for detecting coliform organisms

High performance channel injection sealant invention

Synthesis of 2,4,8,10-tetroxaspiro5,5-undecane

Space station architecture, module, berthing hub, shell

Phosphorus-containing imide resins

Fire extinguishant materials

Carboranylmethylene-substituted phosphazenes and precursors thereof

Doppler velocimeter

Process for preparing pertfluorotriazine elastomers and products thereof

Fire blocking systems for aircraft seat cushions

Visual accommodation trainer-tester

Matching optics for Gaussian beams

Electro-expulsive separation system

Structural panels

Laser Doppler velocimeter multiplexer interface for simultaneous measured events

Passive zero-gravity leg restraint

Metal phosphonate polymers

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Ultrafast electro-optical modulator

Copolymers of vinyl styrenopyridines or vinyl stilbazoles

Aromatic cyclotriphosphazenes

Light weight elastomer resin containing graphitic composites

Visual accommodation trainer-tester

Electro-expulsive separation system

Structural panels

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Visual accommodation trainer-tester

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Laser Doppler velocimeter multiplexer interface for simultaneous measured events

Passive zero-gravity leg restraint

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Liquid immersible ultrasonic transducer

Film advance indicator

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Mechanical and jointed system for structural column elements

Instrument for determining concentration and elapse time between independent sources of random sequential events

Function for environmental exposure of structural materials under compression load

Vehicle anode thermal control coating

Error correction method and apparatus for electronic timepieces

System for controlling aerodynamically induced twist

Powder fed shared particle generator

N-propargyl groups

N-propargyl groups

Aerosol instabilities in storing systems

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Modeling system for preparing thermoplastic polyimide resins by addition of cobalt ions

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Zero speed end joint system for structural column elements

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Thiophenyl ether disiloxanes and trisiloxanes useful as lubricants
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Telescope
Low distortion automatic phase control circuit
Two stage light gas-plasma projectile accelerator
Inserting device
Thermal energy storage system
Holography utilizing surface plasmon resonances
Electrostatic sensor insertion
Wind tunnel
Sputtering device
Apparatus for conducting flow electrophoresis in the
Thrust-isolating mounting
Automatically operable self-leveling load table
Strain gauge ambiguity sensor for segmented mirror
System for depositing thin films
Device for configuring multiple leads
Sprag solenoid brake
Conductive elastomeric extensometer
Apparatus for loading tension members
Internally supported flexible duct joint
Translator/shock absorber for attitude sensors
Wrist joint assembly
Projection system for display of parallax and perspective
Holographic system for nondestructive testing
Hole cutter
Heterodyne interferometer
Solar energy trap
Failure detection and control means for improved drift performance of a gimbaled platform system
Lead-oxide dc power supply system having a closed loop oxygen and water system
Thermal energy storage system
Inverted drive system
Aircraft-mounted crash-activated transmitter device
Multiple in-line docking capability for rotating station}

C-44

NASA

Marshall Space Flight Center

CORPORATE SOURCE

Solar energy trap
Failure detection and control means for improved drift performance of a gimbaled platform system
Lead-oxide dc power supply system having a closed loop oxygen and water system
Thermal energy storage system
Inverted drive system
Aircraft-mounted crash-activated transmitter device
Multiple in-line docking capability for rotating station
Crystal system for temperatures on the order of 2 deg K or less

The dc-to-dc converter employing staggered-phase power switches with two-loop control

Space communication system for compressed data with a concatenated Free-Sea-riev-Olivet coding channel

Computer interface system

High temperature oxidation resistant cement composites

Sample gas to bare part waveguide

feedback for a gas laser

Fiber distributed feedback laser

Zero torque gear head wrench

Highly efficient antenna system using a corrugated horn

Miniature muscle displacement transducer

Indicator providing continuous indication of the presence of species gases

System for minimizing internal combustion engine pollution emission

Hydrogen storage secondary battery

High vacuum system using a corrugated horn and scanning hyperbolic reflector

High energy particulate measurement for measurement of trap density and energy distribution in dielectric films

High pressure particulate measurement for a gaseous particulate testing of pressure vessels

Hydrogen-rich gas generator

Stirling cycle engine and refrigeration systems

Hydrogen-rich gas generator

Myocardium wall thickness transducer and measuring method

Nuclear alkylated pyridine aldehyde polymers and conductive compositions thereof

Low cost solar energy collection system

Differential optical absorption detector

Nuclear thermionic power source

Charge transfer reaction laser with preionization

Sweep group delay measurement

Coal desulfurization process

Charge transfer reaction laser with preionization

RF beam center location method and apparatus for

Low to high temperature energy conversion system

Charge transfer reaction laser with preionization

RF beam center location method and apparatus for

Ring laser gyros and methods for making same

Charge transfer reaction laser with preionization

RF beam center location method and apparatus for

Low to high temperature energy conversion system

Charge transfer reaction laser with preionization

RF beam center location method and apparatus for

Low to high temperature energy conversion system

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RF beam center location method and apparatus for

Low to high temperature energy conversion system

Charge transfer reaction laser with preionization

RF beam center location method and apparatus for

Low to high temperature energy conversion system

Charge transfer reaction laser with preionization

RF beam center location method and apparatus for
Multibeam single frequency synthetic aperture radar processor for imaging separate range swaths.

Method and turbine for transmitting kinetic energy from a steam of two-phase fluid.

Digital data reformatter/deserializer.

System and method for obtaining wide screen Schlieren photographs.

Dynamic capacitor having a peripherally driven element and system incorporating the same.

Seismic vibration source.

Underwater seismic source.

Resolution enhanced sound detecting apparatus.

Start up system for hydrogen generator used with an.

Stabilization of He2(a 3 Sigma u + molecules in liquid.

Chemical vapor deposition reactor.

Bonding machine for forming a solar array strip.

Solar energy collection system.

Compact artificial heart.

System for growing ribbon crystals without subjecting the.

System for detecting substructure microfractures and method therefore.

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Multibeam single frequency synthetic aperture radar processor for imaging separate range swaths.

Electric field and method for forming the same.

Process for ultra cleaning of wire produced by a.

Electromagnetic radiation energy arrangement.

Multibeam single frequency synthetic aperture radar processor for imaging separate range swaths.

Method and turbine for transmitting kinetic energy from a steam of two-phase fluid.

Digital data reformatter/deserializer.

System and method for obtaining wide screen Schlieren photographs.

Dynamic capacitor having a peripherally driven element and system incorporating the same.

Seismic vibration source.

Underwater seismic source.

Resolution enhanced sound detecting apparatus.

Start up system for hydrogen generator used with an.
CORPORATE SOURCE

NASA, Pasadena Office

Obstacle avoidance for redundant robots using configuration control

(NASA CASE-NPO-17852-1-CU) c 63 N93-33019
Real time edge-enhanced optical correlator

(NASA CASE-NPO-17837-1-CU) c 74 N93-33021
Real time pre-detection dynamic range compression

(NASA CASE-NPO-17954-1-CU) c 74 N93-33023
Auto and hetero-associative memory using a 2-D optical logic gap

(NASA CASE-NPO-17907-1-CU) c 60 N93-33037
Hazardous materials emergency response mobile

(NASA CASE-NPO-18690-1-CU) c 37 N93-34205
Cascade VLSI neural network architecture for on-line learning

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Alkal metal for ultraviolet band-pass filter

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Fiber optic frequency transfer link

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Thermal treatment of silicon integrated circuit chips to prevent and heal voids in aluminum metallization

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Planar varactor frequency multiplier devices with blocking barrier

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Syncronous parallel system for control and discrete event simulation

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Controlled under-actuated robot arms using a high speed dynamic system for production of integrated circuits

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Multicomponent gas sorption Joule-Thomson refrigeration

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Network of dedicated processors for finding lowest-cost map path

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Fiberoptic sensor for optical computing
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National Science Foundation, Washington, DC.

North American Rockwell Corp., Los Angeles, CA.

North American Rockwell Corp., El Segundo, CA.

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### NASA Patent Abstracts Bibliography

**Section 2**

**Typical Accession Number Index Listing**

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**Listings in this index are arranged numerically by accession number. The category number indicates the category in Section 1 (Abstracts) to which the citation is located. The accession number denotes the number by which the citation is identified within the subject category. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.**

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JANUARY 1994

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§1245.201 Policy and objective.
It is the policy and objective of this subpart to use the patent system to promote the utilization of inventions arising from NASA supported research and development.

§ 1245.202 Definitions
(a) “Federally owned invention” means an invention, plant, or design which is covered by a patent, or patent application in the United States, or a patent, patent application, plant variety protection, or other form of protection, in a foreign country, title to which has been assigned to or otherwise vested in the United States Government.

(b) “Federal agency” means an executive department, military department, Government corporation, or independent establishment, except the Tennessee Valley Authority, which has custody of a Federally owned invention.

(c) “NASA Invention” means a Federally owned invention with respect to which NASA maintains custody and administration, in whole or in part, of the right, title or interest in such invention on behalf of the United States Government.

(d) “Small business firm” means a small business concern as defined at section 2 of Pub. L. 85-536 (15 U. S. C. 632) and implementing regulations of the Administrator of the Small Business Administration. For the purpose of these regulations, the size standard for small business concerns involved in Government procurement, contained in 13 CFR 121.3-6, and in subcontracting, contained in 13 CFR 121.3-12, will be used.

(e) “Practical application” means to manufacture in the case of a composition or product, to practice in the case of a process or method, or to operate in the case of a machine or system; and, in each case, under such conditions, as to establish that the invention is being utilized and that its benefits are to the extent permitted by law or Government regulations available to the public on reasonable terms.

(f) “United States” means the United States of America, its territories and possessions, the District of Columbia, and the Commonwealth of Puerto Rico.

§1245.203 Authority to grant licenses.
NASA inventions shall be made available for licensing as deemed appropriate in the public interest. NASA may grant nonexclusive, partially exclusive, or exclusive licenses thereto under this subpart on inventions in its custody.

§1245.204 All licenses granted under this subpart.

(a) Restrictions. (1) A license may be granted only if the applicant has supplied NASA with a satisfactory plan for development or marketing of the invention, or both, and with information about the applicant’s capability to fulfill the plan.

(2) A license granting rights to use or sell under a NASA invention in the United States shall normally be granted only to a licensee who agrees that any products embodying the invention or produced through the use of the invention will be manufactured substantially in the United States.

(b) Conditions. Licenses shall contain such terms and conditions as NASA determines are appropriate for the protection of the interests of the Federal Government and the public and are not in conflict with law or this subpart. The following terms and conditions apply to any license:

(1) The duration of the license shall be for a period specified in the license agreement, unless sooner terminated in accordance with this subpart.

(2) The license may be granted for all or less than all fields of use of the invention or in specified geographical areas, or both.

(3) The license may extend to subsidiaries of the licensee or other parties if provided for in the license but shall be nonassignable without approval of NASA, except to the successor of that part of the licensee’s business to which the invention pertains.

(4) The license may provide the licensee the right to grant sublicenses under the license, subject to the approval of NASA. Each sublicense shall make reference to the license, including the rights retained by the Government, and a copy of such sublicense shall be furnished to NASA.

(5) The license shall require the licensee to carry out the plan for development or marketing of the invention, or both, to bring the invention to practical application within a period specified in the license, and to continue to make the benefits of the invention reasonably accessible to the public.

§1245.205 Nonexclusive licenses.

Subpart 2—Licensing of NASA Inventions

§ 1245.206 Exclusive and partially exclusive licenses.

Subpart 3—Restrictions and Conditions

Restrictions and Conditions

§1245.207 Application for a license.

§1245.208 Processing applications.

§1245.210 Modification and termination of licenses.

§1245.211 Appeals.

§1245.212 Protection and administration of inventions.

§1245.213 Transfer of custody.

Authority: 35 U.S.C. Section 207 and 208.94 Stat 3023 and 3024.

Subpart 2—Licensing of NASA Inventions

§ 1245.200 Scope of subpart.

This subpart prescribes the terms, conditions and procedures upon which a NASA invention may be licensed. It does not affect licenses which (a) were in effect prior to July 1, 1981; (b) may exist at the time of the Government’s acquisition of title to the invention, including those resulting from the allocation of rights to inventions made under Government research and development contracts; (c) are the result of an authorized exchange of rights in the settlement of patent disputes; or (d) are otherwise authorized by law or treaty.
PATENT LICENSING REGULATIONS

(6) The license shall require the licensee to report periodically on the utilization or efforts at obtaining utilization that are being made by the licensee, with particular reference to the plan submitted.

(7) All licenses shall normally require royalties or other consideration.

(8) Where an agreement is obtained pursuant to §1245.204(a)(2) that any products embodying the invention or produced through use of the invention will be manufactured substantially in the United States, the license shall recite such agreement.

(9) The license shall provide for the right of NASA to terminate the license, in whole or in part, if:

(i) NASA determines that the licensee is not executing the plan submitted with its request for a license and the licensee cannot otherwise demonstrate to the satisfaction of NASA that it has taken or can be expected to take within a reasonable time effective steps to achieve practical application of the invention;

(ii) NASA determines that such action is necessary to meet requirements for public use specified by Federal regulations issued after the date of the license and such requirements are not reasonably satisfied by the licensee;

(iii) The licensee has willfully made a false statement of or willfully omitted a material fact in the license application or in any report required by the license agreement; or

(iv) The licensee commits a substantial breach of a covenant or agreement contained in the license.

(10) The license may be modified or terminated, consistent with this subpart, upon mutual agreement of NASA and the licensee.

(11) Nothing relating to the grant of a license, nor the grant itself, shall be construed to confer upon any person any immunity from or defenses under the antitrust laws or from a charge of patent misuse, and the acquisition and use of rights pursuant to this subpart shall not be immunized from the operation of state or Federal law by reason of the source of the grant.

Types of Licenses

§1245.205 Nonexclusive licenses.

(a) Availability of licenses. Nonexclusive licenses may be granted under NASA inventions without publication of availability or notice of a prospective license.

(b) Conditions. In addition to the provisions of §1245.204, the nonexclusive license may also provide that, after termination of a period specified in the license agreement, NASA may restrict the license to the fields of use or geographic areas, or both, in which the licensee has brought the invention to practical application and continues to make the benefits of the invention reasonably accessible to the public. However, such restriction shall be made only in order to grant an exclusive or partially exclusive license in accordance with this subpart.

§1245.206 Exclusive and partially exclusive licenses.

(a) Domestic licenses.

(1) Availability of licenses. Exclusive or partially exclusive licenses may be granted on NASA inventions; (i) 3 months after notice of the invention's availability has been announced in the Federal Register; or (ii) without such notice where NASA determines that expeditious granting of such a license will best serve the interests of the Federal Government and the public; and (iii) in either situation, specified in (a)(1)(i) or (ii) of this section only if:

A Notice of a prospective license, identifying the invention and the prospective licensee, has been published in the Federal Register, providing opportunity for filing written objections within a 60-day period;

B After expiration of the period in §1245.206(a)(1)(iii)(A) and consideration of any written objections received during the period, NASA has determined that:

1 The interests of the Federal Government and the public will best be served by the proposed license, in view of the applicants intentions, plans, and ability to bring the invention to practical application or otherwise promote the invention's utilization by the public;

2 The desired practical application has not been achieved, or is not likely expeditiously to be achieved, under any nonexclusive license which has been granted, or which may be granted, on the invention;

3 Exclusive or partially exclusive licensing is a reasonable and necessary incentive to call forth the investment of risk capital and expenditures to bring the invention to practical application or otherwise promote the invention's utilization by the public; and

4 The proposed terms and scope of exclusivity are not greater than reasonably necessary to provide the incentive for bringing the invention to practical application or otherwise promote the invention's utilization by the public;

C NASA has not determined that the grant of such license will tend substantially to lessen competition or result in undue concentration in any section of the country in any line of commerce to which the technology to be licensed relates, or to create or maintain other situations inconsistent with the antitrust laws; and

D NASA has given first preference to any small business firms submitting plans that are determined by the agency to be within the capabilities of the firms and as equally likely, if executed, to bring the invention to practical application as any plans submitted by applicants that are not small business firms.

(2) Conditions. In addition to the provisions of §1245.204, the following terms and conditions apply to domestic exclusive and partially exclusive licenses:

(i) The license shall be subject to the irrevocable, royalty-free right of the Government of the United States to practice and have practiced the invention on behalf of the United States and on behalf of any foreign government or international organization pursuant to any existing or future treaty or agreement with the United States.

(ii) The license shall reserve to NASA the right to require the licensee to grant sublicenses to responsible applicants, on reasonable terms, when necessary to fulfill health or safety needs.

(iii) The license shall be subject to any licenses in force at the time of the grant of the exclusive or partially exclusive license.

(iv) The license may grant the licensee the right of enforcement of the licensed patent pursuant to the provisions of Chapter 29 of Title 35, United States Code, or other statutes, as determined appropriate in the public interest.

(b) Foreign licenses.

(1) Availability of licenses. Exclusive or partially exclusive licenses may be granted on a NASA invention covered by a foreign patent, patent application, or other form of protection, provided that:

i Notice of a prospective license, identifying the invention and prospective license, has been published in the Federal Register, providing opportunity for filing written objections within a 60-day period and following consideration of such objections;

ii NASA has considered whether the interests of the Federal Government or United States industry in foreign commerce will be enhanced; and

iii NASA has not determined that the grant of such license will tend substantially to lessen competition or result in undue concentration in any section of the United States in any line of commerce to which the technology to be licensed relates, or to create or maintain other situations inconsistent with antitrust laws.

(2) Conditions. In addition to the provisions of §1245.204, the following terms and conditions apply to foreign exclusive and partially exclusive licenses:

(i) The license shall be subject to the irrevocable, royalty-free right of the Government of the United States to practice and have practiced the invention on behalf of the United States and on behalf of any foreign government or international organization pursuant to any existing or future treaty or agreement with the United States.

(ii) The license shall be subject to any licenses in force at the time of the grant of the exclusive or partially exclusive license.

(iii) The license may grant the licensee the right to take any suitable and necessary actions to protect the licensed property, on behalf of the Federal Government.

(c) Record of determinations. NASA shall maintain a record of determinations to grant exclusive or partially exclusive licenses.

Procedures

§1245.207 Application for a license.

An application for a license should be addressed to the Patent Counsel at the NASA installation having responsibility for the invention and shall normally include:

(a) Identification of the invention for which the license is desired, including the patent application serial number or patent number, title, and date, if known;

(b) Identification of the type of license for which the application is submitted;

(c) Name and address of the person, company, or organization applying for the license and the citizenship or place of incorporation of the applicant;

(d) Name, address, and telephone number of representative of applicant to whom correspondence should be sent;
## NASA Patent Abstracts Bibliography

### Section 2: Indexes (Supplement 44)

**Abstract**

A subject index is provided for over 5500 patents and patent applications for the period May 1969 through December 1993. Additional indexes list personal authors, corporate authors, contract numbers, NASA case numbers, U.S. patent class numbers, U.S. patent numbers, and NASA accession numbers.

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