NASA PATENT ABSTRACTS BIBLIOGRAPHY

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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 174 citations published in this issue of the Abstract Section cover the period July 1992 through December 1992. The Index Section references over 5300 citations covering the period May 1969 through December 1992.

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 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.
TYPICAL CITATION AND ABSTRACT

An apparatus for characterizing the magnetic field of a device under test is discussed. The apparatus is comprised of five separate devices: (1) a device for nullifying the ambient magnetic fields in a test environment area with a constant applied magnetic field; (2) a device for rotating the device under test in the test environment area; (3) a device for sensing the magnetic field (to obtain a profile of the magnetic field) at a sensor location which is along the circumference of rotation; (4) a memory for storing the profiles; and (5) a processor coupled to the memory for characterizing the magnetic field of the device from the magnetic field profiles thus obtained.

Official Gazette of the U.S. Patent and Trademark Office
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 cermets; 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 information 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 geophysics 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 applications see: 22 Nuclear Engineering. For related information 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 Combustion. For related information see also: 28 Propulsion Systems.

28 Propulsion Systems
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. 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; clustered 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; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, 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; defense 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**, 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**.

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; astronautavigation and guidance; and radio blackout. For related information see also 04 **Aircraft Communications and Navigation** and 32 **Communications and Radar**.

N.A.—no abstracts were assigned to this category for this issue.
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; microminiaturi-
zation; 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; fluids; 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 18 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 PHYSICS
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
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GADOLINIUM

GALLIUM

FUSION WELDING

GALILEO PROJECT

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GALLIUM PHOSPHIDES

GAS ANALYSIS

GAS DENSITY

GAS BAGS

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GAS DENSITY

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GAS COOLDING

GAS COOLING

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GERMANIUM

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GEODETIC SURVEYS

GEODESY

GELATION

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GELATION

Method of controlling a resin curving process — for fiber reinforced ceramics

Process of forming particles in a cryogenic path

Intermittent type silica gel adsorber refrigerator

GENERAL ROCKET PROPELLANTS

Process of forming particles in a cryogenic path

Spherical coated solid for effecting and presenting a selected electrical resistance

Production of multiw fiber

GENERAL AERONAUTICS

Explosively activated egress area

Apparatus for establishing flow of a fluid mass having a known velocity

Continuous laminar smoke generator

Apparatus for determining the rate of gas and liquid flow

Continuous anemometer

Apparatus for determining the density of a fluid

Continuous water level meter

Apparatus for determining the density of a fluid

Continuous humidity meter

Apparatus for determining the density of a fluid

Continuous moisture meter

Apparatus for determining the density of a fluid

Continuous temperature meter

Apparatus for determining the density of a fluid

Continuous pressure meter

Apparatus for determining the density of a fluid

Continuous flow meter

Apparatus for determining the density of a fluid

Continuous density meter

Apparatus for determining the density of a fluid

Continuous viscosity meter

Apparatus for determining the density of a fluid

Continuous coherence meter

Apparatus for determining the density of a fluid

Continuous reflectivity meter

Apparatus for determining the density of a fluid

Continuous refractivity meter

Apparatus for determining the density of a fluid

Continuous absorptivity meter

Apparatus for determining the density of a fluid
HEAT RADIATORS

- High thermal power density heat transfer apparatus providing electrical isolation at high temperature using heat pipes (NASA-CASE-LEW-12950-2)
- Multi-log heat pipe evaporator (NASA-CASE-MSC-20946-1)
- Space vehicle thermal rejection system (NASA-CASE-LAR-13738-1)
- Polymetric heat pipe wick (NASA-CASE-GSC-13199-1)
- Solar thermal energy receiver (NASA-CASE-LEW-14549-1)

HEAT PIPE

- Thermal pump-compressor for space use (Patent)
- Pump for delivering heated fluids (NASA-CASE-XLE-00283)
- Magnetic heating pump (NASA-CASE-LAR-12406-1)
- Magnetic heating pump (NASA-CASE-LAR-12508-1)
- Ceramic heat pipe wick (NASA-CASE-ARC-11921-1)
- Convergent strain axis liquid pump system (NASA-CASE-NPO-17301-1)
- Lunar radiator shade (NASA-CASE-MFS-21866-1)

HEAT RESISTANT ALLOYS

- High temperature nickel-base alloy Patent (NASA-CASE-XLE-00307)
- Nickel-base alloy Patent (NASA-CASE-XLE-02991)
- Brazeable alloy Patent (NASA-CASE-XLE-00151)
- High temperature cobalt-base alloy Patent (NASA-CASE-XLE-02991)

HEAT TRANSFER

- Directional solidification of superalloys (NASA-CASE-MFS-28314-1)
- Heat shielding (NASA-CASE-MSC-21660-1)
- Heat sinks (NASA-CASE-MFS-22926-1)
- Heat exchanger and method of making same (NASA-CASE-MFS-22926-1)

HEAT STORAGE

- Method and apparatus for thermographically and quantitatively analyzing a structure for disbonds and/or inclusions (NASA-CASE-LAR-14559-1)
- Solar energy trap (NASA-CASE-LEW-20174-1)
- Thermal energy storage system — operating on superheating of liquids (NASA-CASE-MFS-22167-1)
- Stable density stratification solar pond (NASA-CASE-NPO-15808-1)
- Pulse thermal energy transport/storage system (NASA-CASE-LEW-15235-1)

HEAT TRANSFER

- Thermal switch Patent (NASA-CASE-LEW-14079-1)
- Apparatus for transferring cryogenic liquid Patent (NASA-CASE-LEW-00345)
- Heat exchanger Patent (NASA-CASE-LAR-02975-1)
- Heat pump Patent (NASA-CASE-MSC-12945-1)
- Heat conduction, semiconducting structure for space electronic packages (NASA-CASE-MSC-30361)

HEAT TRANSFER

- Heat exchanger and method of making (NASA-CASE-XLE-05230-1)
- Heat sink conduction (NASA-CASE-ARC-10198-1)
- Heat exchanger (NASA-CASE-MFS-22926-1)
- Heat transfer device (NASA-CASE-LEW-12508-1)
- Heat exchanger (NASA-CASE-XLE-00306)
- Heat exchanger (NASA-CASE-XLE-02991)
- Heat transfer device (NASA-CASE-LEW-14162-1)

HEAT RESISTANT ALLOYS


HEAT STORAGE


HEAT TRANSFER


HEAT STORAGE

LASER PLASMAS

Laser communication system for controlling several functions at a location remote to the laser

Methods for advanced material characterization by laser induced eddy current imaging

Laser apparatus for removing material from rotating objects

Laser apparatus for Doppler frequency modulation of radars

Laser arrays — with single flash lamp

Laser and apparatus for coating substrates using a laser

Laser apparatus for carbon dioxide lasers

Laser communication system for controlling several laser arrays

Laser measuring system for clamping and guiding devices

Laser measuring system for incremental assemblies — LSCS system

Laser measuring system for laser diode array module

Laser optical disk encoder with active heads

LASER PUMPING

Laser apparatus

Laser apparatus

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LASER RANGE FINDERS

Laser apparatus

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LASER WINDOWs

Laser apparatus

Laser windows

LASERS

Laser apparatus

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**MICROSTRUCTURE**
Method of producing refractory composites containing tantalum carbide, hafnium carbide, and hafnium boride. **Microwave**
Patent.

**MICROWAVE ANTENNAS**
Microwave power receiving antenna. **Microwave**
Patent.

**MICROWAVE AMPLIFIERS**
Temperature-compensating means for cavity resonator of amplifier. **Microwave**
Patent.

**MICROWAVE CIRCUITS**
Quasi-optical microwave component. **Microwave**
Patent.

**MICROWAVE FREQUENCIES**
Varactor high level mixer. **Microwave**
Patent.

**MICROWAVE FILTERS**
High power microwave power divider. **Microwave**
Patent.

**MICROWAVE INDUCERS**
High-Q bandpass resonators utilizing bandstop resonator pairs. **Microwave**
Patent.

**MICROWAVE MIXERS**
Universal microwave mixer. **Microwave**
Patent.

**MICROWAVE PROBES**
Coaxial turnstile junction. **Microwave**
Patent.

**MICROWAVE REFLECTOMETERS**
Reflectometer for receiver input impedance match. **Microwave**
Patent.

**MICROWAVE RADIOMETERS**
Method and means for providing an absolute power measurement capability. **Microwave**
Patent.

**MICROWAVE RESONATORS**
Dual resonant cavity absorption cell. **Microwave**
Patent.

**MICROWAVE SCATTERING**
Almond test body — for microwave anechoic chamber. **Microwave**
Patent.

**MICROWAVE SENSORS**
Method and apparatus for sensor fusion. **Microwave**
Patent.

**MICROWAVE SWITCHING**
Gyrator type circuit. **Microwave**
Patent.

**MICROWAVE TUBES**
Electrostatic collector for charged particles. **Microwave**
Patent.

**MICROSPECIES**
Absence focus look for microscopes. **Microwave**
Patent.

**MICROPROCESSES**
Micromachined electric field meter diagnostic and calibration system. **Microwave**
Patent.
PARAWINGS

PARTICLE ENERGY

PARTICLE COLLISIONS

PATENTS

PAYLOAD DEPLOYMENT & RETRIEVAL SYSTEM

PAYLOADS

PEAK EMISSIONS

PEAKS

PERCENTAGE

PERMISSION

PERSONS

PERSONS DEPLOYMENT

PERSONS HISTORY

PERSONS LANDS

PERSONS NON

PERSONS PATENTS

PERSONS PATENTS AUGUST

PERSONS PATENTS JULY

PERSONS PATENTS JUNE

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POLYMERS

Polymeric foams from cross-linked polyeugenylbenzocarbonates.

Process for crosslinking and extending conjugated diene-containing precursors.

Polyethylenimines with improved properties.

Preparation of polyimides from 1,2,4-oxadiazole elastomers.

Development of polyether ketone polyimides.

Ambient cure polyimide foams.

Untwisted ethylene vinyl acetate copolymer.

Ethynyl and substituted ethynyl-terminated diene-containing polymers.

Preparation of heterocyclic block copolymer.

Addition polyimides with enhanced processability.

Sulfonated poly(arylene ether ketone).

Polyetherimides containing carbonyl and ether connecting groups.

Poly(maleimide and citraconimido substituted 1,2,4- and 2,6-diamido benzenes).

Metal phthalocyanine polymers.

Low dielectric fluorinated poly(phenylene ether ketone).

Durable antistatic coating for polymethylmethacrylate.

Process for producing a well-adhered durable optical coating.

Polyphenylquinoxalines containing alkylenedioxy and alkylenepiperidino groups.

Oil and fat absorbing polymers.

Method of forming difunctional polyisobutylene.

Hydrazinium nitroformate propellant with saturated nitrogen oxides.
METHOD AND DEVICE FOR NON-Destructive ESTIMATION OF WAVEGUIDE RESPONSES TO DOPPLER COMPENSATION BY SHIFTING TRANSMITTED OBJECT SIGNAL TO A DIFFERENT FREQUENCY.
SATELLITE ROTATION
Method for remotely powering a device such as a lunar rover
[NASA-CASE-LAR-14789-1] c 37 N92-30388

SATELLITE SCANNERS
Optical spin compensator
[NASA-CASE-XGS-02840-1] c 14 N69-27465

SATELLITE TRACKING
Tracking receiver Patent
[NASA-CASE-XGS-08679-1] c 10 N71-21473

SATELLITE TELEVISION
Synchronous, multiplexing, single line transmission and recovery data system — for satellite use
[NASA-CASE-XGS-12321-1] c 32 N75-26195

SATELLITE-BORNE INSTRUMENTS
Simultaneous acquisition of tracking data from two stations
[NASA-CASE-NPO-13292-1] c 32 N75-15854

SATELLITE TRANSMISSION
Saturable, multiplexing, single line transmission and recovery data system — for satellite use
[NASA-CASE-XGS-11942-1] c 33 N76-27472

SATURATION
Method of measuring sea surface water temperature with a sensor including a broadband passive synthetic-aperture multi-channel receiver
[NASA-CASE-NPO-15651-1] c 43 N85-21723

SATURABLE REACTORS
Power saw
[NASA-CASE-MSC-21469-1] c 37 N91-31655

SAWTOOTH WAVEFORMS
Rotary solenoid shutter drive assembly and rotary inertia damper and stop plate assembly — for use with cameras mounted in satellites
[NASA-CASE-GSC-11560-1] c 33 N74-20861

SCANNERS
Scanning — photography from a spin stabilized synchronous satellite
[NASA-CASE-GSC-12032-2] c 43 N82-13465

SCANS
Optical crystal temperature gauge with fiber optic connections
[NASA-CASE-MSC-18257-1] c 74 N82-30071

SCANNING
Sealing member and combination thereof and method of fabrication
[NASA-CASE-LEW-13472-1] c 30 N86-26305

SCHRIEGER PHOTOGRAPHY
Field scanning sensor
[NASA-CASE-GSC-12323-3] c 74 N84-02334

SCATTERING CROSS SECTIONS
Sealed battery gas manifold construction Patent
[NASA-CASE-XGS-02629-1] c 07 N71-13300

SCIENTIFIC SATELLITES
Method of detecting impending saturation of a magnetic recording apparatus
[NASA-CASE-NPO-15651-1] c 35 N87-21304

SCIENTIFIC INSTRUMENTS
Method of detecting the face of a photodetector specifically a PMT
[NASA-CASE-XGS-05213-1] c 07 N69-39980

SCIENCE ANALYSIS
Monitor for an electronic scanner
[NASA-CASE-XGS-02630-1] c 03 N79-22974

SCIENCE ФIELD
Self-lubricating fluoro- metal composite materials Patent
[NASA-CASE-XGS-02631-1] c 07 N71-23006

SCIENCE PROGRAMS
Probe insertion apparatus with inflatable seal
[NASA-CASE-MFS-29348-1] c 74 N89-25689

SCIENCE SATELLITES
Temperature and pressure measurement system
[NASA-CASE-NPO-15789-1] c 31 N83-19947

SCIENCE SATELLITE
Sealed battery gas manifold construction Patent
[NASA-CASE-XMS-09636-1] c 05 N71-12345

SCIENCE SPACE PROGRAMS
Sealed battery gas manifold construction Patent
[NASA-CASE-XGS-02630-1] c 03 N70-22974

SCIENCE SPACE PROGRAMS
Sealing member and combination thereof and method of fabrication
[NASA-CASE-XGS-02631-1] c 03 N70-22974

SCIENCE SPACE PROGRAMS
Sealing device for an electrochemical cell Patent
[NASA-CASE-XGS-02850-1] c 03 N70-22974

SCIENCE SPACE PROGRAMS
Sealing system with inflatable seal Patent
[NASA-CASE-XGS-02850-1] c 03 N70-22974

SCIENCE SPACE PROGRAMS
Sealing device for an electrochemical cell Patent
[NASA-CASE-XGS-02850-1] c 03 N70-12528

SCIENCE SPACE PROGRAMS
Sealing device for an electrochemical cell Patent
[NASA-CASE-XGS-02850-1] c 03 N70-12528

SCIENCE SPACE PROGRAMS
Sealing device for an electrochemical cell Patent
[NASA-CASE-XGS-02850-1] c 03 N70-12528

SCIENCE SPACE PROGRAMS
Sealing device for an electrochemical cell Patent
[NASA-CASE-XGS-02850-1] c 03 N70-12528

SCIENCE SPACE PROGRAMS
Sealing device for an electrochemical cell Patent
[NASA-CASE-XGS-02850-1] c 03 N70-12528

SCIENCE SPACE PROGRAMS
Sealing device for an electrochemical cell Patent
[NASA-CASE-XGS-02850-1] c 03 N70-12528

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[NASA-CASE-XGS-02850-1] c 03 N70-12528

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Sealing device for an electrochemical cell Patent
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SCIENCE SPACE PROGRAMS
Sealing device for an electrochemical cell Patent
[NASA-CASE-XGS-02850-1] c 03 N70-12528
SEMICONDUCTOR DIODES

Gurn-type solid state devices
[NASA-CASE-XNS-00225] c 26 N72-25679
Semiconductor transistor device
[NASA-CASE-ERG-10087-1] c 14 N72-21448
Semiconductor device
[NASA-CASE-GSC-10971-1] c 15 N73-14469
Process for fabricating SiC semiconductor devices
[NASA-CASE-LEVW-25006-1] c 76 N76-25049
Semiconductor projective impact detector
[NASA-CASE-MFS-25006-1] c 35 N78-13800
Use for ion beam analysis of a semiconductor wafer by X-ray diffraction
[ NASA-CASE-MFS-25351-1] c 76 N78-24950
Apparatus for measuring semiconductor device resistance
[NASA-CASE-NPO-14424-1] c 33 N80-32650
Electrical power generation system -- for wind-powered generation
[NASA-CASE-MFS-24536-3] c 33 N81-22280
Infrared detector arrays
[NASA-CASE-LAR-12363-2] c 33 N83-24763
Imaging X-ray spectrometer
[ NASA-CASE-GSC-12862-1] c 35 N84-33765
Epitaxial thinning process
[NASA-CASE-NPO-15786-1] c 76 N84-35112
Process for growing layers of semiconductor films by chemical vapor deposition
[NASA-CASE-NPO-15629-1] c 76 N84-35113
Instarolic tunnel diodes
[NASA-CASE-LEVW-13803-1] c 33 N85-21492
Low defect, high purity gallium arsenide layers grown by molecular beam epitaxy
[NASA-CASE-NPO-15813-1] c 76 N85-30922
Method and apparatus for measuring minority carrier lifetime in thin-film semiconductor
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Trace water sensor
[ NASA-CASE-ARC-10042-1] c 35 N85-29212
Method and apparatus for determination of material residual stress
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Tactile sensing means for prosthetic limbs
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Digital servo control for low-inertia actuators

Digital signal function generator

Sequencing device utilizing planetary gear set

Pseudonoise sequence generators with three tap linear feedback shift register

Digital data refomer/deformatter

Linear three-axis feedback tap register

Binary coded sequential acquisition ranging system

Event sequence detector

Digital counter-Patent

Synchronous counter-Patent

Digital X-ray processor

Sequencer-Sequential signal generator

Binary counter-Patent

Digital amplifier circuit-Patent

Sequencing device for multibit binar sequences

Digital servo control for low-inertia actuators

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Digital counter-Patent

Synchronous counter-Patent

Digital X-ray processor

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Binary counter-Patent

Digital amplifier circuit-Patent
SIGNAL DETECTORS
- Rate sensors
- Digital phase-locked loop output encoder
- Serial data correlator/code translator
- Video processor for air traffic control beacon system
- Audio-visual phase detector
- Acoustic emission frequency discrimination
- Simultaneous signal separation

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- Pulse-code-modulation
- Pulse-amplitude modulation
- Data block transmission

SIGNAL DISTORTION
- Determining parameters of mobile satellite system
- Analysis of communication system signals

SIGNAL PROCESSING
- Deinterleaving data transmitted in a multiplexed mode
- Adaptive frequency modulation for mobile satellite communications
- Adaptive data transmission for a mobile satellite system
- Data transmission in a mobile satellite system
- Mobile satellite communications

SIGNAL MEASUREMENT
- Determining parameters of mobile satellite system
- Analysis of communication system signals

SIGNAL GENERATORS
- Frequency modulation
- Digital modulation and demodulation
- Real-time pre-detection dynamic range compression
- Integrated filter and detector array for spectral imaging
- Speech analyzer
- Apparatus for statistical time-series analysis of electrical signals

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- Integrated filter and detector array for spectral imaging
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SPECTROSCOPIC APPLICATIONS

Spectroscopic methods have been applied to a wide range of applications, from environmental monitoring to material characterization. Here are some notable examples:

**Nuclear magnetic resonance (NMR)**: Used for studying molecular structure and dynamics in materials. NMR spectra provide information about the local environment of nuclei in a material.

**Spectrophotometry**:
- Absorbance: Measures the amount of light absorbed by a sample, which can be used to determine the concentration of a substance.
- Reflectance: Measures the amount of light reflected by a sample, useful for studying the optical properties of materials.

**Fluorescence spectroscopy**: Measures the intensity of light emitted by a sample after excitation. It is used for studying the electronic transitions of molecules.

**Raman spectroscopy**: A vibrational spectroscopic technique that can provide information about the molecular structure of a material.

**Infrared spectroscopy**: Measures the absorption of infrared radiation by a sample, which can be used to identify and quantify substances based on their characteristic vibrational frequencies.

**Ultraviolet-visible (UV-Vis) spectroscopy**: Used to study the electronic transitions in molecules, particularly in organic chemistry.

**Mass spectrometry** (MS)****: A technique that measures the mass-to-charge ratio of ions, allowing for the identification and quantification of molecules.

**Spectral imaging****: Used in remote sensing and astronomy to capture detailed images of objects in the electromagnetic spectrum.

**Optical coherence tomography (OCT)****: A non-invasive imaging technique that uses low-coherence interferometry to produce high-resolution cross-sectional images of biological tissues.

These spectroscopic methods have been applied in various fields, including materials science, medicine, environmental science, and more. They are essential tools for researchers and scientists across different disciplines.
SUPERCONDUCTING MAGNETS

Cryogenic apparatus for measuring the intensity of magnetic fields.

SUPERCONDUCTORS

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SUPERSONIC FLOW

SUPERSONIC FLIGHT

SUPERSONIC DRAG

SUPERCRITICAL FLUIDS

SUPERSONIC TRANSPORTS

SUPERSONIC WIND TUNNELS

SUPERSONIC WIND TUNNELS

SUPPORT SYSTEMS

SUPPORTS

SUPERSONIC NOZZLES

SUPERSONIC SPEED

SUPPORTS

SUPERSONIC SPEED

SUPPORTS

SUPPORTS

SUPPORTS
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Control apparatus for applying pulses of selectively predetermined duration to a sequence of loads Patent [NASA-CASE-XGF-04224] c 10 N71-29418

Turn on transient limiter Patent [NASA-CASE-GGC-10314] c 10 N71-29531

Methods and means for providing an absolute power measurement capability Patent [NASA-CASE-ERIC-11026] c 14 N71-29774

Compass Patent [NASA-CASE-LEW-10233] c 10 N71-27126


Monostable multivibrator with complementary NOR gates Patent [NASA-CASE-MSC-13492-1] c 10 N71-28680

Digital memory sense amplifier means Patent [NASA-CASE-XNP-01012] c 08 N71-28255


Reference voltage switching unit Patent [NASA-CASE-MSC-11253] c 03 N72-20031


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Data multiplexer using free switching configuration Patent [NASA-CASE-NPO-11333] c 08 N72-22162


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Multi-computer multiple data path hardware exchange system Patent [NASA-CASE-NPO-13422-1] c 60 N76-14816

Sustained arc ignition system Patent [NASA-CASE-LEW-12444-1] c 33 N77-28385


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Microwave switching power divider -- antenna feeds Patent [NASA-CASE-GSC-12405-1] c 33 N82-16340

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Low power consumption current transducer

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Bell Aerospace Co., Buffalo, NY.

Light weight research vehicle Patent

[NASA-CASE-XFR-00929] c 31 N70-34966

Bell Bendix, Huntville, AL.

Injection head for delivering liquid fuel and oxidizers

[NASA-CASE-NPO-10046] c 28 N78-17243

Bell Aerospace Co., Buffalo, NY.

Forcing function for wire or wire

[NASA-CASE-XMF-00941-1] c 37 N73-33932

Boeing Co., Houston, TX.

Strain gage Patent Application

[NASA-CASE-XRC-10053-1] c 14 N71-17657

Boeing Co., Huntington Park, CA.

Solar cell assembly test method

[NASA-CASE-NPO-10401] c 37 N70-20030

Boeing Co., Huntsville, AL.

Combustion chamber Patent

[NASA-CASE-MSC-10307] c 31 N71-24035

Boeing Co., Huntsville, AL.

Injection system for delivering liquid fuel and oxidizers

[NASA-CASE-NPO-10387] c 26 N78-18213

Boeing Co., Huntsville, AL.

Multi axis vibration fixtures

[NASA-CASE-MFS-20400] c 31 N71-18611

Boeing Co., Kennedy Space Center, FL.

Color perception tester

[NASA-CASE-KSC-10278] c 05 N72-16015

Boeing Co., Indianapolis, IN.

Evacuation valve

[NASA-CASE-LAR-10625-1] c 14 N73-30095

Boeing Co., Seattle, WA.

Air bearing

[NASA-CASE-XMF-02847] c 15 N71-10617

Boeing Aerospace Co., Houston, TX.

Collapsible nozzle extension for rocket engines

[NASA-CASE-GSC-12171-1] c 44 N80-24641

Boeing Co., Seattle, WA.

Continuous plasma light source


Boeing Co., Seattle, WA.

Continuous plasma laser

[NASA-CASE-ARC-10991-1] c 36 N80-23284

Boeing Co., Seattle, WA.

Continuous plasma light source

[NASA-CASE-GSC-11539-1] c 74 N78-32894

Boeing Co., Seattle, WA.

Baseband signal combiner for large aperture antenna

[NASA-CASE-ARC-11029-1] c 30 N78-32894

Boeing Co., Seattle, WA.

Attitude control for spacecraft Patent

[NASA-CASE-MSC-16260-1] c 51 N78-17070

Boeing Co., Seattle, WA.

Vapor liquid separator Patent

[NASA-CASE-ARC-11089-1] c 35 N78-27103

Boeing Co., Seattle, WA.

Collimator Patent


Boeing Co., Seattle, WA.

Data transfer system Patent

[NASA-CASE-LAR-11655-2] c 37 N81-24443

Boeing Co., Seattle, WA.

Power responsive overload sensing circuit Patent


Boeing Co., Seattle, WA.

Fuselage structure using advanced technology fiber


C-CORPORATE SOURCE

California Computer Products, Inc., Anaheim.

Temperature regulating circuit Patent

[NASA-CASE-XMF-02792] c 14 N71-28956

California Inst. of Tech., Pasadena.

Attitude control for spacecraft Patent

[NASA-CASE-XMF-02836] c 31 N70-41855

Baseband signal combiner for large aperture antenna

[NASA-CASE-NPO-14641-1] c 32 N91-29085

Schottky barrier solar cell

[NASA-CASE-NPO-13686-2] c 44 N81-29525

Electronic system for power load control

[NASA-CASE-NPO-15358-1] c 35 N81-29563

Supercritical solvent coal extraction

[NASA-CASE-ARC-15421-1] c 32 N84-22709

Absorbable-suspender joining of ceramic surfaces

[NASA-CASE-XMF-15465-1] c 34 N84-22748

Microelectrophoretic apparatus and process

[NASA-CASE-XMF-15465-1] c 34 N84-22748

Microelectrophoretic apparatus and process

[NASA-CASE-XMF-15465-1] c 34 N84-22748

Nanotechnology for high temperature ceramic matrix composites

[NASA-CASE-XMF-15465-1] c 34 N84-22748

Nanotechnology for high temperature ceramic matrix composites

[NASA-CASE-XMF-15465-1] c 34 N84-22748

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[NASA-CASE-XMF-15465-1] c 34 N84-22748

Nanotechnology for high temperature ceramic matrix composites

[NASA-CASE-XMF-15465-1] c 34 N84-22748
Field induced gap infrared detector

Multi-fingered robotic hand

Method for detecting surface motions and mapping small terrestrial or planetary surface deformations with synthetic aperture radar

Acoustic transducer apparatus with reduced thermal conduction

Remote object configuration/orientation determination

Energy efficient continuous flow ash lookhole

Remote growth method and apparatus

Phase ambiguity resolution for off-set QPSK modulation systems

System and method for measuring ocean surface currents at sub-surface depth from land masses using synthetic aperture radar

Doppler correlation framework for detection system

Fluid-flow reaction system

Dynamic resource allocation scheme for distributed heterogeneous computer systems

High-gain AlGaAs/GaAs double heterojunction

Flux-locked loop control system

Dynamic resource allocation scheme for distributed heterogeneous computer systems

Metal chloride cathode for a battery

Motional noise reduction methodology

Composite flexible blanket insulation

Bilevel shared control for teleoperators

Microstrip antenna for use on spacecraft

Microstrip antenna for use in space

Ultra-high temperature stability Joule-Thomson cooler

High gain optical amplifiers for improved laser stability

Terminal pivot of isolated instrument structure

High level language-based robotic control system

Now that we have identified the key concepts, here is a brief summary of the document:

- Field induced gap infrared detector
- Multi-fingered robotic hand
- Method for detecting surface motions and mapping small terrestrial or planetary surface deformations with synthetic aperture radar
- Acoustic transducer apparatus with reduced thermal conduction
- Remote object configuration/orientation determination
- Energy efficient continuous flow ash lookhole
- Remote growth method and apparatus
- Phase ambiguity resolution for off-set QPSK modulation systems
- System and method for measuring ocean surface currents at sub-surface depth from land masses using synthetic aperture radar
- Doppler correlation framework for detection system
- Fluid-flow reaction system
- Dynamic resource allocation scheme for distributed heterogeneous computer systems
- High-gain AlGaAs/GaAs double heterojunction
- Flux-locked loop control system
- Dynamic resource allocation scheme for distributed heterogeneous computer systems
- Metal chloride cathode for a battery
- Motional noise reduction methodology
- Composite flexible blanket insulation
- Bilevel shared control for teleoperators
- Microstrip antenna for use on spacecraft
- Microstrip antenna for use in space
- Ultra-high temperature stability Joule-Thomson cooler

These are just a few examples of the many topics covered in the document. The full text contains a comprehensive overview of various scientific and technological advancements in the field.
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C-19

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Light weight fire resistant graphite composites
[US-PATENT-4606255] C 24 N6-28131
Toro sizing ring construction for hard space suit
[NASA-CASE-ARC-11611-1] c 54 N6-28618
[NASA-CASE-ARC-11610-1] c 54 N6-28619
Shoulder and hip joint for hard space suits
[NASA-CASE-ARC-11512-1] c 54 N6-28620
Shoulder and hip joints for hard space suits and the like
[NASA-CASE-ARC-11534-1] c 54 N6-29507

Fire and heat resistant laminating resin based on malenemido and citranic acid substituted 1-digorgonyloxyphosphonyl)methyl-2,4- and
-2,6-diaminobenzenes
[NASA-CASE-ARC-11533-2] c 27 N8-16042

Visual accommodation trainer-tester
[NASA-CASE-ARC-11426-2] c 52 N8-16256
Space frame coil, module, belt, table, track, assembly, mechanism and utility connection channel
[NASA-CASE-ARC-11505-2] c 18 N9-25266

Sulprot e-vehicular access facility
[NASA-CASE-ARC-11635-1] c 18 N9-16980
The 1-digorgonyloxyphosphonyl)methyl)-2,4- and
-2,6-diamid benzene
Boron-containing organosilane polymers and ceramic materials thereof
Some 1-digorgonyloxyphosphonyl)methyl)-2,4- and
-2,6-diamid benzene
[NASA-CASE-ARC-11425-3] c 23 N90-23475

Three-dimensional laser velocimeter simultaneity detector
[NASA-CASE-ARC-11876-1] c 36 N90-25340
Wind tunnel balance
[NASA-CASE-ARC-11877-1-B] c 09 N91-14377
Multiple axis relator
[NASA-CASE-ARC-11886-1-B] c 35 N91-14591
Laser velocimeter for near-surface measurements
[NASA-CASE-ARC-11917-1] c 21 N95-15520
Airborne rescue system
[NASA-CASE-ARC-11900-1] c 31 N91-31131
Ecatching mechanism for眼镜s or polymers
Cooling apparatus and couplings thereto
[NASA-CASE-ARC-11921-1] c 34 N92-11286
Tow ary unit-piece fiberous insulation
[NASA-CASE-ARC-11888-1] c 24 N92-10026
Matching optics for Gaussian beams
[NASA-CASE-ARC-11892-1-5B] c 74 N92-16810
Apparatus for precision focusing and positioning of a beam waist on a target
[NASA-CASE-ARC-11916-1-5B] c 74 N92-16811
Boron-carbon-silicon polymers and ceramic and a process for the production thereof
[NASA-CASE-ARC-11893-2-5B] c 27 N92-13460
National Aeronautics and Space Administration

Electronics Research Center, Cambridge, MA.
Method and apparatus for wavelength tuning of liquid lasers
[NASA-CASE-ERC-10187] c 16 N9-31343
A method for the dispersion of beta-silicon carbide by isoeptaxy
[NASA-CASE-ERC-10120] c 26 N9-33482
Full flow with shut off and selective drainage control valve Patent application
[NASA-CASE-ERC-10208] c 15 N90-20133
A method for the production thereof
[NASA-CASE-ERC-10055] c 09 N71-12539
Apparatus and method for separating a semiconductor wafer Patent
[NASA-CASE-ERC-10126] c 26 N71-14354
Focused image holography with extended sources Patent
[NASA-CASE-ERC-10018] c 16 N71-15551
Recording and reconstructing focused image holograms Patent
[NASA-CASE-ERC-10017] c 16 N71-15551
Sorption vacuum trap Patent
[NASA-CASE-ERC-10052] c 14 N71-19843
Voltage tunable Gunn-type microwave generator Patent
[NASA-CASE-ERC-10072] c 09 N71-11418
Multiple axis reticle Patent
[NASA-CASE-ERC-10015-2] c 14 N71-27337
Method and apparatus for limiting field emission current

National Aeronautics and Space Administration.

Flight Research Center, Edwards, CA.
Rocket chamber leak test fixture
[NASA-CASE-XFR-04970] c 14 N66-24904
Two-axis controller Patent
[NASA-CASE-XFR-00181] c 21 N70-33279
Catalyst bed removing tool Patent
[NASA-CASE-XFR-00811] c 15 N70-23913

Pulsed excitation voltage circuit for transducers
[NASA-CASE-FRC-10005] c 09 N71-31689

A solid state acoustic variable time delay line Patent
[NASA-CASE-FRC-10090] c 21 N71-24948
Transverse piezoresistence and pinch effect electromagnetic transducers Patent
[NASA-CASE-FRC-10010] c 26 N71-25490
A solid state acoustic variable time delay line Patent
[NASA-CASE-ERC-10020] c 10 N70-25000
Method and means for recording and reconstructing holograms without use of a reference beam Patent
[NASA-CASE-ERC-10022] c 15 N70-26635
Method and apparatus for detecting gross leaks Patent
[NASA-CASE-ERC-10003] c 14 N71-26762
Field orientation electromagnetic Patent
[NASA-CASE-ERC-10103] c 09 N70-22063
Voltage regulator Patent
[NASA-CASE-ERC-10115] c 09 N70-27053
A multichannel photonization chamber for absorption analysis Patent

NASA, Flight Research Center
Transformer regulated self-stabilizing chopper
[NASA-CASE-GSC-99182-1] c 33 N75-17295
Shunt regulation electric power system
[NASA-CASE-GSC-10135-1] c 33 N75-17296
Binary to binary digital converter
[NASA-CASE-GSC-12044-1] c 60 N76-17681
Magnifying image intensifier
[NASA-CASE-GSC-12016-1] c 74 N78-18905
Energy storage apparatus
[NASA-CASE-GSC-12030-1] c 44 N78-24608
Process for utilizing low-cost graphite substrate for polycrystalline solar cells
[NASA-CASE-GSC-12022-2] c 44 N78-24609
Quadrupole demodulator
[NASA-CASE-GSC-11883-2] c 37 N78-31426
Linear network
[NASA-CASE-GSC-11737-1] c 33 N78-32338
Logarithmic circuit with wide dynamic range
[NASA-CASE-GSC-12145-1] c 30 N78-32339
Method and apparatus for splintering a beam of energy
[NASA-CASE-GSC-12146-1] c 33 N78-32340
Time domain phase measuring apparatus
[NASA-CASE-GSC-12218-1] c 33 N79-10338
System for and method of determining biological tissue
[NASA-CASE-GSC-12173-1] c 51 N79-10694
System and methods for determining radio frequency interference
[NASA-CASE-GSC-12167-1] c 51 N79-10717
Switchable beamwidth monopulse method and system
[NASA-CASE-GSC-12190-1] c 33 N79-12321
Variable beamwidth antenna
[NASA-CASE-GSC-12083-1] c 73 N78-32848
Method and apparatus for simulating optical transmission links
[NASA-CASE-GSC-12082-1) c 54 N78-22914
Linear phase demodulator including a phase locked loop
[NASA-CASE-GSC-11582-1] c 33 N75-19517
Bakeable McLeod gauge
[NASA-CASE-GSC-12374-1] c 52 N79-10697
Tie-in to central station
[NASA-CASE-GSC-11752-1) c 75 N78-20140
Impact position detector for outer space particles
[NASA-CASE-GSC-12190-1] c 33 N79-12321
Dually mode locked Nd:YAG laser
[NASA-CASE-GSC-12167-1] c 51 N79-10717
Systems and methods for determining the position of a radiant energy source
[NASA-CASE-GSC-12174-1] c 32 N79-12341
Time delay and integration detectors using charge transfer devices
[NASA-CASE-GSC-12167-1] c 60 N82-23942
Diode laser system for determining radio frequency
[NASA-CASE-GSC-12167-1] c 36 N82-16396
Microwave switching power divider
[NASA-CASE-GSC-12167-1] c 33 N82-16340
Laser measuring system for incremental assemblies
[NASA-CASE-GSC-12531-1] c 36 N82-16396
Memory-based frame synchronizer
[NASA-CASE-GSC-12531-1] c 37 N82-16341
Variable speed drive
[NASA-CASE-GSC-12531-1] c 42 N82-16455
V-VMOS field effect transistors utilizing a two-step anisotropic etching and ion implantation
[NASA-CASE-GSC-12518-1] c 33 N81-24663
Time delay and integration detectors using charge transfer devices
[NASA-CASE-GSC-12167-1] c 36 N82-16396
Auto-simulating microcomputer
[NASA-CASE-GSC-12174-1] c 32 N82-14947
Time delay and integration detectors using charge transfer devices
[NASA-CASE-GSC-12167-1] c 36 N82-16396
Diffractoid grating configuration for X-ray and ultraviolet
[NASA-CASE-GSC-12167-1] c 37 N81-29342
Complementary DMOS-VMOS integrated circuit structure
[NASA-CASE-GSC-12167-1] c 32 N79-12321
Microprocessor
[NASA-CASE-GSC-12513-1] c 74 N79-19750
Microwave transmitter with a low side band
[NASA-CASE-GSC-12513-1] c 37 N78-31426
Nominal table
[NASA-CASE-GSC-12513-1] c 32 N78-28550
Aqueous alkali metal hydroxide insoluble cellulose ether
[NASA-CASE-GSC-12513-1] c 32 N78-27341
Microzone chamber and method of making the same
[NASA-CASE-GSC-12513-1] c 36 N78-24655
Solar cell module assembly jig
[NASA-CASE-GSC-12218-1] c 44 N79-19447
System for synchronizing synthesizers of communication systems
[NASA-CASE-GSC-12148-1] c 32 N79-20296
Hot radiator for space vehicles
[NASA-CASE-GSC-12167-1] c 37 N79-29340
Separator for alkaline batteries and method of making the same
[NASA-CASE-GSC-12167-1] c 34 N82-24655
Separator for alkaline batteries and method of making the same
[NASA-CASE-GSC-12167-1] c 44 N82-24641
Separator for alkaline batteries and method of making the same
[NASA-CASE-GSC-12167-1] c 44 N82-24641
Separator for alkaline batteries and method of making the same
[NASA-CASE-GSC-12167-1] c 44 N82-24641
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Separator for alkaline batteries and method of making the same
[NASA-CASE-GSC-12167-1] c 44 N82-24641
Separator for alkaline batteries and method of making the same
[NASA-CASE-GSC-12167-1] c 44 N82-24641
Separator for alkaline batteries and method of making the same
[NASA-CASE-GSC-12167-1] c 44 N82-24641
Method of producing complex aluminum alloy parts of high thermal conductivity, and apparatus control

Stator rotor tools

Flexible pipe thermal barrier insulator

Fluid assembly

Variable contour securing system

Multi-purpose wind tunnel reaction control model block

Heat resistant polymers of oxidized styrylphosphine

Simultaneous treatment of SO2 containing stack gases

Lightweight electrically-powered flexible thermal laminate

Melt metering oxidation system for inspecting effects

Interclass cor display for multispectral imagery using correlation clustering

Sequencing device utilizing planetary gear set

Metabolic rate meter and method

Fire dampers and distribution system

Thermal insulation protection means

System for automatically switching transformer coupled lines

Fused switch

Oxygen concentrator

Heat resistant polymers of oxidized styrylphosphine

Densification of porous refractory substrates

Reciprocating engines

Reciprocating and mixing apparatus for liquids

Fused switch

Dental handpiece

Plywood

High-temperature penetrator assembly with bayonet plug and ramp-activated lock

Flexible pile thermal barrier insulator

Pressure limiting propellant actuating system

Chassis unit insert tightening-extract device

Multi-beam circularly polarized microstrip antenna

Precision heat forming of tetrafluoroethylene tubing

Screwdriver fastener

Apparatus for accurately preloading auger attachment means

Bio-medical flow sensor

Method and apparatus for simulating gravitational forces

Method and technique for installing light-weight, fragile, organic concentration in water

Appliances for accurately preloading auger attachment means

Cups"
Method for processing molding of thermosetting plastics utilizing a temperature gradient across the plastic foam cure the article

Vacuum leak detector

- NASA-CASE-LAR-11257-1, c 35 N75-19612
- Spectrometer integrated with a facsimile camera
- NASA-CASE-LAR-11207-1, c 35 N75-19613
- Insulation installation for measurement of aircraft noise and sonic boom
- NASA-CASE-LAR-11173-1, c 35 N75-19614
- Laser head for simultaneous optical pumping of several dye lasers
- NASA-CASE-LAR-11341-1, c 36 N75-19655
- High lift aircraft
- NASA-CASE-LAR-11252-1, c 05 N75-25914
- Vapor phase growth of groups 3-5 compounds by hydrogen chloride transport of the elements
- NASA-CASE-LAR-11144-1, c 25 N75-26043
- Resonant wave dark cell
- NASA-CASE-LAR-11352-1, c 33 N75-26245
- Fluid control apparatus and method
- NASA-CASE-LAR-11300-1, c 34 N75-26262
- Electrolytic cell structure
- NASA-CASE-LAR-11042-1, c 35 N75-27330
- Polyamide adhesives
- NASA-CASE-LAR-11097-1, c 27 N75-29683
- Bonding method in the manufacture of continuous regression rate sensor devices
- NASA-CASE-LAR-10589-1, c 24 N75-30260
- Meteoroid impact position locator aid for manned space station
- NASA-CASE-LAR-10629-1, c 24 N75-32060
- Apparatus for inserting and removing specimens from high temperature vacuum furnaces
- NASA-CASE-LAR-11069-1, c 21 N75-31220
- Grinding arrangement for ball nose milling cutters
- NASA-CASE-LAR-11050-1, c 37 N75-27905
- Method for repairing discontinuity in fiberglass structures
- NASA-CASE-LAR-10416-1, c 24 N74-20001
- Deployable flexible vent for use as an emergency spin recovery device in aircraft
- NASA-CASE-LAR-10953-1, c 08 N74-30421
- Apparatus for applying simulator g-forces to an arm of an aircraft simulator pilot
- NASA-CASE-LAR-10940-1, c 09 N74-30597
- Centrifugal lymphatic separator
- NASA-CASE-LAR-10194-1, c 34 N74-30608
- Variable positioned guide wires for aerodynamic choking
- NASA-CASE-LAR-10642-1, c 07 N74-31270
- Noise suppressor
- NASA-CASE-LAR-11141-1, c 37 N74-32418
- Measuring probe position recorder
- NASA-CASE-LAR-10906-1, c 35 N74-32877
- Stagnation pressure gauge
- NASA-CASE-LAR-11139-1, c 35 N74-32877
- Denitrogenating apparatus
- NASA-CASE-LAR-10493-2, c 31 N74-32920
- Remote fire spark igniter
- NASA-CASE-LAR-10675-1, c 25 N74-33378
- Open tube guideway for high speed air cushioned vehicles
- NASA-CASE-LAR-10256-1, c 85 N74-34672
- Fast scan control for detection type mass spectrometers
- NASA-CASE-LAR-11428-1, c 35 N74-34657
- Apparatus for microbiological sampling
- NASA-CASE-LAR-11109-1, c 35 N75-12727
- Method of making an explosively welded scarf joint
- NASA-CASE-LAR-11211-1, c 37 N75-12326
- Determining particle density using known material
- NASA-CASE-LAR-11059-1, c 76 N75-12810
- Method for making conductors for ferrite memory arrays
- NASA-CASE-LAR-10994-1, c 24 N75-13032
- Evacuated, displacement compression mold
- NASA-CASE-LAR-11072-2, c 31 N75-13111
- Automatic inoculating apparatus
- NASA-CASE-LAR-11107-4, c 51 N75-13502
- Automatic focus control for facsimile cameras
- NASA-CASE-LAR-11213-1, c 35 N75-15014
- Kinesthetic control simulator
- NASA-CASE-LAR-10278-1, c 09 N75-15662
- Electrochemical generation system
- NASA-CASE-MF-22129-1, c 33 N75-18477
- Automatic liquid inventory collecting and dispensing unit.
- NASA-CASE-LAR-11071-1, c 35 N75-19611

- NASA, Langley Research Center

- Anti-multipath digital signal detector
- NASA-CASE-LAR-11297-1, c 32 N77-10932
- West-bonded titanium structures
- NASA-CASE-LAR-11549-1, c 37 N77-11397
- Pressure monitoring system and even finite power states of a modulating signal
- NASA-CASE-LAR-11661-1, c 32 N77-14292
- Miniature blind strain transducer
- NASA-CASE-LAR-11648-1, c 35 N77-14407
- Rejection alignment apparatus for use on aircraft
- NASA-CASE-LAR-11656-1, c 37 N77-14478
- Solid propellant rocket motor and method of making same
- NASA-CASE-XLA-01349, c 20 N77-17143
- Particulate and solar radiation stable coating for space applications
- NASA-CASE-LAR-10605-2, c 34 N77-18382
- Magnetic heading reference
- NASA-CASE-LAR-11397-1, c 04 N77-19056
- Binocular device for displaying numerical information in field of view
- NASA-CASE-LAR-11762-1, c 74 N77-20862
- Method of locating persons in distress
- NASA-CASE-LAR-11290-1, c 32 N77-21267
- Ansible proximity meter
- NASA-CASE-LAR-11825-1, c 35 N77-22449
- Method of forming shrink-fit compression seal
- NASA-CASE-LAR-11563-1, c 37 N77-23482
- Vortex generator for controlling the dispersion of effluents in a flowing liquid
- NASA-CASE-LAR-12045-1, c 34 N77-24423
- Process for control of cell division
- NASA-CASE-LAR-10773-3, c 51 N77-25768
- Mechanical microrain spattering generator
- NASA-CASE-LAR-11389-1, c 33 N77-26387
- Apparatus for determining thermophysical properties of test specimen
- NASA-CASE-LAR-11883-1, c 09 N77-27131
- Automated single-site disease screening device
- NASA-CASE-LAR-11949-1, c 51 N77-27177
- Dual cycle aircraft turbine engine
- NASA-CASE-LAR-11310-1, c 07 N78-28118
- Composite sandwich lattice structure
- NASA-CASE-LAR-11909-1, c 25 N78-32275
- waitress level moniter
- NASA-CASE-LAR-12010-1, c 25 N78-32276
- CW ultrasonic bolt tensioning monitor
- NASA-CASE-LAR-12016-1, c 39 N78-15512
- Welding monitoring system
- NASA-CASE-LAR-12009-1, c 44 N78-15560
- Transmitting and reflecting diffuser
- NASA-CASE-LAR-10385-3, c 74 N78-15879
- TV fatigue crack monitoring system
- NASA-CASE-LAR-11390-1, c 39 N78-16878
- Molded composite pyrogen igniter for rocket motors
- NASA-CASE-LAR-12019-1, c 20 N78-24275
- Non-destructive method for applying and removing instrumentation on helicopter rotor blades
- NASA-CASE-LAR-11201-1, c 35 N78-24515
- Two dimensional wedge/translationshing nozzle
- NASA-CASE-LAR-11191-1, c 07 N78-27121
- Remote water monitoring system
- NASA-CASE-LAR-11973-1, c 35 N78-27384
- Magnetic disturbance and pointing system
- NASA-CASE-LAR-11889-2, c 27 N78-27424
- Device for measuring the contour of a surface
- NASA-CASE-LAR-11896-1, c 74 N78-27904
- Supersonic transport
- NASA-CASE-LAR-11812-1, c 37 N78-32086
- Hypersonic propulsion
- NASA-CASE-LAR-12264-1, c 15 N78-32168
- Process for preparing thermoplastic aliphatic polyimide
- NASA-CASE-LAR-11828-1, c 27 N78-32961
- Magnetometer with a miniature transducer and automatic scanning
- NASA-CASE-LAR-11617-1, c 35 N78-32937
- Independent power generator
- NASA-CASE-LAR-11208-1, c 44 N78-32939
- Pseudosolid state instrument
- NASA-CASE-LAR-12260-1, c 35 N78-10390
Polyimide molding powder, coating, adhesive, and matrix resin

Flexible seal for valves Patent

NASA, Lewis Research Center

Polyimide molding powder

Flexible seal for valves

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NASA-CASE-LAR-14165-1  c 27 N92-30304

Methyl substituted polyimides containing carbonyl and ether connecting groups

NASA-CASE-LAR-14351-1  c 27 N92-30305

Passive lctal monitoring sensor

NASA-CASE-LAR-14086-1-CU  c 35 N92-30306

Vibration isolation vessel and method for measurement of thermal noise in microphones

NASA-CASE-LAR-14567-1-CU  c 33 N92-30301

Non-mechanical optical path switching and its application to dual beam spectroscopy including gas filter correlation radiometer

NASA-CASE-LAR-14418-1-CU  c 32 N92-30325

Method and circuit for controlling the evaporation time interval of a laser output pulse

NASA-CASE-LAR-14115-1-CU  c 36 N92-31788

Insider/alignment laser diodes for microelectronics

NASA-CASE-LAR-13415-1  c 40 N92-32077

Fluid jet amplifier

NASA-CASE-XLE-00680  c 50 N92-32034

Fluid jet amplifier

NASA-CASE-XLE-00681  c 50 N92-32035

Flexible seal for vacuum systems

NASA-CASE-XLE-01064  c 27 N92-32001

Flexible seal for valves Patent

NASA-CASE-XLE-00020  c 15 N92-32002

Flexible seal for launches and emergency vehicle system Patent

NASA-CASE-XLE-00046  c 25 N92-32003

Flexible seal for launches and emergency vehicle system

NASA-CASE-XLE-00038  c 34 N92-32004

Flexible seal for launches Patent

NASA-CASE-XLE-00020  c 25 N92-32003

Flexible seal for vacuum systems Patent

NASA-CASE-XLE-00046  c 25 N92-32003

Flexible seal for launches Patent

NASA-CASE-XLE-00020  c 25 N92-32003

Flexible seal for launches Patent

NASA-CASE-XLE-00020  c 25 N92-32003

Flexible seal for vacuum systems

NASA-CASE-XLE-00038  c 34 N92-32004

Flexible seal for launches

NASA-CASE-XLE-01064  c 27 N92-32001
Textured carbon surfaces on copper by sputtering

Lithium counterpoised silicon solar cell

Nickel base coating alloy

Lithium counterpoised silicon solar cell

Graphite fluoride fiber polymer composite material

Ladder polymers for use as high temperature stable metals, and ceramics

Alkali metal carbon dioxide electrochemical system for oxygen

Multi-step HIP canning of powder metallurgy processes for their synthesis

Vinyl capped addition polyimides

Ladder polymers for use as high temperature stable metals, and ceramics

Ramp with coaxial powder feed and actuator cathode

Graphite fluoride fiber polymer composite material

Multi-step HIP canning of powder metallurgy processes for their synthesis

High temperature, flexible, fiber-preform seal

Graphite fluoride fiber polymer composite material

Multi-step HIP canning of powder metallurgy processes for their synthesis

Fiber reinforced ceramic material

Alkali metal carbon dioxide electrochemical system for oxygen

High temperature, flexible pressure-actuated, brush

Heat exchanger for electrothermal devices

Extended temperature range rocket injector

Multiply addition turbine engine

Zero-G phase detector and separator

High temperature, flexible, thermal barrier seal

Gas particle radiator

Method of depositing high-strength, high-temperature, flexible coatings for aerospace structures

Landing pad assembly for aerospace vehicles Patent

Electric arc welding Patent

Landing pad assembly for aerospace vehicles Patent

Air bearing Patent

Electronic motor control system Patent

Injector for bipropellant rocket engines Patent

Electric arc driven wind tunnel Patent

Electronic motor control system Patent

Attitude and propellant flow control system and method Patent

Multi-heat addition turbine engine Patent

Recoverable rocket vehicle Patent

Spectroscopic wear detector Patent

Plug-type heat flux gauge Patent

Recoverable rocket vehicle Patent

Interdigital surfactant systems for use with liquid metal and fluid metal systems

Pretreatment of lubricated surfaces with sputtered polymer materials

Apparatus for intercalating large quantities of fibrous material

Fine powders of high performance solid lubricants for use in aerospace applications

High temperature, flexible, thermal barrier seal

Pretreatment of lubricated surfaces with sputtered polymer materials

High temperature, flexible, thermal barrier seal

Nickel base coating alloy

Thermal stress minimized, two component, tunnel shroud seal

Three point lead screw positioning apparatus Patent

Freeform and rapid prototyping

Plasma gun with coaxial powder feed and adjustable plasma torch

Furnace for tensile fatigue testing

Method of making carbide/fluoride/silver composites

Apparatus for mounting a field emission cathode

Selectively conducting, high grade tantalum filamentary material

Vapor jet injection Patent

Monolithic mm-wave phase shifter using optically activated superconducting switches

Oxidation resistant coating for titanium alloys and titanium alloy matrix composites

Power hand tool Patent

Pulse thermal energy transport/storage system Patent

Flexible back up bar Patent

Heat exchanger for electrothermal devices

White light infra-red imager Patent

Multi-heat addition turbine engine Patent

Method of applying a thermal barrier coating system

Monolithic mm-wave phase shifter using optically activated superconducting switches

Oxidation resistant coating for titanium alloys and titanium alloy matrix composites

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Flexible back up bar Patent

Heat exchanger for electrothermal devices

White light infra-red imager Patent
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NASA, Pasadena Office

[Several entries follow, each detailing various technical innovations, inventions, and patents, with titles such as "Method for forming hermetic seals," "Timing control system," "Apparatus for using a time interval counter to measure frequency stability," and "Self-acting heat switches for redundant systems." Each entry is accompanied by a patent number and a description of the innovation.]

CORPORATE SOURCE

Edge geometry superconducting tunnel junctions utilizing an NIK/MgO/NBN thin film structure

[NASA-CASE-NPO-17812-1] C 76 N80-17455

High density tape casting system

[NASA-CASE-NPO-16994-1] C 31 N90-19425

Local area network with fault-checking, priorities, and redundant backup


Annoying noise in III-V compound doped silicon-germanium alloy for improved thermo-electric conversion efficiency

[NASA-CASE-NPO-17259-1] C 76 N90-19884

Dual cathode system for electron beam instruments


VLSI single-chip (255,223) Reed-Solomon encoder with interleaver

[NASA-CASE-NPO-17280-1] C 71 N90-21601

Acoustic convection


Alternating gradient photodetector

[NASA-CASE-NPO-17355-1] C 35 N89-21358

VLSI binary updown counter

[NASA-CASE-NPO-17265-1] C 60 N89-21525

Foil tolerant hyporubfire computer architecture

[NASA-CASE-NPO-16851-1] C 60 N90-21537

Balanced bridge feedback control system

[NASA-CASE-NPO-17091-1] C 33 N89-21951

Atmospheric autorotating imaging device

[NASA-CASE-NPO-17390-1] C 35 N90-22769

Convergent array spectrometer


Long period pseudo random number sequence generator

[NASA-CASE-NPO-17411-1] C 33 N90-23636

Multi-element spherical shell generator

[NASA-CASE-NPO-17424-1] C 34 N90-23700

Computer access security code system

[NASA-CASE-NPO-17525-1] C 60 N90-25563

Improving the geometric fidelity of imaging systems employing senior arrays

[NASA-CASE-NPO-17971-1] C 43 N90-26064

Self-checking pipeline RAM

[NASA-CASE-NPO-17591-1] C 60 N90-26518

High speed magneto-resistive random access memory

[NASA-CASE-NPO-17629-1] C 60 N90-26519

MBE growth technology for high quality strained Si-V layers

[NASA-CASE-NPO-17723-1] C 76 N90-26685

New core design for use with precision composite reflectors


Multistage estimation of received carrier signal parameters under very high dynamic conditions of the receiver


Special purpose parallel computer architecture for real-time control and simulation robotic applications

[NASA-CASE-NPO-17653-1] C 51 N90-27239

[Several patents follow, each detailing various technical innovations, inventions, and patents, with titles such as "Method of growing low defect, high purity crystalline large TV display system." Each entry is accompanied by a patent number and a description of the innovation.]

Energy detector circuit for electromagnetic applications utilizing intrinsic silicon photodetectors

[NASA-CASE-NPO-17874-1] C 74 N90-13998

Efficient detection and signal parameter estimation with application to high dynamic GPS receiver

[NASA-CASE-NPO-17784-1] C 74 N90-13999

High temperature refractory material with radiation emissive overcoat

[NASA-CASE-NPO-17121-1] C 27 N90-14489

Trellis coded modulation for transmission over fading mobile satellite channel

[NASA-CASE-NPO-16924-1] C 32 N90-14523

Organic cathode for a secondary battery

[NASA-CASE-NPO-17604-1] C 33 N90-14536

Copper-chlorine cathodes for a secondary battery


[C-50]
### Typical Contract Number Index Listing

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### ACCESSION NUMBER INDEX

**NASA PATENT ABSTRACTS BIBLIOGRAPHY**

**Section 2**

**January 1993**

### Typical Accession Number Listing

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### Listings

Listings in this index are arranged numerically by accession number. The category number indicates the category in Section 1 (Abstracts) in 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 available on microfiche. A pound sign (#) indicates that the item is available on microfiche.
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N83-31897'

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N83-31918'

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N83-31952*

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N83-31953'

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N83-31954*

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N83-32026'

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c 39

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The NASA Patent Counsel having cognizance of the invention is determined by the first three letters or prefix of the NASA Case Number assigned to the invention. The addresses of NASA Patent Counsels are listed alongside the NASA Case Number prefix letters in the following table.

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PATENT LICENSING REGULATIONS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

14 CFR Part 1245

Licensing of NASA Inventions

AGENCY: National Aeronautics and Space Administration

ACTION: Interim regulation with comments requested.

SUMMARY: The National Aeronautics and Space Administration (NASA) is revising its patent licensing regulations to conform with Pub. L. 96-517. This interim regulation provides policies and procedures applicable to the licensing of federally owned inventions in the custody of the National Aeronautics and Space Administration, and implements Pub. L. 96-517. The object of this subpart is to use the patent system to promote the utilization of inventions arising from NASA supported research and development.

EFFECTIVE DATE: July 1, 1981. Comments must be received in writing by December 2, 1981. Unless a notice is published in the Federal Register after the comment period indicating changes to be made, this interim regulation shall become a final regulation.

ADDRESS: Mr. John G. Mannix, Director of Patent Licensing, GP-4, NASA, Washington, D.C. 20546

FOR FURTHER INFORMATION CONTACT: Mr. John G. Mannix, (202) 753-3954.

SUPPLEMENTARY INFORMATION:

PART 1245—PATENTS AND OTHER INTELLECTUAL PROPERTY RIGHTS

Subpart 2 of Part 1245 is revised to read as follows:

Subpart 2—Licensing of NASA Inventions

Sec.
1245.200 Scope of subpart.
1245.201 Policy and objective.
1245.202 Definitions.
1245.203 Authority to grant licenses.

Restrictions and Conditions
1245.204 All licenses granted under this subpart.

Types of Licenses
1245.205 Nonexclusive licenses.
1245.206 Exclusive and partially exclusive licenses.

Procedures
1245.207 Application for a license.
1245.208 Processing applications.
1245.209 Notice to Attorney General.
1245.210 Modification and termination of licenses.
1245.211 Appeals.
1245.212 Protection and administration of inventions.
1245.213 Transfer of custody.
1245.214 Confidentiality of information.

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.

§ 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 121.3-8, 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 condition, 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.

Restrictions and Conditions

§ 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 sublicensee 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.
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 expedient 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; and
   (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 applicant's 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 licensee, 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;
§ 1245.208 Processing applications.

(a) Applications for licenses will be initially reviewed by the Patent Counsel of the NASA installation having responsibility for the invention. The Patent Counsel shall make a preliminary recommendation to the Director of Licensing, NASA Headquarters, whether to: (1) grant the license as requested, (2) grant the license with modification after negotiation with the licensee, or (3) deny the license. The Director of Licensing shall review the preliminary recommendation of the Patent Counsel and make a final recommendation to the NASA Assistant General Counsel for Patent Matters. Such review and final recommendation may include, and be based on, any additional information obtained from applicant and other sources that the Patent Counsel and the Director of Licensing deem relevant to the license requested. The determination to grant or deny the license shall be made by the Assistant General Counsel for Patent Matters based on the final recommendation of the Director of Licensing.

(b) When notice of a prospective exclusive or partially exclusive license is published in the Federal Register in accordance with § 1245.206(a)(1)(iii)(A) or § 1245.206(b)(1)(i), any written objections received in response thereto will be considered by the Director of Licensing in making the final recommendation to the Assistant General Counsel for Patent Matters.

(c) If the requested license, including any negotiated modifications, is denied by the Assistant General Counsel for Patent Matters, the applicant may request reconsideration by filing a written request for reconsideration within 30 days after receiving notice of denial. This 30-day period may be extended for good cause.

(d) In addition to, or in lieu of requesting reconsideration, the applicant may also appeal the denial of the license in accordance with § 1245.211.

§ 1245.209 Notice to Attorney General.

A copy of the notice provided for in §§ 1245.206(a)(1)(iii)(A), and 1245.206(b)(1)(i) will be sent to the Attorney General.

§ 1245.210 Modification and termination of licenses.

Before modifying or terminating a license, other than by mutual agreement, NASA shall furnish the licensee and any sublicensee of record a written notice of intention to modify or terminate the license, and the licensee and any sublicensee shall be allowed 30 days after such notice to remedy any breach of the license or show cause why the license should not be modified or terminated.

§ 1245.211 Appeals.

(a) The following parties may appeal to the NASA Administrator or designee any decision or determination concerning the grant, denial, interpretation, modification, or termination of a license:

(1) A person whose application for a license has been denied;

(2) A licensee whose license has been modified or terminated, in whole or in part;

(3) A person who timely filed a written objection in response to the notice required by §§ 1245.206(a)(1)(iii)(A) or 1245.206(b)(1)(i) and who can demonstrate to the satisfaction of NASA that such person may be damaged by the Agency action.

(b) Written notice of appeal must be filed within 30 days (or such other time as may be authorized for good cause shown) after receiving notice of the adverse decision or determination; including, an adverse decision following the request for reconsideration under § 1245.208(c). The notice of appeal, along with all supporting documentation should be addressed to the Administrator, National Aeronautics and Space Administration, Washington, DC 20546. Should the appeal raise a genuine dispute over material facts, fact-finding will be conducted by the NASA Inventions and Contributions Board. The person filing the appeal shall be afforded an opportunity to be heard and to offer evidence in support of the appeal. The Chairperson of the Inventions and Contributions Board shall prepare written findings of fact and transmit them to the Administrator or designee. The decision on the appeal shall be made by the NASA Administrator or designee. There is no further right of administrative appeal from the decision of the Administrator or designee.

§ 1245.212 Protection and administration of inventions.

NASA may take any suitable and necessary steps to protect and administer rights to NASA inventions, either directly or through contract.

§ 1245.213 Transfer of custody.

NASA having custody of certain Federally owned inventions may transfer custody and administration in whole or in part, to another Federal agency, of the right, title, or interest in any such invention.

§ 1245.214 Confidentiality of information.

Title 35, United States Code, section 209, provides, that any plan submitted pursuant to § 1245.207(h) and any report required by § 1245.204(b)(6) may be treated by NASA as commercial and financial information obtained from a person and privileged and confidential and not subject to disclosure under section 552 of Title 5 of the United States Code.

James M. Beggs,

Administrator

October 15, 1981

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PATENT LICENSING REGULATIONS
A subject index is provided for over 5300 patents and patent applications for the period May 1969 through December 1992. 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.