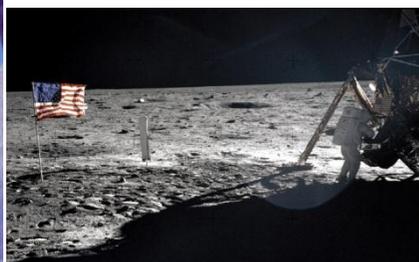


2013

# NASA SUPPLEMENTAL CLASSIFICATION SYSTEM AST SPECIALTY DEFINITIONS



Office of Human Capital  
Management  
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## 701 SPACE SCIENCES

**DEFINITION:**

Includes positions engaged in the study of the Earth and planetary atmospheres and ionospheres; field and particles in the interplanetary space environment; the Sun and extra-solar objects and radiation emitted by them; the chemical, physical, and morphologic properties of moons, planetary bodies, and other solid materials in the solar system and of their samples; data obtained from the above investigations and/or the development of instrumentation for these purposes.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
701-05	Atmospheres and Ionospheres	Astrophysicist	GS-1330
701-09	Space Sciences (Entry-level positions at GS-7 and GS-9 Only.)	Space Scientist	GS-1330
701-15	Fields and Particles	Astrophysicist	GS-1330
701-20	Stellar, Galactic, and Extragalactic Astrophysics	Astrophysicist	GS-1330
701-25	Planetary Studies	Space Science	GS-1330
701-35	Solar and Solar Terrestrial Studies	Astrophysicist	GS-1330
701-40	Solar Systems Analysis	Physical Scientist	GS-1301
701-90 thru 701-99	*	*	*

\* At the Center's discretion

### ***701-05 Classification***

NASA Title: AST-Atmospheres and Ionospheres

Class Code: 701-05

OPM Title: Astrophysicist

Series Code: GS-1330

#### *Definition of Work*

This specialty includes positions which involve research of the composition, motions and temperature, and pressure structure of planetary atmospheres, including both the lower, well-mixed, neutral atmospheres dominated by meteorology and the upper neutral atmosphere (aeronomy) dominated by separation, chemistry and reaction to radiation from outer space. It also includes studies of the ionized upper atmospheres dominated by reactions to electromagnetic and particle radiation, e.g., ionization, excitation and dissociation.

Investigations include theory-modeling and/or experiment-observation, with the latter being either in the field or laboratory. Investigators frequently develop the techniques and tools necessary for these investigations, e.g., computer codes, sensors, and other instrumentation and devices used in experiments, and obtain research data through the use of instruments aboard aircraft, flyby spacecraft, satellites, and entry probes.

#### *Specialty Knowledge*

Knowledge required to perform this work span conventional physical science and engineering disciplines (physics, chemistry, astronomy, electronics, mathematics, etc.) together with a specialized knowledge of charged particles and magnetics, and a thorough grounding in the theory, use, and operation of spectrometers, interferometers, telescopes, radio receiving devices, filters, cryogenics, vacuum technology, optics, and data communication electronics, as well.

### ***701-15 Classification***

NASA Title: AST-Fields and Particles

Class Code: 701-15

OPM Title: Astrophysicist

Series Code: GS-1330

#### *Definition of Work*

This specialty includes positions that involve the study of resources, natures and effects of magnetic, gravitational and electric fields, as well as, energetic particles in space environments. Experiments include mapping and plotting the Earth's magnetic field, identification of characteristics and measurement of the flux of energetic particles peculiar to radiation belts, auroras, and cosmic rays through both low and high energy ranges, and determination of the ways in which these particles are formed, their source of energy, their composition, the mechanism of their movement into atmospheres, and similar information.

These investigators characteristically perform developmental work in the conception or further modification of equipment, instrumentation and techniques through which magnetic fields and energetic particles are studied. Techniques and instrumentation used include magnetometers, nuclear emulsion techniques, and other specialized devices for identifying the density, energy, velocity, and scatter pattern of particles.

#### *Specialty Knowledge*

Knowledge required includes the effects of magnetic fields on particles, the basic physics of particles, the principles and use particle detectors in space probes, and the physics of magnetic fields and magnetic properties of materials.

## **701-20 Classification**

NASA Title: AST-Stellar, Galactic, and Extragalactic Astrophysics

Class Code: 701-20

OPM Title: Astrophysicist

Series Code: GS-1330

### *Definition of Work*

This specialty includes positions that involve studies of the Sun, and extra-solar celestial bodies and phenomena both in the galaxies and external to it, to the limits of the universe. Observations in various regions of the electromagnetic spectrum are made to characterize the objects and phenomena and to provide information on the origin and evolution of the universe and its constituents. Examples of astrophysical problems pursued include the effect of star formation in the surrounding medium, the history of star formation as inferred from elemental abundance measurements, the formation of and heating, cooling, and ionization of the interstellar clouds which form stars, the effects of the life and death of stars on the surrounding medium, the interaction of active galactic nuclei with surrounding plasma, and the energy-generating processes in unusual extragalactic objects and phenomena.

Investigations include theory-modeling and/or experiment-observation, with the latter being either in the field or laboratory. Investigators frequently develop the techniques and tools necessary for these investigations, e.g., computer codes, sensors and other instrumentation and devices used in experiments; and obtain research data through the use of instruments aboard aircraft, balloons, rockets, spacecraft, and satellites. Instruments include sophisticated optical and electronic devices that are sensitive throughout the electromagnetic spectrum, such as radio, infrared visible, ultraviolet, X-ray, and gamma-ray.

### *Specialty Knowledge*

Knowledge required to perform this work span conventional physical science and engineering disciplines, e.g., physics, chemistry, astronomy, electronics, and mathematics, together with a specialized knowledge of infrared astronomy. It also includes a thorough understanding of the use and operation of spectrometers, interferometers, telescopes, radio and other receiving devices, filters, cryogenics, vacuum technology, optics, and data communication electronics, and computer data processing, evaluation techniques and mathematical modeling.

## ***701-25 Classification***

NASA Title: AST-Planetary Studies

Class Code: 701-25

OPM Title: Space Scientist

Series Code: GS-1330

### *Definition of Work*

This specialty includes positions that involve the study of the origin, composition, structure, and evolution of the bodies of the solar system, including the planets and their satellites, the Earth and Moon, meteorites, asteroids, comets and dust. Also included are theoretical and experimental studies, studies of planetary atmospheres, investigations into effects of solar emissions on solar system objects, and studies that relate to the origin of the solar system.

Investigations include theory-modeling and/or experiment-observation, with the latter being conducted in the field or the laboratory. Investigators frequently develop the techniques and tools necessary for these investigations, e.g., computer codes, sensors, and instrumentation used in experiments.

Instruments include many types of sophisticated devices for collecting analytical or astronomical data.

Research data may be obtained through the use of instruments aboard aircraft, balloons, rockets, spacecraft, and satellites, or in terrestrial analytical laboratories or observations.

### *Specialty Knowledge*

Knowledge required to perform this work spans conventional physical science and engineering disciplines, including physics, chemistry, astronomy, geology, electronics, and mathematics. Specialized knowledge in one or more topical areas of planetary studies, described above, is normally required.

Also, specialized knowledge may be required in some areas of supporting technology, such as the theory, use, and operation of laboratory and/or flight instruments, cryogenics, vacuum technology, optics, data communication, computers, and mathematical modeling.

### ***701-35 Classification***

NASA Title: AST-Solar and Solar Terrestrial Studies

Class Code: 701-35

OPM Title: Astrophysicist

Series Code: GS-1330

### ***Definition of Work***

This specialty includes positions that involve the determination, understanding, and analysis of natural phenomena, and physical processes of the Sun by investigations of electromagnetic solar radiations from long infrared rays to short X-rays, including gamma rays, and the effects of such radiations on the interplanetary medium and planetary atmospheres. This includes understanding of how solar phenomena influence the space environment between the Sun and Earth, and the Earth's atmosphere and climate. Investigations include theory-modeling and/or experiments-observations, with the latter being either in the field or laboratory. Utilizes a variety of modern experimental techniques, including X-ray imaging devices and sophisticated theoretical techniques.

This work includes associated research and development of detection and measurement techniques, devices and related circuitry and electronics for aerospace application, such as those related to pulse height analyzers, proportional counters, scintillation detectors, spectrometers, selective filters for utilization in investigations of the nature of solar corona, extension, and distribution of coronal material into space, functioning, and processes of solar flares and effects upon other heavenly bodies. The work includes the development of improved detection devices for the entire spectrum of radiation, magnetic fields, and mass ejections to be observed, and analytical tools that utilize computers. The work also includes development and operation of highly sensitive optical surfaces, ultra-high resolution, two-dimensional digital detectors, spectro-spectrometers, and related systems to operate in near-Sun environment.

### ***Specialty Knowledge***

This specialty requires an interdisciplinary approach involving a broad basic knowledge of physical science, planetary sciences, and life sciences.

## ***701-40 Classification***

NASA Title: AST-Solar System Analysis

Class Code: 701-40

OPM Title: Physical Scientist

Series Code: GS-1301

### *Definition of Work*

This specialty includes positions that involve experimental and theoretical research directed toward the development of analytical techniques and concepts for laboratory and flight instruments and experiments used in solar system exploration. Areas of research include, but are not limited to, the following:

- A. Studies of analytical techniques, both physical and chemical, employed in making direct measurements of the chemical composition of the atmospheres and surface materials of solar system bodies relative to the origin, evolution, and distribution of life in the solar system,
- B. Studies of the fundamental aspects of terrestrial and extraterrestrial environmental relationships with life and life-related molecules and elements as they relate to the development of flight experiments,
- C. Studies utilizing fundamental scientific principles in conjunction with existing and novel state-of-the-art analytical techniques leading to the design and development of new and miniaturized analytical instrumentation,
- D. Design, development, and conduct of flight experiments to be carried aboard spacecraft, followed by analysis of the collected science data relative to laboratory tests and evaluations, and/or
- E. Other related studies concerning the interpretation of flight experiment data in terms of validity and significance to the origin, evolution, and distribution of life in the solar system.

### *Specialty Knowledge*

This specialty requires an interdisciplinary approach involving a broad basic knowledge of physical science including organic, inorganic, physical, and analytical chemistry; planetary sciences including geology, aeronomy, astronomy, and astrophysics; and life sciences including biology, microbiology, and biochemistry.

## 702 EARTH SCIENCES

**DEFINITION:**

Includes positions that are involved in the development of future remote sensing missions and aircraft experiments; defining new or modifying aerospace sensing instrumentation used in obtaining data on the characteristics and phenomena of the Earth and its atmosphere, including the utilization and operational control of such instrumentation; and analysis, interpretation, and application of data obtained through remote sensing in the biological and physical science disciplines.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
702-02	Earth Sciences Remote Sensing	Physical Scientist	GS-1301
702-03	Climate and Radiation Studies	Physical Scientist	GS-1301
702-04	Atmospheric Chemistry and Dynamics	Physical Scientist	GS-1301
702-05	Earth Biosphere Studies	Chemist	GS-1320
702-06	Atmospheric Measurements	Physical Scientist	GS-1301
702-07	Applications Data Management	Physical Scientist	GS-1301
702-08	Science Missions	Physical Scientist	GS-1301
702-09	Earth Sciences (Entry-level positions at GS-7 and GS-9 Only.)	Physical Scientist	GS-1301
702-10	Oceanographic Studies	Oceanographer	GS-1360
702-11	Meteorological Studies	Meteorologist	GS-1340
702-12	Solid Earth Geophysical Studies	Geophysicist	GS-1313
702-90 thru 702-99	*	*	*

\*At the Center's discretion

## **702-02 Classification**

NASA Title: AST-Earth Sciences Remote Sensing

Class Code: 702-02

OPM Title: Physical Scientist

Series Code: GS-1301

### *Definition of Work*

This specialty includes positions which typically involve the design, implementation and reporting of Earth science studies (biosphere, atmospheric, oceanic, geologic processes and their interactions) through the analysis, interpretation, and application of data obtained from instruments from space complimented by airborne, ground-based, and laboratory measurements. Studies involve the application of aerospace technology to improve observations of the Earth's surface and to understand Earth system processes, properties, and trends. Activities include identification, development, application, and testing of analytical techniques for deriving useful Earth science information from a variety of remotely sensed data and supportive data obtained from ground and laboratory measurements; development of mathematical algorithms (empirical techniques, physically-based models, and inversion methods) and software techniques that more accurately predict and characterize Earth processes using remotely sensed data and ancillary ground data; perform research which leads to the specifications of new remote sensing missions required for conducting Earth science programs; and conduct studies that ensure the scientific integrity of new Earth remote sensing systems designed to improve space-based observations.

The observations and information derived from activities within this specialty are utilized in furthering knowledge in Earth science disciplines. The disciplines include forestry, agriculture, and ecosystem management; physical geography; human interactions including environmental human impacts, natural disasters, and human health issues; soil science; ecology; hydrology; oceanography; and geology. Research programs involve the development of systems and techniques to provide data required for more accurate weather and climate prediction, better resources management, improved environmental quality, more accurate prediction of natural hazards, development of human health warning systems, and improved understanding of our changing global environment. Emphasis is placed on developing techniques for the collection and analysis of remotely sensed data from active and passive sensors of electromagnetic radiation emanating from the Earth-atmosphere system through space. In addition, airborne and ground instruments are utilized with ancillary ground data at the local, regional, or global scale.

### *Specialty Knowledge*

Knowledge required to perform this work spans conventional Earth science disciplines, as listed above, coupled with an understanding of remote sensing technology (electromagnetic radiation interactions and sensor characteristics), and the techniques needed for analysis of remotely sensed data and ancillary data in their application to Earth science problems. Specifically, the remote sensing technology includes but is not limited to, passive systems (optical, microwave, sun photometers) and active systems (lidar, radar). The analysis techniques include image processing, visualization, geographic information systems, signal processing, radiative transfer modeling, and mathematical and statistical methods. The work can range from developing application using existing techniques to basic theoretical research. In

addition to knowledge of basic interdisciplinary Earth science concepts, cognizance of economic, sociopolitical, and intergovernmental interactions are important for carrying out projects that address global issues.

### *702-03 Classification*

NASA Title: AST-Climate and Radiation Studies

Class Code: 702-03

OPM Title: Physical Scientist

Series Code: GS-1301

### *Definition of Work*

This specialty includes positions that involve research and study of solar variability on weather and climate and the mechanisms, by which the different levels of the Earth's atmosphere are coupled. The objective of this research is to develop an ability to predict and characterize the distribution of solar and infrared radiative fluxes, to interpret the relevance of these distributions to long- and short-term climate variations, and to understand the role played by atmospheric temperature, sea-surface temperatures, clouds, aerosols, and optically active trace constituents, e.g., CH<sub>4</sub>, N<sub>2</sub>O, NO<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O, and O<sub>3</sub>. The purpose of the work is to assess the importance of man's activities on the radiative balance of the Earth-atmosphere-ocean system. The work centers about studies of the Earth's long and short wave radiative energy balance and the role played by clouds. The work includes:

- A. Theoretical analysis of remotely sensed solar and infrared flux measurements and cloud distributions,
- B. Theoretical studies of the solar and infrared energy budget of the Earth-atmosphere-ocean system on both long and short time scales and over widely varying spatial scales,
- C. Design and development of satellite borne and shuttle borne sensors required to collect the relevant data,
- D. Test and evaluation of the instrumentation and support systems required,
- E. Experimental and theoretical analysis of available and anticipated data related to the radiative energy balance of the Earth-atmosphere ocean system, and/or
- F. Investigations of the effects of tropospheric and stratospheric aerosols, optically active trace gases, and cloud type, distribution, height, and coverage.

Positions in this specialty may be engaged in analytical and experimental work to define research programs of contemporary interest, instrumentation required for the conduct of such programs, or data bases required for the study of related problems. These positions may also be responsible for management of contractual programs for the performance of these functions.

### *Specialty Knowledge*

This work requires an interdisciplinary approach including capabilities in the disciplines of radiative transfer, cloud physics, instrument design and evaluation, satellite system design, and data analysis.

### *702-04 Classification*

NASA Title: AST-Atmospheric Chemistry and Dynamics

Class Code: 702-04

OPM Title: Physical Scientist

Series Code: GS-1301

### *Definition of Work*

This specialty includes positions that involve research and study of the composition and structure of the Earth's atmosphere. The objective of this research is to understand quantitatively the chemical, dynamic, and radiative processes which regulate the spatial and temporal distribution and abundance of active troposphere and stratospheric gases; to define those processes which influence the abundance of species of importance in the above families; to identify processes which affect the abundance of aerosols and interactions with active gases, and to assess the interaction occurring between radiation, photochemistry, and dynamics. The work includes:

- A. Analysis of data from instruments on satellites, aircraft, balloons and ground based platforms,
- B. Theoretical studies of troposphere and stratospheric photochemistry radiation, and dynamics,
- C. Design, development, test, and evaluation of sensors to measure troposphere and stratospheric species of interest, and/or
- D. Experimental and theoretical analysis of data related to the structure, composition, and transport processes important in the stratosphere and troposphere.

Positions in this specialty may be engaged in analytical and experimental work to define research programs of contemporary interest, instrumentation required for the conduct of such programs, or data bases required for the study of related problems or they may be directly involved in the design, development, test, and evaluation of the remote sensing systems. These positions may also be responsible for management of contractual programs for the performance of these functions.

### *Specialty Knowledge*

This work requires interdisciplinary knowledge, including ones associated with atmospheric chemistry, radiative transfer, atmospheric dynamics and transport, climate, instrument design, spectroscopy, mathematics, numerical analysis, and program planning.

## *702-05 Classification*

NASA Title: AST- Earth Biosphere Studies

Class Code: 702-05

OPM Title: Chemist Series

Code: GS-1320

### *Definition of Work*

This specialty includes positions that involve research and study of biogeochemical processes that impact the Earth's biosphere on a regional to global scale. The objective of this research is to understand the processes that regulate the distributions and abundance of atmospheric trace gases and aerosols in various components of the present atmospheric system—biosphere, soils, atmosphere, ocean, and sediments; and to establish measurement strategies to provide early indications of possible changes. The work centers on studies of those factors controlling source/sink relationships between the atmosphere and biosphere. Studies of the application of remote sensing technology to biophysical indicators of those relationships are also central to this specialty. The work includes:

- A. Theoretical modeling of flux mechanisms and related processes or indicators,
- B. Design, development, testing, and evaluation of measurement and instrumentation or computer modeling techniques to carry out relevant research in this area,
- C. Design and implementation of laboratory and field experiments related to the specialty, and/or
- D. Experimental and theoretical analysis of the results of laboratory/field measurement programs.

Positions in this specialty may be engaged in analytical and experimental work to define and implement research activities in this area or they may be directly involved in the design, development, test, and evaluation of instrumentation and computer models needed to implement the research. These positions may also be responsible for management of contractual programs for the performance of these functions.

### *Specialty Knowledge*

This work requires a range of knowledge which cut across many subjects as they may apply to various aspects of the research such as ecology and earth science including atmospheric/soil chemistry, biogeochemical cycling and microbiology; radiometry; electro-optical measurement techniques; computer science; systems ecology; plant and animal physiology; plate tectonics; informatics; physical geography; geo-statistics; community and population ecology; theoretical ecology; and statistical analysis techniques.

## **702-06 Classification**

NASA Title: AST-Atmospheric Measurements

Class Code: 702-06

OPM Title: Physical Scientist

Series Code: GS-1301

### *Definition of Work*

This specialty includes positions which involve research and study of the measurement techniques which can be used to characterize on regional to global scales the physical, chemical, dynamical and radiative properties of the Earth's atmosphere. The motions, distributions, variability of heat, moisture, and other constituents in the atmosphere and the energy transfer processes which link these parameters are studied. Investigators develop and utilize sensors and other instrumentation and devices for atmospheric experiments and for studying land surface-atmosphere interactions. Equipment used includes in-situ and remote sensors operated from ground, aircraft, balloon, and space platforms for measuring temperature, humidity, composition, cloud properties, and the emitted and reflected energy from the Earth and atmosphere. The work includes:

- A. Conception, development, and evaluation of advanced airplane and satellite remote sensors for atmospheric measurements,
- B. Development of observing system simulations of new measurements, data assimilation experiments, establishment of design criteria, and conduct of laboratory and field measurements required to characterize and demonstrate advanced remote sensing techniques,
- C. Planning and conducting analytical and field measurement campaigns and investigations applying advanced remote sensors to determination of the composition, structure, and dynamics of the atmosphere,
- D. Analyzing and interpreting data from field measurements for scientific investigation of atmospheric processes and the development of new algorithms and applications, and/or
- E. Test and evaluation of appropriate interpretation techniques and interaction with theoretical modeling researchers.

Positions in this specialty may be engaged in original experimental, theoretical, or analytical research aimed at development and application of remote sensing experiments and measurement strategies to improve understanding of the Earth's atmospheric processes. These positions may also be responsible for management of contractual programs for the performance of these functions.

### *Specialty Knowledge*

This work requires a range of knowledge which cut across several subjects as they may apply to electro-optics, active radar, and passive microwave radiometry, spectroscopy visible/infrared imaging, cloud physics and precipitation processes, regional to global-scale modeling-, atmospheric physics/physical meteorology, radiative transfer, and data reduction and interpretation techniques.

### **702-07 Classification**

NASA Title: AST-Applications Data Management

Class Code: 702-07

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of Work*

This specialty includes positions that involve the management of data from research and study of one or more Earth science disciplines. The work centers about the design and development of data management systems for processing large data sets from field and satellite experiments; the development and maintenance of data interfaces between experimenters and final products users; the implementation of inversion and averaging algorithms proposed by principal investigators and experiment science teams; and provision of output products to science team members and scientific community. The work includes:

- A. Developing the software systems and the end-to-end operational data processing system for satellite, aircraft, and balloon borne atmospheric experiments,
- B. Developing and performing computer simulation studies to evaluate different factors for inverting satellite radiation measurements to units useful to Earth scientists,
- C. Developing and maintaining software interfaces between the experiment and those responsible for data collection, and interfacing between experiments and the final user products,
- D. Implementing inversion algorithms developed by experiment Principal Investigators/Science Teams, and providing final output products to science team members and the scientific community, and/or
- E. Testing and evaluating the data processing subsystems to assimilate, validate, and perform initial processing on all satellite telemetry and orbit data.

Positions in this specialty may be engaged in analytical and experimental work to define advanced concepts for making remote measurements of geophysical parameters and techniques for inversion or they may be directly involved in the design, development, test, and evaluation of the data base management systems for processing large data sets from field and satellite experiments. These positions may also be responsible for management of contractual programs for the performance of these functions.

#### *Specialty Knowledge*

This work requires a range of knowledge that cut across several subjects, which may include data management, statistics, applied mathematics, atmospheric physics, space flight mechanics, and other Earth science disciplines. A high degree of skill in computer programming and a fundamental understanding of computer capabilities, and measurement and instrumentation systems are also an integral part of this work.

## *702-08 Classification*

NASA Title: AST-Science Missions

Class Code: 702-08

OPM Title: Physical Scientist

Series Code: GS-1301

### *Definition of Work*

This specialty includes positions that involve research and study of the processes affecting the composition and structure of the Earth's atmosphere and the Earth's radiation budget. Incumbents of these positions are assigned tasks involving the definition and conduct of multidisciplinary research activities often involving national and international task teams. They may be assigned tasks of experiment management and coordination with specialties such as instrument integration, data management, operations management, or supporting measurements and data requirements. Research activities include scientific workshops, instrument inter-comparison tests, field measurement programs, and spacecraft experiments. The work includes:

- A. Formulation and direction of task teams to implement research task,
- B. Definition of experiment goals, data parameters, measurement requirements, and data management requirement,
- C. Coordination of all phases of task team activities,
- D. Preparation and dissemination of requirements documents and operations procedures,
- E. Operational support of experimental activity including logistics supporting/correlative measurements, data management, and communications, and/or
- F. Coordination and implementation of post mission activities including data processing, calibration, archiving, and dissemination.

Positions in this specialty may be engaged in analytical experimental work to define mission requirements or they may be directly involved in the design, development, test, and evaluation of specialized instrumentation, data acquisition and display systems, and computer programs needed to carry out the science missions. These positions may also be responsible for management of contractual programs for the performance of these functions.

### *Specialty Knowledge*

This work requires a range of knowledge that cut across several subjects as they may apply to various technical tasks, e.g., atmospheric science, in situ and remote sensing techniques, computer science, and program management.

## **702-10 Classification**

NASA Title: AST-Oceanographic Studies

Class Code: 702-10

OPM Title: Oceanographer

Series Code: GS-1360

### *Definition of Work*

This specialty includes positions that involve research and study of ocean circulation, physics, chemistry, and biology; and air-sea-ice and sea-land interaction processes. The objective of this research is to conduct scientific studies and experiments that will lead to better understanding of oceanographic phenomena; to study the interaction mechanisms between the ocean and the atmosphere, the ocean and the cryosphere; the ocean and land; to develop new data processing techniques; to develop and evaluate instrumentation and techniques used in aircraft and satellite remote sensing to make detailed observations of the ocean; to develop models of oceanographic phenomena and their interactions; and to develop techniques to assimilate in situ and satellite data into ocean models to study ocean phenomena. The work may include:

- A. Developing requirements for active and passive instruments and systems to take direct and remote measurements;
- B. Processing and analyzing measurements of physical and biological parameters, such as ocean color, sea surface temperature, salinity, height, and roughness to improve fundamental knowledge of the ocean;
- C. Developing and testing of models of oceanographic phenomena;
- D. Developing and testing data assimilation systems for inclusion into ocean models;
- E. Evaluating sensor systems including observing system design for remote sensing; and/or
- F. Developing and furnishing algorithms that convert instrument observation into geophysical parameters.

Positions in the specialty may be engaged in analytical and experimental research activities, or they may be directly involved in the design, development, test and evaluation of instrumentation, systems, models, or assimilation techniques needed to implement the research. These positions may also be responsible for management of contractual programs or academic grants for the performance of these functions.

### *Specialty Knowledge*

This work requires a broad range of knowledge covering such subjects as oceanography, atmospheric science, chemistry, biology, climatology, physics, remote sensing systems and techniques, fluid dynamics, applied mathematics, statistics, data processing, and computational systems and methods.

## **702-11 Classification**

NASA Title: AST-Meteorological Studies

Class Code: 702-11

OPM Title: Meteorologist

Series Code: GS-1340

### *Definition of Work*

This specialty includes positions that involve research and study of atmospheric systems and processes and the role they play in the Earth's energy and hydrological cycles. The objective of the research is to develop an ability to characterize and understand the kinematics, dynamics, physics, and energetics of atmospheric processes on micro-, meso-, regional, and global scales, the interaction of these systems with the land and ocean surface and their effect on global change. The generation and distribution of aerosols, dust, gases, clouds, and rainfall in relation to the evolution of atmospheric dynamic and convective systems is a focus of the research. Objectives also include improved forecasts of weather and climate, applications of meteorological knowledge to broader socio-economic and political disciplines (e.g. agriculture, health, transportation, policymaking), and assessing the impact of human activities on weather and climate. Approaches include:

- A. Analysis and assimilation of data from instruments on satellites, aircraft, balloons and ground sites, especially passive and active remote sensing of the Earth's atmosphere and surface,
- B. Theoretical and modeling studies of the physics, dynamics, and energetics of atmospheric systems on various space and time scales with the intent to improve prediction of weather and climate,
- C. Design and development of ground-based and aircraft and satellite borne sensors required for collecting the relevant data,
- D. Experimental and theoretical analysis and interpretation of data related to the structure, evolution, and dynamics of atmospheric systems,
- E. Investigations of the structure and physics of aerosols, dust, clouds, precipitation fields and cloud systems and their impact on larger scale systems and climate, and/or
- F. Application of meteorological knowledge to agriculture, health, transportation-related topics, and policy impacts related to the potential effects of human activities on weather and climate.

Positions in this specialty may be engaged in analytical and experimental work to define research programs of contemporary interest, instrumentation required for the conduct of such programs, or data bases required for the study of related problems or they may be directly involved in the design, development, test, and evaluation of the remote sensing systems. These positions may also be responsible for management of contractual programs for the performance of these functions.

### *Specialty Knowledge*

This work requires an interdisciplinary approach involving knowledge and skills in the areas of radiative transfer, cloud physics, atmospheric dynamics, climate dynamics, instrument design and evaluation, satellite system design, remote sensing techniques, data analysis and modeling. In addition, knowledge in the areas of chemistry, oceanography, land processes, agriculture, and health will be helpful.

## **702-12 Classification**

NASA Title: AST-Solid Earth Geophysical Studies

Class Code: 702-12

OPM Title: Geophysicist

Series Code: GS-1313

### *Definition of Work*

Positions within this specialty involve research into and study of the physical characteristics of the Earth, Moon and other planets, often using data from aircraft, balloons, ships, spacecraft, geophysical observatories and sensors on the surface of the Moon and other planets. The primary purpose of this research is to understand the characteristics, origin and dynamics of the crust, mantle, and core, as well as the effects of ongoing changes in the nature and interrelationships of these planetary components. Methods and techniques that can be used in the course of these studies include: gravity and magnetic fields; thermal properties and heat flow; electrical methods, geomorphology and surface change (ocean currents); petrology and petrography and isotopic studies for age determinations, geodetic methods (planetary rotation, tides and precession); interaction of the ionosphere, magnetospheres with interplanetary space; plate tectonic and structural geology; seismological (natural and man made) processes; and electromagnetic methods and techniques.

### *Specialty Knowledge*

Knowledge required to perform this work is found in the conventional disciplines such as geology, physics, chemistry, mathematics, geodynamics, physical geography, mathematical modeling, and remote sensing, together with an ability to formulate mathematical and/or computer-based models describing physical phenomena observed in the natural environment. Familiarity with digital data processing techniques and geophysical data archives is important. Knowledge of the relationships between solid-Earth geophysics and related fields is necessary

## 709 LIFE SCIENCES AND SYSTEMS

**DEFINITION:**

Includes positions engaged in research, development, and application of human-system integration technology for use in the aerospace environment and in research pertaining to humans and other life forms in the universe. Also includes, their interaction with their natural and space environments; including psycho-physiological attributes of human functioning as part of a human-machine system, countermeasures for problems that result when humans are exposed to the space flight environment, determining requirements for life support and environmental control systems, flight investigations, and experiment payloads; origin and evolution of biological processes, systems, structures, and species; and means for detection of life and life-related molecules beyond Earth.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
709-09	Life Sciences and Systems (Entry-level positions at GS-7 and GS-9 Only.)	Physical Scientist	GS-1301
709-22	Biological Studies	Biological Studies	GS-401
709-31	Chemical and Biological Evolution	Physical Scientist	GS-1301
709-42	Human Performance Studies	Psychologist	GS-180
709-43	Medical Studies	Medical Officer	GS-602
709-44	Life Support Studies	Physical Scientist	GS-1301
709-45	Human/Machine Systems	Human/Machine Systems	GS-801
709-50	Life Sciences Research	Life Sciences Research	GS-401
709-60	Biological/Physical Sciences Research	Physical Scientist	GS-1301
709-90 thru 709-99	*	*	*

\*At the Center's discretion

### **709-22 Classification**

NASA Title: AST-Biological Studies

Class Code: 709-22

OPM Title: AST-Biological Studies

Series Code: GS-401

### *Definition of Work*

This specialty includes positions that involve theoretical and/or experimental research on the biological processes of living organisms and systems as related to aeronautical and space travel. Main areas of study include, but are not limited to:

- A. Investigations of the cardiovascular, renal, respiratory, musculoskeletal, and endocrine systems as affected by space environments,
- B. Investigations of the effects of space environment factors of weightlessness, high and low atmospheric pressures, acceleration forces, temperature, and others,
- C. Investigations of biological systems (in vivo and in vitro) and processes (e.g. temperature regulation, nutrition, metabolism, and toxicology) related to performance in artificial environments under both terrestrial and extraterrestrial conditions, and/or
- D. Studies may also include basic ecological and physiological investigations of life under space conditions, including genetic factors and adaptations. Investigators frequently develop the techniques, tools and laboratory apparatus necessary for these investigations, including human and animal experimental protocols, computer data processing techniques, and mathematical modeling procedures.

### *Specialty Knowledge*

This work requires an interdisciplinary approach involving a broad basic knowledge of biological science in combination with concepts, principles, and processes of physiology, biochemistry, microbiology, molecular biology, and behavioral testing techniques.

### **709-31 Classification**

NASA Title: AST-Chemical and Biological Evolution

Class Code: 709-31

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of work*

This specialty includes positions that involve theoretical and experimental research on the nature, distribution, origin, and evolution of protobiological processes and prebiotic molecular systems. Areas of research include, but are not limited to, studies of the following:

- A. The cosmic history of the biogenic elements and compounds from nucleosynthesis in stars to interstellar clouds, to solar nebula, to incorporation in pre-planetary bodies,
- B. The chemical evolutionary pathways in a planetary context by which the molecular systems and rudimentary attributes of living organisms evolved from abiotic milieux,
- C. The biogeochemical record of early biological evolution, manifested in the chemical relationships between sedimentary organic matter and the biosphere from which it derives, and is preserved in ancient sediments, contemporary environments, and microorganisms,
- D. The origin and early evolutionary development of living systems for which clues can be traced in contemporary organisms, and/or
- E. The influence of astrophysical, stellar, and solar system events on the evolution of complex life on Earth.

#### *Specialty Knowledge*

This work requires an interdisciplinary approach involving familiarity with concepts, principles, and processes of at least several fields, among which are included chemistry, physics, astronomy, geology, biology, and related life sciences, coupled with a broad basic knowledge of one of these disciplines.

### *709-42 Classification*

NASA Title: AST-Human Performance Studies

Class Code: 709-42

OPM Title: Psychologist

Series Code: GS-180

### *Definition of Work*

This specialty includes positions that involve theoretical and experimental research on behavior and behavioral capabilities of humans functioning as integral components of human-machine systems in aerospace environments. Areas of research include, but are not limited to, the following.

- A. Studies of human abilities to gain information for system operation through the various sense modalities, e.g., visual, auditory, and tactile; and by psycho-physiological methods (i.e., electrophysiological measurement of central and autonomic nervous systems);
- B. Studies of cognitive processing of information necessary to arrive at correct decisions either strategic or tactical;
- C. Studies of the effects of environmental (physical) or task demand (job) stresses on the ability to process information and perform the required function. Tests of behavioral countermeasures designed to improve performance in unusual environments; and/or
- D. Studies of crew-crew interrelationships and their effect on performance.

These studies may also include examination of the cognitive and behavioral processes (including language usage, and clinical evaluations of psychosocial/neurobehavioral phenomena) of humans interacting with systems having varying levels of artificial intelligence or other highly developed expert computing systems which share in a decision or information-gathering process.

### *Specialty Knowledge*

This work requires an interdisciplinary approach involving a thorough understanding of psychology, especially experimental psychology, statistical analyses, and related disciplines in combination with an understanding of the basic principles used in engineering, computer science, or other related aerospace disciplines.

### ***709-43 Classification***

NASA Title: AST-Medical Studies

Class Code: 709-43

OPM Title: Medical Officer

Series Code: GS-602

### ***Definition of Work***

This specialty covers medical officer positions engaged in supporting theoretical and experimental research on the physiological and psychological performance, capacities, and limitations of humans for aerospace flight and exploration. Studies of humans in these roles may be conducted under simulated or actual flight conditions. The incumbents design, manage, and conduct experimental protocols for tests and experiments that utilize humans as subjects or that involve humans as test participants. Included in this specialty is the medical monitoring of the performance and physiological status of test pilots and other human subjects as they participate in experiments in which they may be subjected to stressful environments.

Also included are the development of procedures and data in support of and the monitoring of humans prior to, during, and following the conduct of actual aerospace flight.

### ***Specialty Knowledge***

The nature of research assignments and medical monitoring responsibilities requires that incumbents hold the degree of Doctor of Medicine from an accredited institution and a current license to practice medicine.

### **709-44 Classification**

NASA Title: AST-Life Support Studies

Class Code: 709-44

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of Work*

This specialty includes positions that involve theoretical and experimental research to provide basic data and feasibility demonstrations, and research and development to fabricate, test, and evaluate crew and life support equipment for future space missions and Extravehicular Activity. The overall goal of this specialty is to develop and demonstrate equipment and systems that are directed toward the maintenance of an individual's well being and optimum performance in spacecraft, planetary habitats and space suit environments.

Activities include, but are not limited to fundamental research, analytical studies, system integration, modeling and analysis, laboratory and hardware feasibility demonstrations, hardware development and testing, and environmental and habitat chamber testing and evaluation for artificially engineered environments.

These systems include atmospheric pressure and composition control including total pressure, oxygen, carbon dioxide, and nitrogen partial pressures; fire detection and suppression; temperature and humidity control; atmospheric revitalization; water recovery, waste processing, and resource recovery; biomass production and food processing; and Extravehicular Activity equipment development and testing including space suit systems and portable life support functions of carbon dioxide control, thermal control, and oxygen generation.

#### *Specialty Knowledge*

This specialty requires interdisciplinary knowledge involving physical and chemical sciences, and a broad range of engineering disciplines (chemical, mechanical, electrical, environmental, and systems) in combination with the concepts, principles, and processes of physiology, biochemistry, biotechnology, plant science, and other related life sciences disciplines as they apply to specific life support/environmental control applications.

### **709-45 Classification**

NASA Title: AST-Human/Machine Systems

Class Code: 709-45

OPM Title: AST-Human/Machine Systems

Series Code: GS-801

### *Definition of Work*

This specialty includes engineering positions that involve theoretical and experimental research to develop, assess, and verify design criteria and engineering guidelines for the optimum integration of humans as integral components of advanced aerospace systems. Areas of performance include, but are not limited to, the following:

- A. Knowledge and expertise in design requirements, criteria, and guidelines to provide a human/equipment interface that is safe for operation and emphasizes optimal efficiencies.
- B. Performance of general manned system discipline and program-specific studies to further characterize and define human factors interfaces, including:
  - 1. Studies to support the establishment, consolidation, and verification of human interface requirements, criteria, and guidelines for manned spaceflight hardware and software designs. These studies may also include hardware and software needs and the human factors requirements for crew support and function in space and particularly a space station,
  - 2. Assessments of state-of-the-art technologies (hardware and software) influencing the overall performance of the human components of the system,
  - 3. Studies to identify which of the overall system functions can and should be automated through new or existing technology applications and which functions are best performed by a human being, and identification of appropriate operating constraints,
  - 4. Studies of human performance with advanced visual and auditory display systems, and/or
  - 5. Development, evaluation, and validation of flight simulation equipment and utilization techniques.

### *Specialty Knowledge*

This work requires an interdisciplinary approach involving a broad basic knowledge of general engineering, *e.g.*, electrical, mechanical, human factors, and industrial, in combination with the concepts, principles, and experimental techniques of psychology, physiology, and other life sciences disciplines, as they apply to those specific human-machine applications described above.

### ***709-50 Classification***

NASA Title: AST-Life Sciences Research

Class Code: 709-50

OPM Title: AST-Life Sciences Research

Series Code: GS-401

### ***Definition of Work***

This specialty includes positions that involve experimental and theoretical research directed toward the understanding of the effects of space flight on biological processes in living organisms. The research may involve humans, animals, and cells in culture. Areas of research include, but are not limited to:

- A. Design, development and conduct flight experiments to be carried aboard spacecraft or in ground-based laboratories, followed by analysis of the collected science data,
- B. Studies concerning the interpretation of flight and ground experimental data in terms of their validity and significance to the relevant life science disciplines, and/or
- C. Development of the techniques, tools and laboratory apparatus necessary for these investigations, including human and animal experimental models, ground-based analogue populations, computer data processing techniques, and mathematical modeling procedures.

### ***Specialty Knowledge***

This work requires an interdisciplinary approach involving a broad basic knowledge of chemistry and biology in combination with the concepts, principals and processes of physiology and other related life science disciplines. In addition, these positions will frequently involve the leadership of laboratory teams composed of civil servant, contractor, and visiting science personnel. Also, individuals will normally serve as discipline experts and will provide guidance, input and interpretation concerning science-related issues to management.

### **709-60 Classification**

NASA Title: AST-Biological and Physical Sciences Research

Class Code: 709-60

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of work*

This specialty includes interdisciplinary positions that involve theoretical and experimental research to provide basic data and feasibility demonstrations, and research and development to fabricate, test, and evaluate fundamental characteristics of molecular and cellular systems with applications to biochemical, cellular, tissue engineering and material sciences.

The overall goal of this specialty is to develop and demonstrate equipment and systems that are directed toward the elucidation of the fundamental physical and chemical characteristics of molecules, cells and tissues with specific emphasis on causal relations between the structural and functional properties of molecules, cells and tissues related to NASA-specific problems and needs.

Activities include, but are not limited to fundamental research, analytical studies, system integration, modeling and analysis, laboratory, technology, hardware feasibility demonstrations, technology and hardware development and testing the basic properties of molecules, cells and tissues that are relevant for understanding structural and functional interactions of biological systems at the molecular level. These biological systems include but are not limited to proteins, living cells, tissues and organisms, related assay technologies, polymers, and systems assembled at the nano-scale level.

#### *Specialty Knowledge*

This specialty requires interdisciplinary knowledge involving physical, chemical, biochemical, and biophysical sciences, and a broad range of engineering disciplines (chemical, mechanical, electrical, environmental, and systems) in combination with the concepts, principles, and processes of biotechnology, cell science, tissue engineering, human physiology, health related biophysical processes and other related physical sciences disciplines, as they apply to NASA-specific problems, needs and applications.

## 710 FLUID AND FLIGHT MECHANICS

**DEFINITION:**

Includes positions engaged in research, development, test, and evaluation of fluid and flight mechanics pertaining to aerospace and aeronautical vehicles. Includes investigations of the force and motion mechanics of vehicles in various atmospheric and celestial environments, wind tunnel testing, and computational analysis of aircraft and spacecraft fluid flow phenomena and flight mechanics problems; studies of the aerothermodynamics of vehicles entering planetary atmospheres including dissociation and ionized gas effects; the development of systems to control, navigate, and guide flight vehicles in planetary atmospheres and in space including trajectory analysis; investigations into the effects of structural vibrations and noise on the design and operation of vehicles; studies of space flight vehicle design and mission analyses; and research on the characteristics of electrically conducting fluids under the action of magnetic and electric fields.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
710-02	Aerothermodynamics	Aerospace Engineer	GS-861
710-09	Fluid and Flight Mechanics (Entry-level positions at GS-7 and GS-9 Only.)	Aerospace Engineer	GS-861
710-10	Aerospace Vehicle Design and Mission Analysis	Aerospace Engineer	GS-861
710-15	Navigation, Guidance, and Control Systems	Aerospace Engineer	GS-861
710-30	Fluid Mechanics	Aerospace Engineer	GS-861
710-45	Flight Vehicle Acoustics	Aerospace Engineer	GS-861
710-55	Heat Transfer	Aerospace Engineer	GS-861
710-60	Stability, Control, and Performance	Aerospace Engineer	GS-861
710-65	Flight Vehicle Atmospheric Environments	Aerospace Engineer	GS-861
710-68	Basic Properties of Gases	Physicist	GS-1310
710-70	Flight Vehicle Space Environments	Aerospace Engineer	GS-861
710-90 thru 710-99	*	*	*

\*At the Center’s discretion

## **710-02 Classification**

NASA Title: AST-Aerothermodynamics

Class Code: 710-02

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions, that involve research and study of the flow of fluids in circumstances where the thermodynamics of the system play a significant role. The work is frequently related to, but is not limited to, very high-speed flows, such as occur in launch vehicle ascents, hypersonic flight, missiles, and the entry of vehicles into planetary atmospheres. It involves computational methods as well as the use of ground-based and flight test facilities in the determination of heat transfer, aerodynamics, viscous interaction effects, and non continuum flow effects. Specific areas of study include:

- A. Equilibrium and finite-rate chemistry in high speed flows,
- B. Launch vehicle exhaust plume convective and radiative heating,
- C. Convective aerodynamic heating of vehicles, and shock-cap radiative transfer,
- D. Diffusion in chemically reactive flows,
- E. Wall catalytic effects on gas chemistry,
- F. The coupling between flow field and an ablative heat shield,
- G. The coupling between gas radiation and the flow field,
- H. Localized heating problems on entry or hypersonic vehicles,
- I. Development of hypersonic or hypervelocity facilities, such as shock tubes or arc jets,
- J. Aerothermal instrumentation developments,
- K. Viscous flow,
- L. Predication of electron number,
- M. Densities in hypersonic flows for evaluation of radio blackout, and/or
- N. Non-equilibrium flow effects on vehicles in the rarefied transitional flow regime.

The purpose of the research is to develop an understanding of the physics involved and, as appropriate, develop physical models of significant phenomena, and to develop the capability to calculate the flow of fluids about and the heat transfer to hypersonic and entry vehicle. Aerodynamics and heating of entry vehicles are considered from the time the atmospheric effects first become significant until vehicle speed is sufficiently low that thermal effects need not be considered. To achieve technical objectives, positions may also be engaged in the planning, direction, coordination, and evaluation of contracted efforts in performance of this work.

### *Specialty Knowledge:*

This specialty requires a range of knowledge in various disciplines such as fluid dynamics, aerodynamics, thermodynamics, physical chemistry, gas spectroscopy, kinetic theory of gases, numerical methods, and experimental techniques.

### **710-10 Classification**

NASA Title: AST-Aerospace Vehicle Design and Mission Analysis

Class Code: 710-10

OPM Title: Aerospace Engineer

Series Code: GS-861

#### *Definition of Work*

This specialty includes positions that involve research and analytical and experimental investigations of the force and motion mechanics of flight vehicles in various atmospheric, planetary, celestial and space environments and space flight regimes. The work includes:

- A. Studies to establish the analytical and experimental dynamic characteristics of vehicles required to perform projected missions and evaluation of vehicle configurations for use on these missions,
- B. Analysis of total aerospace vehicle performance based on theoretical predictions, ground or flight experimental data. Includes the determination of vehicle characteristics such as range, payload, excess energy, fuel efficiency, and acceleration,
- C. Conduct of aerospace mission analyses and configuration studies to assess mission feasibility and configuration optimization using analytical and/or experimental data,
- D. Studies, experiments, and fundamental research on new techniques and methods of analysis of the performance of aerospace vehicles and subsystems and the force and motion mechanics of flight vehicles, and/or
- E. Determination and analysis of mass properties and mass distributions of major components, subsystems, and systems.

Positions in this specialty may be engaged in research or may participate in the investigation and development of vehicles. These studies must consider the various aerospace phenomena and their effects on vehicles and program feasibility. To achieve technical objectives, positions may also be engaged in the planning, direction, coordination, and evaluation of contracted efforts.

#### *Specialty Knowledge*

This work requires a range of knowledge that cut across several disciplines such as celestial mechanics, propulsion dynamics, aerodynamics, and guidance and control to achieve a practical projection of the movement and flight paths of human-made bodies in atmospheric and space environments, and the application of numerical analysis and computer simulation techniques.

### **710-15 Classification**

NASA Title: AST-Navigation, Guidance, and Control Systems

Class Code: 710-15

OPM Title: Aerospace Engineer

Series Code: GS-861

#### *Definition of Work*

This specialty includes positions that involve research, development, design, test, and evaluation of integrated aerospace vehicle systems and their components and subsystems for the control, navigation, and guidance of flight vehicles in the atmosphere and space. The work centers about studies of vehicle flight dynamics and flight management and the definition, design, development, and evaluation of systems and subsystems to control or guide the vehicle in flight. This would include studies leading to technologies for air traffic management. Some positions may coordinate and exercise technical monitoring of in-house and contractor research, development, and evaluation of control and guidance systems from theoretical studies through hardware tests and installation. The work includes:

- A. Theoretical analysis of flight paths, mission errors, air traffic management and the flight dynamic characteristics of vehicles to establish criteria for the development of control, guidance and air traffic management systems,
- B. Theoretical studies of the effects of sensor errors, failure modes, course corrections upon control, guidance and air traffic management systems, and establishment of means to compensate for or correct these errors and failure,
- C. Design and development of guidance, navigation, air traffic management and control systems and their respective components requiring application of a knowledge of flight dynamics and airspace operations as it affects control, guidance and air traffic management,
- D. Test and evaluation of guidance, navigation, air traffic management and control systems by simulation programs, both theoretical and experimental; hardware tests; and post-flight analysis of flight performance or air traffic data for the purpose of evaluating the control and guidance system used on the vehicle and air traffic management systems used to coordinate the flow of traffic,
- E. Experimental and theoretical linear and nonlinear analyses of control, guidance and air traffic management systems, including constituent components of the systems, and/or
- F. Investigation of the effects of structural dynamics on control and guidance system.

Positions in this specialty may be engaged in analytical and theoretical work to define control, guidance, and air traffic management systems; or they may be directly involved in the design, development, test, and evaluation of the systems.

#### *Specialty Knowledge*

This work requires a range of knowledge which cut across several subjects as they apply to control and guidance and air traffic management systems; e.g., aerodynamics, orbital mechanics, control theory, vehicle dynamics, nonlinear mathematics, dynamical system theory, electronics, mechanical systems design, propulsion dynamics, and the application of computer simulation computer programming, and experimental test techniques.

## 710-30 Classification

NASA Title: AST-Fluid Mechanics

Class Code: 710-30

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions that involve aeronautics and space research, study, and technology development related to the flow of fluids about bodies and through passages, nozzles, pumps, turbines, etc., and the calculation and measurement of related forces, moments, and physical processes in support of technology development. The work is conducted utilizing theoretical, computational, and experimental procedures in all flow regimes from subsonic to hypersonic to outer space. Sophisticated flow diagnostic equipment, such as hot wire anemometers and lasers, along with conventional and high-energy flow facilities as well as flight facilities may be required. Specific areas of study include:

- A. Steady and unsteady characteristics of laminar, transitional, and turbulent boundary layers,
- B. Flow separation, including small and large eddy structures,
- C. Flow discontinuities, such as slip surfaces and shock waves,
- D. Skin friction and drag,
- E. Natural and forced convection,
- F. Heat and mass transfer including change of phase,
- G. Steady-state and time-dependent aerodynamic and hydrodynamic forces as input to structural response problems,
- H. Control of unsteady flow characteristics such as by acoustic excitation or special surface materials, and/or
- I. Process involving energy addition or extraction from flowing fluids.

The purpose of the research, study or technology development is to develop an understanding of the physics of the flow phenomena and, as appropriate, physical models of these phenomena to improve the methodology for calculating the flow of fluids through or about aircraft, spacecraft missiles, entry probes, etc., and their components and to apply these improved methods to the development of advanced aircraft, spacecraft, etc., and their components. To achieve technical objectives, positions may also be engaged in the planning, direction, coordination, and evaluation of contracted efforts in these areas.

### *Specialty Knowledge*

This specialty requires knowledge in various disciplines such as fluid dynamics, aerodynamics, chemistry, thermodynamics, numerical methods, and computer simulation.

## **710-45 Classification**

NASA Title: AST-Flight Vehicle Acoustics

Class Code: 710-45

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions that involve the theoretical and experimental study of noise and its effect on the design and operation of aircraft, missiles, and space vehicles. This includes the investigation of the fundamental phenomena of noise generation; the transmission of noise through gases, liquids, and complex structures; and the effects of noise on personnel, structures, and sensitive mechanical and electrical equipment. Studies involve:

- A. Prediction and measurement of far-field noise, internal noise environments, and acoustic loadings on all types of aeronautical and space flight vehicles,
- B. Evaluation of significant variables in noise generation by gas turbine and rocket engines, aerodynamic shear and boundary layers, propellers, dusted fans, helicopter rotors, gear trains, accessories, etc.,
- C. Evaluation of atmospheric and terrain effects on sound propagation, and/or
- D. Analyses of stress response and fatigue characteristics of various types of flight vehicle structures due to intense acoustic loading.

This specialty also includes positions where acoustics and wave mechanics are used for detection, diagnosis, analysis, and control of static and dynamic phenomena in flight vehicles and space structures. For example, studies involve means of using acoustic signals to detect fiber breakage and delamination in composite materials and to diagnose incipient mechanical failures; use of acoustic signatures to identify and locate flight vehicles; and active acoustic control to eliminate undesirable wave phenomena in flight and space vehicles.

Also, positions in this specialty are involved in conducting ground-based and flight tests of vehicles and components for the purposes described in subparagraph a. They are also involved in developing concepts, devices, and operating procedures for minimizing noise and its effects, in developing and using laboratory equipment, and testing techniques for research and development in all aspects of flight vehicle acoustics, and in developing and using devices and procedures for the detection, diagnosis, analysis, and control applications of acoustics and wave mechanics as previously described. Positions may also be engaged in planning, direction, coordination, and evaluation of grant or contract efforts in this area.

### *Specialty Knowledge*

The work requires a range of knowledge in disciplines such as fluid mechanics, aerodynamics, structural mechanics, vibrations, acoustics, numerical analysis, human factors, computer simulation, and experimental techniques.

### *710-55 Classification*

NASA Title: AST-Heat Transfer

Class Code: 710-55

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions that involve the study of radiation, convection, and conduction heat transfer within solids, fluids, and vacuums. The work involves study of the time-dependent radiative, convective, and conductive heating variables with and without phase change affecting temperature distribution, heat transfer, the measurement of the flow of heat, and the study of means of controlling or minimizing the flow of heat or dissipating/absorbing heat through techniques such as radiation, transpiration cooling, mass transfer, chemical reactions, heat sinks, selective surfaces/finishes/coatings, and regenerative cooling. The work also includes the study of heat transfer in tubing/ducts, high-speed flow, heat exchangers, mechanical components, propulsion systems, ground test articles (wind tunnel and environmental), calibration rakes and tubes, cryogenic fluids, launch vehicles, space structures, spacecraft and spacecraft components, optical systems, ground systems including ground support equipment and test facilities, etc. Included in this work are studies of the effects of solar and planet-emitted/reflected radiation on spacecraft and the thermal control of spacecraft, including spacecraft components.

The work involves basic or applied theoretical, computational, or experimental studies utilizing various techniques and equipment, such as shock tubes, arc jets, wind tunnels, experimental launch vehicles/spacecraft/aircraft, thermal-vacuum/thermal-humidity chambers, altitude chambers, cryogenic test equipment, infrared imaging, etc. Test support associated with verification of studies and design activities associated with this specialty include test planning, analysis (pre/post-test) and real-time monitoring with the responsibility of assuring appropriate environmental test conditions have been attained. To achieve technical objectives, positions may also be engaged in the planning, coordination, and evaluation of contracted efforts.

### *Specialty Knowledge*

Work in this specialty requires a range of knowledge in such disciplines as heat/mass transfer, thermodynamics, gas dynamics, physics, chemistry, mathematics, numerical analysis, computer simulation, and experimental techniques. Knowledge of applied active and passive thermal control techniques is also essential.

### *710-60 Classification*

NASA Title: AST-Stability, Control, and Performance

Class Code: 710-60

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This includes positions that involve research and analysis of the stability, control, and/or aerodynamic performance characteristics of flight vehicles. This work includes:

- A. The study and analysis of linear and nonlinear aerodynamic lift, drag, and associated forces and moments derived from analytical models, ground and/or flight tests; the study and analysis of aerodynamically induced oscillatory motions in flight vehicles and investigation prediction of stability and controllability including analytical or experimental selection of stability and control devices and determination of their contour, size, and placement; the study, testing, and analysis of the structural elasticity effects upon aerospace vehicle stability, control, and aerodynamic performance. Aerodynamic models are developed that accurately reflect flight vehicle characteristics. Evaluates and models such phenomena as fuel sloshing, on-board motions, torques, cross-coupling effects, center-of-gravity location and similar phenomena on the stability, control, and aerodynamic performance characteristics of aerospace vehicles.
- B. Evaluating the flying qualities of aerospace vehicles considering pilot and vehicle mission. The effects of the vehicle guidance control system are also to be-considered in the flying qualities evaluation as required. Flying qualities criteria are improved for traditional aerospace vehicles and new criteria are developed for new or unconventional designs and/or new regimes of flight.

These positions frequently involve the development and use of experimental techniques, equipment and instrumentation such as wind tunnel models and flight test hardware and software, and the development of math and simulation models for validation in flight. In achieve technical objectives, positions may also be engaged in the planning, direction, coordination, and evaluation of contracted efforts in performing these functions.

### *Specialty Knowledge*

The work requires a range of knowledge in such disciplines as flight mechanics, aerodynamics, fluid mechanics, control system theory, numerical analysis, computer simulation, and flight test techniques.

### **710-65 Classification**

NASA Title: AST, Flight Vehicle Atmospheric Environments

Class Code: 710-65

OPM Title: Aerospace Engineer

Series Code: GS-861

#### *Definition of Work*

This specialty includes positions that involve engineering, analysis, and understanding of the natural environment effects on the selection, design, construction and operation of aircraft, missiles, and space vehicles. The work is directed toward the problems of defining basic terrestrial and planetary atmospheric environment input data needed in response calculations of various vehicle systems. The terrestrial atmospheric definitions covers two altitude strata; first, altitudes up to 100,000 feet wherein atmospheric disturbances occur such as gusts, turbulence, and wind shear (due to both natural and artificially produced causes) which produce critical dynamic loading conditions and are important to the stability and control behavior of flight vehicles; and second, the higher altitudes wherein temperatures, pressures, densities, and winds enter into the development of guidance equipment, in reentry studies, and in estimating the drag and other trajectory parameters of flight vehicle systems. The overall effort involves measurements of the turbulence in a variety of weather conditions from altitudes of 0 to 1000 or 2000 feet to upwards of 55,000 feet, wind-tower measurements of the wind and wind shear characteristics and other atmospheric properties within the sensible atmosphere.

In addition to specifying the environmental characteristics, the work also involves their correlation with other meteorological measurements for prediction purposes and for defining diurnal, seasonal, and geographical variations. The planetary work is directed toward defining the atmospheric environment of Mars. Positions in this specialty may also engage in planning, direction, coordination, and evaluation of contracted efforts identified herein.

#### *Specialty Knowledge*

The work requires the pertinent knowledge of fluid dynamics and atmospheric systems plus the application of mathematical modeling to data collection, measurement, and analysis techniques.

### **710-68 Classification**

NASA Title: AST-Basic Properties of Gases

Class Code: 710-68

OPM Title: Physicist

Series Code: GS-1310

#### *Definition of Work*

This specialty includes positions that involve aerospace research and study of the physical and chemical properties of gases in their molecular, atomic, and ionized states. These positions involve studies and calculations of the thermodynamic and transport properties of fluids, particularly gases at high temperatures, including the equilibrium composition of combustion products; rates of dissociation, recombination and ionization; chemical reaction rates of various gases at different energy levels; studies of the interactions of electrons and ions; and study and calculation of radiation from high temperature gases.

Also, this specialty involves the conduct of basic aerospace theoretical, computational, and experimental studies of high temperature chemical kinetics; gas cross sections for high energy particle interactions; erosion or sputtering effects; and surface material accommodation coefficients. Work in this specialty frequently involves the development and use of experimental techniques and equipment such as shock tubes, flow reactors, high energy beams, or accelerators and specialized diagnostic instruments such as laser probes and spectrometers. Also covered by this specialty are those positions engaged in the planning, direction, coordination, and evaluation of contracted efforts in performing this work.

#### *Specialty Knowledge*

Work in this specialty requires a range of knowledge such as the thermodynamics, classical mechanics, kinetic theory of gases, quantum mechanics, statistical mechanics and numerical analysis, computer simulation, and experimental techniques.

### ***710-70 Classification***

NASA Title: AST-Flight Vehicle Space Environments

Class Code: 710-70

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes positions that involve engineering, analysis, and understanding of the space environment effects on the selection, design, construction, and operation of missiles and space vehicles. The work is directed toward the problems of defining near planetary space and interplanetary space environment input data needed in response calculations of various vehicle systems. The space environment work includes the definition of the neutral thermosphere, ionizing radiation, plasma, meteoroid and orbital debris, and solar and thermal environments and determination of the effects of these environments on spacecraft design and operations. It requires definition and analysis of environments for radiation belts, cosmic rays, solar activity, meteoroid streams, orbital debris, magnetic and gravitational fields, and plasma as they effect vehicles and hardware components in orbit around the earth, in interplanetary space, in orbit around other planets, and in transit out of the solar system. Positions in this specialty may also engage in planning, direction, coordination, and evaluation of contracted efforts identified herein.

### ***Specialty Knowledge***

The work requires pertinent knowledge of space physics, basic spacecraft engineering, and the application of mathematical modeling and data collection, measurement, and analysis techniques.

## 715 MATERIALS AND STRUCTURES

**DEFINITION:**

Includes positions engaged in research, developing, designing, manufacturing, fabricating, processing, testing and/or evaluating work on various kinds of metallic and non-metallic materials for use in aerospace and aeronautical vehicles; into the effects of space environments, loads, and stresses on the structures and materials of aerospace and aeronautical vehicles and support systems; and on the problems of tribology (lubrication, friction, and wear) in relation to these systems.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
715-02	Structural Dynamics	Aerospace Engineer	GS-861
715-03	Mechanics of Materials and Structures	Materials Engineer	GS-806
715-09	Materials and Structures (Entry-level positions at GS-7 and GS-9 Only.)	Aerospace Engineer	GS-861
715-15	Structural Materials	Materials Engineer	GS-806
715-17	Aerospace Metallic Materials	Materials Engineer	GS-806
715-20	Basic Properties of Materials	Physicist	GS-1310
715-25	Aerospace Polymeric Materials	Chemical Engineer	GS-893
715-35	Aerospace Ceramic Materials	Materials Engineer	GS-806
715-40	Tribology Materials	Engineer	GS-806
715-50	Structural Mechanics	Aerospace Engineer	GS-861
715-55	Flight Structures	Aerospace Engineer	GS-861
715-60	Aerospace Materials	Materials Engineer	GS-806
715-65	Aeroelasticity	Aerospace Engineer	GS-861
715-90 thru 715-99	*	*	*

\*At the Center's discretion

## ***715-02 Classification***

NASA Title: AST-Structural Dynamics

Class Code: 715-02

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty involves investigation of problems of free, forced, or self-induced vibration of structures of aeronautical and space flight vehicles, both in and out of the atmosphere. Included are studies of time-dependent and frequency-dependent input forces, whether of a transient, steady oscillatory, or random nature, concentrated or distributed, and the resulting structural response. In addition, the means for alleviating or controlling this response considering the limitations imposed by vehicle mission are included. Problems studied are characterized by many specialties such as flutter, divergence, and structure control interaction. Proceed response problems include the study of natural environments such as atmospheric turbulence and induced environments such as vibrations and acoustic fields. Structural response due to imposed on-pad forces, lift-off transients, impulsive control inputs, and other vehicle loads such as those created by on-board equipment, combustion dynamics, fuel dynamics, stage separation, on-orbit excitations, landing impact, reentry, chute deployment, water impact, and transportation are included.

The study of structural vibratory and damping characteristics and unsteady aerodynamics as related to these problems is also included. Such problems may occur on a large variety of configurations over an extreme range of flight parameters. Investigations may overlap related structural fields as in the study of --the fatigue life of structures subject to acoustic loadings, or the consideration of the behavior of mechanical systems, structural components, or payloads under combined natural and induced environments. This specialty also includes positions monitoring and evaluating contractors' work in the area of structural dynamics.

### ***Specialty Knowledge***

Performance of this work requires knowledge of structural modeling, modal analysis, acoustics, vibration, flutter, aeroelasticity, computer methods, and experimental techniques, involving both flight research and dynamic models using vibration equipment, impact machines, environmental facilities, and wind tunnels.

### *715-03 Classification*

NASA Title: AST-Mechanics of Materials and Structures

Class Code: 715-03

OPM Title: Materials Engineer

Series Code: GS-806

### *Definition of Work*

This specialty includes positions that emphasize research in the mechanical behavior and life prediction methodology of high temperature materials and structures for aerospace propulsion and power applications. Research includes theoretical, computational, and experimental investigations into the behavior of materials and structures subjected to static, cyclic, and impact loads under extreme environments. The research is directed toward evolving a methodology for predicting material and structural life when subjected to extreme loads. This specialty encompasses wide range of engineering materials (metals, intermetallics, ceramics, polymers, and composites) and the application of engineering mechanics principles to define material and structural behavior. The research is broad in scope, involving advanced analysis techniques and detailed experimental evaluation of predictive models.

Research in this specialty emphasizes the following technology areas for aerospace propulsion and power applications:

- A. Deformation behavior,
- B. Fracture behavior,
- C. Fatigue behavior,
- D. Impact behavior,
- E. Creep behavior
- F. Test standards for establishing material properties and structural characteristics,
- G. Life prediction methodology,
- H. Damage tolerance concepts,
- I. Failure analysis, and/or
- J. Probabilistic analysis methods.

The development of new analyses, experimental techniques, special test equipment, and engineering analysis of test data are required to verify predictive models.

Positions included in this specialty may also monitor and evaluate university grants and/or industrial contracts that emphasize research in deformation and life prediction methodology.

### *Specialty Knowledge*

Performance of the work in this specialty requires an extensive knowledge of engineering science and mechanics, as well as, in depth understanding of structural materials (metals, intermetallics, ceramics, polymers, and composites).

## *715-15 Classification*

NASA Title: AST-Structural Materials

Class Code: 715-15

OPM Title: Materials Engineer

Series Code: GS-806

### *Definition of Work*

This specialty includes positions that emphasize the engineering development, evaluation, selection, and application of advanced structural materials to aerospace systems such as aircraft and spacecraft structures and their power and propulsion systems. Materials research and development in specialty encompasses the basic engineering materials that include metals, intermetallics, ceramics, polymers, and composites. Positions in this specialty may focus on one of the basic materials or they may be broad in scope covering several of the basic engineering materials. The research and development objectives are directed toward the application of advanced materials to meet either specified or anticipated requirements of aerospace systems. Usually the research and development activities are broad in scope; and they encompass all phases of material development and evaluation.

Typical positions in this specialty emphasize one, or more, of the following:

- A. Materials processing,
- B. Materials joining,
- C. Materials fabrication,
- D. Manufacturing technology,
- E. Environmental behavior of materials,
- F. Evaluation of material performance,
- G. Engineering analysis of materials failures,
- H. Recommendation or selection of materials,
- I. Non-destructive evaluation of material performance,
- J. Materials replacement technology,
- K. Materials compatibility,
- L. Chemical and environmental analysis of materials, and/or
- M. Materials tribology.

Often the development of new experimental techniques, engineering and design of special test equipment, and engineering analysis of test data are required to verify the performance of advanced materials for aerospace applications.

Positions included in this specialty may also direct and evaluate university and/or industrial contractor programs that emphasize the engineering application of advanced materials.

### *Specialty Knowledge*

Performance of the work in this specialty requires an in-depth knowledge of one or more of the basic materials (metals, intermetallics, ceramics, polymers, and composites) as well as a basic understanding of engineering principles.

### *715-17 Classification*

NASA Title: AST-Aerospace Metallic Materials

Class Code: 715-17

OPM Title: Materials Engineer

Series Code: GS-806

### *Definition of Work*

This specialty includes positions that emphasize:

- A. Fundamental or applied research into the structure/property relationship of aerospace metals, and/or
- B. Research and testing directed toward the engineering application of metallic materials to aerospace applications.

Research includes experimental and theoretical investigations of the microstructure of metals as related to their mechanical and physical behavior and synthesis of advanced metallic alloys with tailored microstructures to meet specific material property requirements for specific applications. The research purposes include the advancement of the scientific knowledge of metals and the modification or establishment of new principles and theories of the behavior of metallic materials. Research in the engineering application of metallic materials includes materials processing, fabrication technology, performance evaluation, and material selection.

Typical positions in this specialty may emphasize one or more of the following research objectives:

- A. Fundamental understanding of metals,
- B. Evolution of concepts for synthesis of new or improved metallic alloys having potential for use in high performance aerospace applications, including extreme environments,
- C. Theoretical model developments to explain or characterize unique features of metal behavior,
- D. Research and technology development in the engineering application of metals to advanced aerospace systems, and/or
- E. Materials and processes evaluation for aerospace applications.

Often the development of new experimental techniques, special diagnostic equipment, and novel analytical procedures is required.

Positions included in this specialty may also monitor and evaluate university grant programs and/or industrial contractor programs that emphasize fundamental or applied research in metals.

### *Specialty Knowledge*

Performance of this work requires an in-depth, fundamental knowledge of metals encompassing metallurgy, metallurgical engineering or materials science, as well as a basic understanding of engineering principles.

### ***715-20 Classification***

NASA Title: AST - Basic Properties of Materials

Class Code: 715-20

OPM Title: Physicist

Series Code: GS-1310

### ***Definition of Work***

This specialty includes positions which involve theoretical and experimental research into the basic properties, behavior, and mechanisms by which various types of materials react. The primary purpose of this research is to advance scientific knowledge in the materials area by modifying or establishing new principles and theories. Studies may include investigation of the molecular, atomic, and subatomic structures of materials and reaction of these structures to various stresses, processes, and environments; e.g., oxidation, temperature and pressure, heating, and cooling. Also included is the study of the optical properties of materials.

Experimental techniques and equipment used include electron microscope, field emission microscope, various radiation-generating devices, ultra-high vacuum techniques, mass spectroscopy, and microwave techniques. Often development of new experimental techniques and equipment is required.

### ***Specialty Knowledge***

Performance of this work requires knowledge of solid state physics and/or materials science, and the pertinent aspects of metallurgy and mathematical physics.

### *715-25 Classification*

NASA Title: AST-Aerospace Polymeric Materials

Class Code: 715-25

OPM Title: Chemical Engineer

Series Code: GS-893

### *Definition of Work*

This specialty includes positions that emphasize fundamental or applied research into the structure/property relationship of aerospace polymers, and research and testing directed toward the engineering application of polymeric materials to aerospace applications. Fundamental and applied research encompasses experimental and theoretical investigation of the molecular structure of polymeric materials as related to their mechanical and physical behavior, and the synthesis of advanced polymeric materials with tailored molecular structures to meet specific material property requirements. The research purposes include the advancement of scientific knowledge of polymeric materials and modification or establishment of new principles and theories governing the behavior of polymeric materials. Research in the engineering application of polymeric materials may include processing science, fabrication technology, performance evaluation, and material selection.

Typical positions in this specialty may emphasize one or more of the following research objectives:

- A. Fundamental understanding of polymeric materials,
- B. Evolution of concepts for synthesis of new or improved polymers having potential use in high performance aerospace application, including extreme environments,
- C. Theoretical model developments to explain or characterize unique features of advanced polymers,
- D. Research and technology development in the engineering application of polymeric materials to advanced aerospace systems, and/or
- E. Evaluation of materials and processes for aerospace applications.

Often the development of new experimental techniques, special diagnostic equipment, and novel analytical procedures is required.

Positions included in this specialty may also monitor and evaluate university grant programs and/or industrial contractor programs that emphasize fundamental or applied research in polymer materials.

### *Specialty Knowledge*

Performance of this work requires an in-depth, fundamental knowledge of polymer science that typically encompasses chemical engineering, organic chemistry, polymer chemistry and/or polymer physics.

### *715-35 Classification*

NASA Title: AST-Aerospace Ceramic Materials

Class Code: 715-35

OPM Title: Materials Engineer

Series Code: GS-806

### *Definition of Work*

This specialty includes positions that emphasize fundamental or applied research into the structure/property relationship of aerospace ceramics, and research directed toward the engineering application of ceramic materials to aerospace requirements. Fundamental research includes the advancement of scientific knowledge of ceramics as well as the establishment or modification of the principles and theories of ceramic materials behavior. Research includes experimental and theoretical investigations of the microstructure and chemical composition of ceramic materials as related to their mechanical and physical behavior as well as the synthesis of advanced ceramic materials with tailored properties to meet specific material application requirements. Research in the engineering application of ceramic materials may include material selection, processing science, fabrication technology, material characterization, performance evaluation, and specification development. Positions in this specialty may emphasize one or more of the following research objectives:

- A. Fundamental understanding of ceramic material behavior;
- B. Evolution of concepts for the synthesis of new or improved ceramics having potential for uses in high performance aerospace applications;
- C. Theoretical model development to explain or characterize unique features of ceramics materials behavior;
- D. Research and technology development in the engineering application of ceramic materials to advanced aerospace systems, and/or
- E. Development of new experimental techniques, special diagnostic equipment, and novel analytical procedures.

### *Specialty Knowledge*

Performance of this work requires an in-depth, fundamental knowledge of ceramic materials including ceramics, ceramic engineering, materials science, or materials engineering.

## **715-40 Classification**

NASA Title: AST-Tribology

Class Code: 715-40

OPM Title: Materials Engineer

Series Code: GS-806

### *Definition of Work*

This specialty includes positions that involve research and development on tribological problems (friction, lubrication and wear) relevant to aerospace vehicle and propulsion system applications such as:

- A. The properties and function of various liquid, solid and gaseous lubricants under extreme operating conditions of sliding or rolling velocity, loads, temperatures, pressures and aggressive or hostile environments (e.g. vacuum, radiation, hydrogen),
- B. The mechanisms of friction and wear of materials and components, devices and mechanisms under extreme conditions encountered in aerospace systems,
- C. The development of research tools and techniques to understand and elucidate tribological phenomena occurring at surfaces and interfaces between surfaces (i.e. surface science and analysis),
- D. The development of research techniques, models and engineering solutions related to the operation, systems integration and lubrication of Oil-Free Turbomachinery technology (e.g., foil air/gas bearings, fluid film lubrication modeling, high speed rotating systems, hybrid bearing integration),
- E. The computational modeling of systems and materials including finite element based representations of tribological elements and materials down to atomistic materials representations including computational quantum chemistry of lubricants and surfaces,
- F. The development of surface and near surface modifications to improve the tribological properties of materials and systems including coatings, thin films and composites, and/or
- G. The study of the effects of the space environment on the performance and properties of materials, lubricants and mechanisms (e.g. radiation damage, out-gassing of lubricants).

### *Specialty Knowledge*

Performance of this work requires working knowledge and understanding of the operating principles and parameters associated with aerospace systems, particularly pertaining to lubrication and tribology phenomena. These systems can include propulsion engines, air and space hardware (airframe vehicles, satellites), and various mechanisms and instruments. Extensive knowledge of tribology and tribological systems is required especially for those activities pertaining to the research and development of tribological materials and systems (e.g. lubricants, coatings, mechanisms and materials). In addition, knowledge of surface analysis instrumentation and associated data reduction techniques (e.g. SEM/EDS, XPS, Auger, FTIR, AFM, Raman, SFM, SPM etc.) is required. To support research activities in computational modeling knowledge of computer science and engineering is required. A working knowledge of complex test equipment such as vacuum, thermal and stress instrumentation where both mechanical components and instrumentation may be subject to extreme operating conditions such as

high pressure oxygen and hydrogen, cryogenic fluids, high speed turbo-machinery and high radiation flux or high temperatures is required.

### *715-50 Classification*

NASA Title: AST-Structural Mechanics

Class Code: 715-50

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty involves experimental and theoretical analysis of spacecraft, launch vehicle, and aircraft structures to determine their behavior in atmospheric and space environments and their interaction with the environment. This includes the structural response to loads and temperatures, vibrational and damping properties, fatigue, fracture toughness, crack growth, creep, and static and dynamic stability characteristics of structures and their components. Environmental factors include extreme temperatures associated with advanced flight regimes and atmospheric reentry, and other environmental factors on static and dynamic loads during flight, landing, and reentry.

The work requires consideration of structural and material characteristics: elasticity, fracture mechanics, mechanical impedance, thermal expansion, strain rate, vibrational response, reinforcements, discontinuities, and such functional characteristics as dynamic balance, weight, and geometry. The specialty also encompasses research on advanced structural concepts such as filamentary composite structures and deployable and erectable concepts. Composite structures work includes damage tolerance, post-buckling, failure analysis, and efficient structural configurations. Also included are concepts for economical emplacement in orbit of large space structures such as platforms, reflectors, and space station. This specialty also includes positions monitoring and evaluating contractors' work in the area of structural mechanics.

### *Specialty Knowledge*

Performance of this work requires knowledge of plasticity, viscoelasticity, materials behavior and properties under loads or extreme temperatures, thermal stress, computer methods, and wind tunnel test techniques.

### *715-55 Classification*

NASA Title: AST-Flight Structures

Class Code: 715-55

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty involves development, fabrication, and test of flight vehicle structures, spacecraft, flight instrumentation and/or components including the application of new and improved ideas, methods, and techniques for their structural analysis, design, fabrication, assembly, and test. Such work involves consideration of the structural requirements, size and weight, power requirements, specialized vehicle, spacecraft, flight instrumentation requirements, and other factors to select or specify optimum configurations, structural design, materials, processes, and techniques. Typical structures include low mass shell structures, membrane structures, inflatable structures, truss structures, stiff or thermally stable composite decks, and structures which involve unique assembly and environment problems such as elevated or cryogenic temperatures and/or low or zero atmospheric pressure conditions (including vacuum). Research includes thermal protection systems and the problems of integrating insulation, ablation, heat sink, and active cooling systems with structural design.

Also, included are stability and strength of stiffened shell, and other types of structures and other structural components; evaluation of potentialities, including unique applications, and limitations of new materials; fabrication techniques for structures and vehicles of advanced design; and formulation of general criteria for selection of minimum mass structures. The specialty also encompasses development of composite structures, i.e.: filamentary and honeycomb, and deployable and erectable concepts. The specialty also includes positions that monitor and evaluate contractors' work in the area of flight structures.

### *Specialty Knowledge*

Performance of this work requires a knowledge of structural design and analysis methods, vibration, structural dynamics, aerothermodynamics, heat transfer, materials behavior and properties, computer-aided design, and analysis techniques, and test methods (e.g.: wind tunnels, static load facilities, vibration tables, acoustic facilities, thermal vacuum chambers, etc).

### *715-60 Classification*

NASA Title: AST–Aerospace Materials

Class Code: 715-60

OPM Title: Materials Engineer

Series Code: GS-806

### *Definition of Work*

This specialty includes positions that emphasize: (1) fundamental or applied research into the structure/property/durability relationships of such aerospace materials as metals, intermetallics, ceramics, polymers, nano-structural materials, bio-materials, composites and coatings, and (2) research and testing directed toward the scientific understanding of, and the engineering application of such materials to aerospace applications. Research includes experimental and theoretical investigations of the structures of such materials as related to their mechanical and physical behavior, and synthesis of advanced materials with tailored structures/microstructures and nanostructures to meet specific material property requirements for specific applications. The research purposes include the advancement of the scientific knowledge of all classes of materials and composites and the establishment or modification of new principles and theories of the behavior of materials as mentioned above. Research includes the engineering application of materials processing, fabrication technology, performance evaluation, and material selection. Typical positions in this specialty may emphasize one or more of the following research objectives:

1. Fundamental understanding of metals, intermetallics, ceramics, polymers, nanostructured materials, bio-materials, composites and coatings.
2. Evolution of concepts for synthesis of new or improved materials and composites having potential for use in high performance aerospace applications.
3. Computational and theoretical materials modeling to develop advanced materials, explain or characterize unique features of behavior of materials, and/or to predict performance, as well as time and temperature trade-offs.
4. Research and technology development in the engineering applications of such materials to advanced aerospace systems.
5. Materials, properties, and processes evaluation for aerospace applications.

Often, the development of new experimental techniques, special diagnostic equipment, and novel analytical procedures are required.

Positions included in the specialty may also monitor and evaluate university grant programs and/or industrial contractor programs that emphasize fundamental or applied research in the above-mentioned materials.

### *Specialty Knowledge*

These positions utilize professional scientific and engineering knowledge, with emphasis in aeronautical and astronautical engineering, chemistry, chemical engineering, mathematics, material's science and engineering, physics, mechanical engineering, ceramics, metallurgy, and other appropriate fields such as numerical methods, statistics, and computer science.

## *715-65 Classification*

NASA Title: AST-Aeroelasticity

Class Code: 715-65

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

The aeroelasticity specialty addresses technical issues, investigates technical problems, and proposes solutions associated with the stability and performance of flexible aerospace vehicles. These vehicles experience aerodynamic forces, elastic forces, and inertial forces that are functions of the vehicle structural characteristics, vehicle shape and motion, onboard control systems, and external disturbances. Research in aeroelasticity typically requires the conduct of theoretical, computational, and experimental (laboratory and wind tunnel) studies. The effects of aeroelasticity are present within all speed regimes, subsonic through hypersonic. However, aeroelastic effects are particularly relevant at transonic flight conditions. Aeroelastic phenomena such as flutter, some forms of buffet, limit cycle oscillations and others are more serious concerns in the transonic flight regime. These transonic effects have profound influences on fixed-wing vehicles (flying in Earth's atmosphere and in other planetary atmospheres), rotary-wing vehicles, missiles, launch vehicles (single-use and reusable, on the launch pad and transiting the atmosphere), and aerodynamic decelerators. Therefore, a major research objective of the aeroelasticity specialist is to better understand and predict aeroelastic effects in the transonic regime. This understanding requires both theoretical development and experimentation.

Furthermore, the research objectives of the aeroelasticity specialist must involve both static and dynamic aeroelastic phenomena. Static aeroelastic phenomena involve the mutual interactions between steady aerodynamic forces and elastic forces and include divergence, control system reversal, control effectiveness, load distribution, aeroelastic tailoring, trimmed flight performance, and aeroelastic effects on static stability. Dynamic aeroelastic phenomena involve the mutual interactions between unsteady aerodynamic forces, elastic forces, and inertial forces and include flutter, buffeting, gust or turbulence responses, limit cycle oscillations, and aeroelastic effects on dynamic stability. For both of these basic research areas, the aeroelasticity specialist must potentially develop finite-element modeling to represent the structure and to provide structural dynamic predictions for the configuration. The specialist will also potentially be involved in developing aerodynamic models of the configuration for conducting basic linear unsteady aerodynamic calculations to be used in performing aeroelastic stability analyses. It is also possible that the specialist will use advanced nonlinear computational fluid dynamics methods. Some specialists in this discipline will also develop and demonstrate new methodologies for calculating both static and dynamic aeroelastic phenomena. This work supports programs such as the flutter clearance of the F/A-18 E/F military fighter jet, dynamic response measurements for the Delta-series of launch vehicles, the beneficial application of smart materials to control flexible aircraft, and the aeroelastic behavior of morphing aircraft.

Control system interactions are an important component of the aeroelasticity discipline and when improperly treated or neglected can have a detrimental effect on aeroelastic stability and vehicle performance. Conversely, through proper tailoring and inclusion of the control systems in the problem, the aeroelastic stability and/or vehicle performance can be significantly enhanced. Concepts that involve

the implementation of controls include flutter suppression, gust load alleviation, maneuver load alleviation, buffet load alleviation, aeroelastic shape control, and dynamic stability augmentation. Research objectives for this area of the aeroelasticity specialty include the development of flight vehicle plant models and modeling methodologies, control law development, implementation, and experimental demonstration, and analytical simulations.

### *Specialty Knowledge*

Performance of this work requires knowledge of steady and unsteady aerodynamics, including experimental, theoretical, and computational aerodynamics and their respective modeling techniques. Knowledge of structural finite-element modeling and modal analysis is also a requirement for this type of research. Knowledge of classical and modern control theories, linear-system and random-process theories, optimization, reduced-order modeling, smart materials, computer methods, experimental techniques, similitude relationships and scaling theory, and wind-tunnel testing complement the basic required skills.

## 720 PROPULSION AND POWER

**DEFINITION:**

Includes positions engaged in research, development, design, test, and evaluation of aircraft and aerospace propulsion systems (such as liquid, solid, electrical, chemical, beamed energy, solar sails, antimatter and nuclear, etc., separately or in combination) and aerospace power generation systems and their component parts and subsystems, including processes and systems for the direct and indirect conversion of energy into power for aerospace and aeronautical applications.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
720-02	Electric Propulsion Systems	Electrical Engineer	GS-850
720-03	Electrical Power Systems	Electrical Engineer	GS-850
720-04	Airbreathing Propulsion Systems	Aerospace Engineer	GS-861
720-05	Liquid Propulsion Systems	Aerospace Engineer	GS-861
720-06	Mechanical Components	Mechanical Engineer	GS-830
720-09	Propulsion and Power (Entry-level positions at GS-7 and GS-9 Only.)	Aerospace Engineer	GS-861
720-10	Solid Propulsion Systems	Aerospace Engineer	GS-861
720-19	Aerospace Propulsion Systems	Aerospace Engineer	GS-861
720-25	Direct Energy Conversion	Electrical Engineer	GS-850
720-50	Fuels and Combustion Processes	Chemical Engineer	GS-893
720-60	Propulsion Flow Dynamics	Aerospace Engineer	GS-861
720-70	Pyrotechnic Systems	Aerospace Engineer	GS-861
720-80	Propulsion Systems and Technologies	Aerospace Engineer	GS-861
720-90 thru 720-99	*	*	*

\*At the Center's discretion

## **720-02 Classification**

NASA Title: AST-Electric Propulsion Systems

Class Code: 720-02

OPM Title: Electrical Engineer

Series Code: GS-850

### *Definition of Work*

This specialty includes positions that involve research, development, design, test, and evaluation of electric propulsion systems. Positions in this specialty typically perform fundamental experiments, design, develop, and test prototype components of systems; conduct studies, analyses, and simulations to develop mission and performance requirements or design criteria; evaluate systems and components as they affect the total propulsion system; develop flight hardware for electric propulsion subsystems; manage contractual programs for the performance of the above functions; or perform other experimental and theoretical work pertaining to electric propulsion systems.

Electric propulsion systems combine power generation and conversion system with various kinds of accelerators, e.g., electrostatic (ion or Hall-effect engines), electro-thermal (resistojets or arc jets), electromagnetic (magneto-plasma dynamic engines or pulsed-plasma thrusters), to produce thrust. Associated with electric propulsion systems are power management systems that consist of a variety of power processing, storage, distribution, and control components. Propellant management components/systems and thrust-vector control systems for electric thrusters are also a vital part of the propulsion system.

### *Specialty Knowledge*

Work characteristic of this specialty requires a range of knowledge cutting across several disciplines as they apply to electric propulsion systems. Knowledge required include fluid, plasma, and atomic physics; ion optics and particle acceleration methods; thermodynamics and heat transfer; materials properties, power conversion and control techniques; control systems, mechanical/electrical design methods, plasma diagnostics methods, and data acquisition methods.

### *720-03 Classification*

NASA Title: AST-Electrical Power Systems

Class Code: 720-03

OPM Title: Electrical Engineer

Series Code: GS-850

### *Definition of Work*

This specialty includes positions that perform research, design, development, test and evaluation of electric systems and components for use in space, aeronautical, and terrestrial utility applications. Positions in this specialty will oversee and/or perform the design, development, test and integration of the electric power system or its various components; oversee and/or perform studies, analyses, and simulations to develop system and component design and system stability criteria to meet mission and performance requirements; or manage contractual programs for the performance of the stated functions. Space electric systems include the generation, storage, distribution and protection, management, conversion, integration and thermal management as required for satellites, launch vehicles, interplanetary missions and manned lunar or planetary bases. Aeronautical electric systems include generation, distribution and protection, management, conversion and integration as required for next generation aircraft. Electric utility systems include generation, storage, conversion and integration. Space power generation systems include solar voltaic, fuel cells, solar dynamic, or nuclear energy sources; storage systems include batteries, flywheels or super capacitors. Distribution voltage can be direct current or alternating current or a combination of both at low, medium or high voltage levels. Frequency levels for AC systems can be low, medium or high. Components selected for the management, protection and conversion are compatible with the selected system characteristics and user requirements. Thermal management systems to acquire, transport, or reject heat include radiators, heat pipes and regenerators. Aeronautical electric systems include engine driven generators and auxiliary power units (APU's) for generation at high voltage direct current or medium three-phase AC distribution. Electric utility systems' generation includes solar, wind, fuel cells and microwave energy from space. Conversion and integration will be required to supply existing utility grids.

This specialty is distinguished by its concern with developing an end to end electrical power system including the interfaces from source, all required system components, other related systems and the user. Positions concerned with the development of subsystems and components are also included if knowledge of and interface with other subsystems and components of the power system is a requirement.

### *Specialty Knowledge*

The work requires a range of knowledge cutting across several disciplines as they apply to electrical power systems. Knowledge includes the pertinent aspects of systems engineering and design, electrical and electronics engineering, rotating machinery, solid-state devices, static and/or dynamic generation and/or conversion, analog and/or digital control, fiber optics, electrical system modeling to determine system stability under normal and abnormal operating conditions, heat transfer and thermodynamics and structures.

### **720-04 Classification**

NASA Title: AST-Airbreathing Propulsion Systems

Class Code: 720-04

OPM Title: Aerospace Engineer

Series Code: GS-861

#### *Definition of Work*

This specialty includes positions that involve analysis, research, design, test, and evaluation of a breathing propulsion system for aerospace vehicles, including the integration of the propulsion system with the airframe. This would involve flight regimes from subsonic to hypersonic. The work involves design, development, and integration of the various subsystems and components and the evaluation of these systems and parts as they affect the engine or propulsion system or are affected by environmental or other external constraints. Covered positions typically:

- A. Develop the analytical methods for and/or conduct studies, analyses, and simulations,
- B. Conduct experimental programs/projects, and/or
- C. Manage programs/projects.

Air breathing propulsion systems obtain oxygen either internally or externally from the atmosphere for the combustion of their fuel. Typical systems include the turbofan, turbojet, pulsejet, ramjet, turboprop, and combined cycle engines.

#### *Specialty Knowledge*

The work requires pertinent knowledge of aerodynamics, thermodynamics, fluid mechanics, combustion chemistry and/or rotating machinery as they apply to air breathing engine systems.

### ***720-05 Classification***

NASA Title: AST-Liquid Propulsion Systems

Class Code: 720-05

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes positions that involve research, development, design, test, and evaluation of liquid propulsion systems for aerospace vehicles. The work involves design and development of the various subsystems, components or research simulations, and the evaluation of these systems and parts as they affect the total engine or propulsion system.

Covered positions may also:

- A. Conduct studies, analyses, and simulations to develop performance requirements or design criteria,
- B. Conduct experimental programs to evaluate liquid propulsion systems and their capabilities, and/or
- C. Manage contractual programs for the performance of functions.

### ***Specialty Knowledge***

The work requires knowledge of fluid mechanics, thermodynamics, materials, and structures as they apply to chemical propulsion systems.

### **720-06 Classification**

NASA Title: AST-Mechanical Components

Class Code: 720-06

OPM Title: Mechanical Engineer

Series Code: GS-830

### *Definition of Work*

This specialty includes positions that involve research, analysis, development, and evaluation of mechanical components and power transfer systems such as dampers and shafts, bearings, gears, and seals. The work extends to rotorcraft, V/STOL, and fixed wing aircraft, rocket vehicles, and space systems. Positions covered by this specialty typically:

- A. Conduct research into basic mechanisms such as balancing theory or seal dynamics;
- B. Develop the technical for engine and mechanical power transfer systems;
- C. Evaluate such systems and their components for interface or performance problems;
- D. Manage contractual programs for the performance of this or similar work; and/or
- E. Provide consultation to other agencies and organizations on problems and solutions pertaining to mechanical component systems.

Areas of investigation include research into sealing mechanisms in the molecular, viscous, or inviscid flow regimes utilizing contact and non-contact devices; development of methods to predict and control shaft and bearing response and stability; study of the dynamics of multi-rotor turbine engines or rocket vehicle turbo-pumps for more efficient control of rotor motions and gas path sealing; analysis of the geometry, stress, efficiency and life equations of gear, traction, and hybrid power transmissions; and study of the kinematics and dynamics of advanced bearings, gears, and transmission systems.

### *Specialty Knowledge*

The work requires a range of knowledge including the pertinent aspects of strength of materials and material properties, elastohydrodynamics, engineering mechanics, fluid mechanics, heat transfer, and thermodynamics.

### ***720-10 Classification***

NASA Title: AST-Solid Propulsion Systems

Class Code: 720-10

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes positions that involve the study and development of solid propellant rocket systems to meet various flight performance requirements. This work includes evaluation of existing solid propellant rockets and their performance characteristics; test and modification of existing systems to meet special experimental requirements; and initiation and monitoring of research and development programs on solid propulsion systems. This specialty also includes positions that perform investigation of solid propulsion systems to develop stage separation devices, igniters, and other components used for altitude and velocity control, gas generation, auxiliary power, and other special purposes. This specialty also includes managing contractual programs for performance of these functions.

### ***Specialty Knowledge***

The work requires the pertinent knowledge of strength of materials and materials properties, fluid mechanics, heat transfer, and thermodynamics.

### ***720-19 Classification***

NASA Title: AST-Aerospace Propulsion Systems

Class Code: 720-19

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes positions that involve research, development, design, test and evaluation of spacecraft propulsion components and systems. The work involves the design, development, integration and test of components and systems, including advanced propulsion technologies; analyses and simulations to develop mission and performance requirements or design criteria; evaluation of these systems and parts as they affect the total propulsion system; manage contractual programs for the performance of the above functions; or perform other experimental and analytical work pertaining to aerospace propulsion systems.

Positions whose paramount work is providing direct support to a specific propulsion system, i.e., liquids, solids, electric etc., should also be classified to this specialty.

### ***Specialty Knowledge***

The work for this specialty requires application of scientific and engineering principles in the field of astronautics as applied to spacecraft propulsion systems. The knowledge required includes: aerospace propulsion, fluid mechanics, thermodynamics, thermal, orbit mechanics, applied physics and, materials and structures as they apply to chemical, electric, and electrochemical aerospace propulsions systems.

### ***720-25 Classification***

NASA Title: AST-Direct Energy Conversion

Class Code: 720-25

OPM Title: Electrical Engineer

Series Code: GS-850

### ***Definition of Work***

This specialty includes positions engaged in research, development, design, test, and evaluation of direct energy conversion or storage devices and power systems, such as solar cells, fuel cells, thermionic converters, batteries, and thermoelectric generators using solar, chemical, or nuclear energy sources and micro- and nano-scale energy system architectures. These are devices that directly convert, usually without moving machinery, chemical, thermal, radiant, or other energy to electricity. Direct energy conversion and storage devices, such as solar cells and batteries, serve as power sources themselves or may be used as elements of electrical propulsion and power generation systems. Covered positions may also develop performance requirements, conduct systems analyses, prepare technical requirements, and/or manage contracts for the performance of these functions.

### ***Specialty Knowledge***

The work requires a range of knowledge cutting across several disciplines as they apply to direct energy conversion. This knowledge includes the pertinent aspects of physics, quantum mechanics, electricity and magnetism, electrical engineering, chemical engineering, mechanical engineering, electrochemistry, physical chemistry, polymer chemistry, and material science.

### *720-50 Classification*

NASA Title: AST-Fuels and Combustion Processes

Class Code: 720-50

OPM Title: Chemical Engineer

Series Code: GS-893

### *Definition of Work*

This specialty includes positions involving research, development, evaluation, or analysis of chemical energy processes in aerospace applications. The work may be experimental, computational, and/or analytical in nature. These positions are engaged in the investigation and development of liquid, solid, and hybrid fuels and other propellants, and the combustion processes by which chemical energy is converted to propulsive power. The work includes study of the compatibility of various fuels and other propellants with each other and the materials with which they come in contact, and studies of the physical and chemical properties and behavior of such propellants. The work includes the development of improvements of propulsive energy release, the reduction of undesirable emissions from the combustion of the fuels and propellants, and the interactions of the fuel and propellant combustion with other elements of an aerospace vehicle's design. Other positions involve the development of criteria and methods for the safe handling, storage, and use of fuels and other propellants; and the preparation of technical requirements and management of contracts for this work.

### *Specialty Knowledge*

The work requires knowledge of heat, mass, and momentum transfer; thermodynamics; reaction kinetics; fluid mechanics; and material and energy balances.

### **720-60 Classification**

NASA Title: AST-Propulsion Flow Dynamics

Class Code: 720-60

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes research positions that may include some or all of the following: analysis, design and development, test, and evaluation of the flow processes associated with propulsion aerodynamics. The work involves the evaluation of design concepts and study of basic flow and associated heat transfer problems associated with propulsion flow systems and their components. Typical components associated with propulsion flow dynamics include compressors, turbines, inlets and nozzles, high-speed propellers and combustors. Covered positions typically:

- A. Develop and evaluate analytical methods and simulation techniques,
- B. Conduct studies, analyses, and simulations,
- C. Conduct experimental programs,
- D. Verify analytical and numerical methods by comparing with experimental data,
- E. Manage contractual programs for their performance of the work,
- F. Provide consultation to other agencies and organizations, and/or
- G. Prepare and evaluate technical requirements and design criteria.

### *Specialty Knowledge*

The work requires the pertinent knowledge of aerodynamics, fluid mechanics, heat transfer, thermodynamics, mechanical design, materials and turbomachinery as they apply to propulsion systems.

### ***720-70 Classification***

NASA Title: AST-Pyrotechnic Systems

Class Code: 720-70

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes positions that involve research, development, design, test, evaluation, production, flight certification, and application of pyrotechnic components, and systems for aerospace vehicles and ground support equipment. The work involves design and development of pyrotechnic systems both individually and as parts of the vehicle or ground support equipment.

Covered positions may also:

- A. Conduct studies, analysis, evaluations and simulations for evaluation to develop performance requirements and design criteria,
- B. Conduct experimental programs to evaluate pyrotechnic system components and define their capabilities,
- C. Manage contractual programs for the performance of these tasks, including participating on procurement source boards and serving as a Contracting Officer's Technical Representative, and/or
- D. Perform design and flight safety reviews.

### ***Specialty Knowledge***

This work requires knowledge of fluid and mechanics, thermodynamics, materials, chemistry and physics, structures, mechanical drawings, manufacturing processes and explosive material properties as they apply to pyrotechnic devices and subsystems. It also requires knowledge of electrical, mechanical, and laser-firing systems used to initiate pyrotechnic systems.

## **720-80 Classification**

NASA Title: AST-Propulsion Systems and Technologies

Class Code: 720-80

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions that involve planning, coordination, or conduct of aerospace research, development, design studies, and testing of propulsion and space transportation systems and technologies, which may also include related fluid management systems. These propulsion system efforts are concentrated on, but not limited to: air-breathing propulsion, gas, liquid, and solid chemical propulsion, electrical propulsion and power, nuclear propulsion and power, gun launch concepts, beamed energy launch systems, combined cycle engines, solar and beamed energy sails, and electromagnetic and momentum transfer tethers, in combination with each other and any other propulsion systems.

This work involves conduct of research, development, design, testing, and/or operations projects; keeping abreast of the applicable science and technology; coordination of development and operations to assure the best utilization of money, manpower and facilities; participating in Source Evaluation Boards or contractor design reviews; contract management; evaluating proposals for research grants; and other matters such as serving on various boards and committees concerned with aerospace propulsion development programs.

**NOTE:** “Fluid mechanics” and “related fluid management systems” as used above refers predominantly to liquid, solid, gaseous propulsive fuels, inlet airflow, etc.

### *Specialty Knowledge*

The work requires knowledge of physics and engineering principles, concepts and practices relating to aerospace engineering and propulsion technologies augmented by knowledge of spacecraft systems and their interactions.

These positions also require professional engineering knowledge with emphasis in aeronautical and astronautical systems and design, aerodynamics, thermodynamics, fluid mechanics, combustion, structural dynamics flight dynamics and operations, and propulsion, analytical, computational, and experimental methods as relevant to propulsion and spacecraft applications, including in-space propulsion and transfer vehicles.

## 725 FLIGHT SYSTEMS

### DEFINITION:

Includes positions engaged in safety, reliability, quality assurance, risk management, research, development, design, test, and evaluation of aerospace and aeronautical vehicles and component systems (including stages, propulsion, control and guidance, data management and software, structures, payloads, etc.) or of an aerospace or aeronautical vehicle and the related external systems (e.g., ground support and telemetry).

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
725-04	Reliability and Quality Assurance	Aerospace Engineer	GS-861
725-05	Reliability	Aerospace Engineer	GS-861
725-09	Flight Systems (GS-7/GS-9 Only)	Aerospace Engineer	GS-861
725-10	Flight Systems Test	Aerospace Engineer	GS-861
725-11	Flight Systems Safety	Aerospace Engineer	GS-861
725-12	Aerospace Flight Systems	Aerospace Engineer	GS-861
725-13	Flight Systems Design	Aerospace Engineer	GS-861
725-15	Electronic Systems Failure Analysis	Electronics Engineer	GS-855
725-16	Crew Station Systems	Aerospace Engineer	GS-861
725-17	Environmental Control Systems	Aerospace Engineer	GS-861
725-20	Experimental Manufacturing Techniques	Aerospace Engineer	GS-861
725-22	Quality Assurance	Aerospace Engineer	GS-861
725-30	Electrical Systems	Electrical Engineer	GS-850
725-31	Automation and Robotics Systems	Aerospace Engineer	GS-861
725-40	Safety and Mission Assurance	Aerospace Engineer	GS-861
725-41	Fluid Systems Test	Aerospace Engineer	GS-861
725-42	Flight Systems Engineering	Aerospace Engineer	GS-861
725-90 thru 725-99	*	*	*

\*At the Center's discretion

### ***725-04 Classification***

NASA Title: AST-Reliability and Quality Assurance

Class Code: 725-04

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes positions that involve engineering, analysis, testing, risk management, and quality assurance functions for aeronautical and aerospace systems including all program phases from concept through operational use. The objective is the establishment, implementation, and maintenance of reliability and quality assurance programs. Reliability and quality assurance are evaluated for aeronautical and aerospace systems including launch vehicles, spacecraft, and associated ground support equipment. Risk management plans are developed to assure an integrated project effort for risk management activity to identify project risks, potentially hazardous conditions and failure modes.

Note: Use of this broad specialty is appropriate when the duties of a position involve work that is a combination of AST–Reliability, 725-05 and AST–Quality Assurance, 725-22.

### ***Specialty Knowledge***

Knowledge required to perform this work are interdisciplinary and spans conventional engineering and physical science disciplines including aerospace, aeronautical, electrical, electronics, mechanical, and chemical with emphasis on the theories and principles of reliability engineering and quality assurance functions. Also, required is knowledge of mission safety and risk management.

### *725-05 Classification*

NASA Title: AST-Reliability

Class Code: 725-05

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions that involve the establishment, implementation, maintenance, and evaluation of reliability programs for aeronautical and aerospace systems including launch vehicles, spacecraft, and associated ground support equipment, for all program phases from concept through operational use. These positions concern reliability engineering and operations at Government installations, and technical direction of contractor reliability engineering efforts.

Employees in this specialty develop reliability policy, guidelines, requirements, and procedures, and generate-perform and evaluate documentation, analyses, and tests covering all program phases of aeronautical and aerospace systems development. Examples of required skills and functions include:

- A. Establishment of reliability design criteria,
- B. Performance and evaluation of failure modes and effects analyses,
- C. Development and operation of problem reporting and corrective action systems including failure analyses and recurrence control,
- D. Performance and evaluation of predictions and trade studies,
- E. Identification and evaluation of limited life items,
- F. GIDEP ALERT impact assessments,
- G. Evaluation of design changes for impact upon reliability,
- H. Establishing reliability requirements for electrical, electronic, electromechanical, and mechanical parts, and/or
- I. Evaluation and approval of analyses, tests, and reliability qualifications.

### *Specialty Knowledge*

Knowledge required to perform this work is interdisciplinary and spans conventional engineering and physical science disciplines including aerospace, aeronautical, electrical, electronics, mechanical, and chemical with emphasis on the theories and principles of reliability engineering.

### ***725-10 Classification***

NASA Title: AST-Flight Systems Test

Class Code: 725-10

OPM Title: Aerospace Engineer

Series Code: GS-861

#### ***Definition of Work***

This specialty includes professional engineering positions that involve the conceptualization, demonstration, and implementation of test initiatives and test technologies that address the design, development, verification, and operation of aerospace flight and ground support hardware, including EVA, payloads, and flight experiments equipment. Technological proficiency, strategic test plans, specific metrics, and physical test capabilities are developed and provided in support of flight hardware development programs and associated technology enhancements. Experimental research is planned and carried out that leads to technologies that are relevant to the evaluation and behavior of flight vehicles and systems. It includes performance verification of flight systems under simulated launch and on-orbit conditions, acquisition and analysis of flight data, derivation of test criteria and requirements based on flight measurements, and simulation of flight loads and environments. Existing test technologies including methods, concepts, and procedures are evaluated, modified, and improved and new technologies are derived for innovative test article design concepts and materials utilization.

#### ***Specialty Knowledge***

This work requires professional engineering or physical science knowledge of aerospace, electrical, electro-optical, electro-mechanical, and mechanical space vehicle and launch systems, and includes frequency, power, and network systems. Also required is the ability to develop test documentation, develop and utilize institutional support systems, evaluate test programs relative to criteria and objectives, and to establish certification status of flight articles.

### **725-11 Classification**

NASA Title: AST-Flight Systems Safety

Class Code: 725-11

OPM Title: Aerospace Engineer

Series Code: GS-861

#### *Definition of Work*

This specialty includes positions that are to advise on, coordinate, monitor, Maintain surveillance over, and/or perform duties concerned with the engineering systems safety program for all space and aeronautical programs. These positions typically include responsibility for:

- A. The development, implementation, and countenance of engineering safety policies, standards and criteria directives and plans, and inputs for statements of work,
- B. Technical consulting services in systems safety requirements to ensure the safety of the systems, and that the systems and all their elements will perform satisfactorily and thereby prevent loss of life and systems,
- C. Gross hazards analysis, fault tree analysis, and procedure review,
- D. Providing safety input to program functions such as systems trade-off studies, configuration control, human engineering, assessment waivers, Payload Safety Reviews, and program milestone reviews,
- E. Providing conceptual safety guidance during the definition phase of future programs,
- F. Providing safety engineering analysis support to operational safety and accident investigation groups,
- G. Ensuring inclusion of appropriate safety standards and related requirements in agency contract clause,
- H. Participating in hardware/software accident investigations and evaluating results for potential application to NASA system safety requirements,
- I. Ensuring rapid distribution of accident cases and investigation results for appropriate and timely incorporation into all flight systems, and/or
- J. Monitoring the work of contractor's safety engineering effort at all stages of systems development.

#### *Specialty Knowledge*

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical science disciplines such as aerospace, physics, chemistry, mechanical, electrical, and electronics, with the principal emphasis being aerospace flight systems safety and engineering applications.

## **725-12 Classification**

NASA Title: AST-Aerospace Flight Systems

Class Code: 725-12

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions which involve some or all aspects of project and/or program management of space and aeronautical flight systems, vehicles, and/or payloads, including design and operational requirements definition, hardware and/or software development, testing, verification, safety, integration, certification and operations. This includes:

- A. Defining design, integration and operational requirements for flight systems,
- B. Evaluating in-house and contractor proposals for flight systems and providing technical management and direction of contracts involving the design, development, integration, test, evaluation, operation and long-term sustaining of flight systems,
- C. Developing and integrating flight vehicle systems and elements, including the resolution of issues. Issue resolutions will be required on all aspects of development and operation, including system performance, configuration, component definition, operational capabilities, reliability, safety, etc.,
- D. Analyzing, testing, evaluating, validating and certifying flight hardware, software and system capabilities based on design and operational and safety requirements,
- E. Integrating unique systems, customer products, and project and/or program elements to satisfy vehicle design and operational requirements,
- F. Determining operational performance and required modifications and enhancements to increase capability, efficiency and/or lifetime of the vehicle, and/or
- G. Managing cost, schedule and technical aspects including risk management of the project/program.

### *Specialty Knowledge*

Knowledge required to perform work of this specialty are interdisciplinary and span the conventional engineering disciplines e.g., aerospace, chemical, electrical, electronic, industrial, or mechanical, but the principal requirement is the application of these to accomplish flight systems-engineering functions. These positions require effective management and communications skills.

NOTE: This specialty includes positions in which incumbents perform work that is not specifically classified to another AST specialty or subgroup and which requires interdisciplinary engineering and/or physical sciences knowledge. Positions that perform work identifiable with a specific subgroup such as propulsion and power, control and guidance, structure and materials, etc., are to be classified to a specialty within that subgroup.

### ***725-13 Classification***

NASA Title: AST-Flight Systems Design

Class Code: 725-13

OPM Title: Aerospace Engineer

Series Code: GS-861

#### ***Definition of Work***

This specialty includes professional engineering positions that involve the conceptualization and design of flight systems, subsystems, hardware, components, and mechanisms utilized in the development, support, and integration of major aerospace or aeronautical systems and vehicles. Included are the detailed design, drawing, and identification of specifications for aerospace and aeronautical flight systems and hardware. The requirements for the design may be generated by the incumbent or a requester.

This specialty is primarily distinguished by its concern with the actual performance of detailed design rather than the mere conceptualization of a design. The design work involves the entire spectrum of space flight systems ranging from items of flight hardware to entire spacecraft vehicles and systems. In order for work to be included in this specialty, it must involve flight systems design work, the supervisory evaluation of this work, or the management of contractor activities performing this type of work.

#### ***Specialty Knowledge***

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical science disciplines, e.g., aerospace, aeronautical, electrical, electronics, mechanical, and chemical, with the principal concern being to accomplish the actual flight systems design.

### *725-15 Classification*

NASA Title: AST-Electronic Systems Failure Analysis

Class Code: 725-15

OPM Title: Electronics Engineer

Series Code: GS-855

### *Definition of Work*

This specialty includes positions which involve failure analysis of electrical and electronics systems in a laboratory and the development of congruent failure analysis methodology. These positions conduct scientific investigations to determine the most advantageous approach to take (and the necessary equipment to use, modify, or acquire) in the analysis of reported failures in electrical and electronic components and systems. These positions define and establish requirements for investigation of spacecraft, vehicle, or ground support equipment failures. They develop or review test procedures to ensure that they are rationally aligned with the purposes to be served. Investigation of failures is to be conducted using established techniques and equipment as well as using unique methods required by the peculiarities of the failure.

### *Specialty Knowledge*

This work requires the application of laboratory investigative techniques as well as electrical and electronics engineering knowledge. Knowledge of the concepts, principles, and practices of the design of electronic equipment, including knowledge of digital and analog logic and computer interface technology as utilized by aerospace designers, is required.

## **725-16 Classification**

NASA Title: AST-Crew Station Systems

Class Code: 725-16

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions which involve experimental research and project expertise and direction to develop, evaluate, establish and control design requirements, and criteria and concepts for the layout and arrangement of spacecraft or spacecraft simulator cabins, crew stations, and payloads. Included are deployment and retrieval hardware, crew and equipment tethers, and restraints, equipment layout, controls and displays and safety protection in the crew station, etc., where the concerns are optimum placement, operability, and compatibility with the flight crews. Incumbents evaluate, operate, and maintain the configuration and fidelity of flight designs. This includes spacecraft workstations and those required for simulators, trainers, and training equipment and update them for specific aerospace missions or projects. This specialty also includes positions engaged in the design development of human-machine interfacing hardware that enhances performance and ability to function in control of or as an integral part of the crew station system.

Examples of the type of work performed include:

- A. Managing, directing, and supervising in-house and contractor work efforts in the design and development of crew hardware needed to support on-orbit crew operations, experiments, EVA, etc.,
- B. Managing designs, studies and investigations to define displays, controls, and instrument panels, including consideration of operational requirements, mission to be accomplished, and human factors,
- C. Evaluating the design and placement of cabin instruments, experiments, maintenance items and other stowage items to determine optimum placement,
- D. Developing human-machine interface criteria for crew stations, stowage equipments, displays and controls; and/or
- E. Designing and maintaining the configuration integrity and accuracy of trainers, simulators, and mockups.

### *Specialty Knowledge*

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical sciences disciplines, e.g., aerospace, aeronautical, electrical, electronics, mechanical, and chemical, and systems engineering, including human factors engineering, with the principal concern being to accomplish crew station systems engineering.

### ***725-17 Classification***

NASA Title: AST-Environmental Control Systems

Class Code: 725-17

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes professional work that involves the applied research and developmental engineering of specialized habitats necessary for human space flight. Positions assigned to this specialty are involved in the engineering analysis, design, development, and testing of environmental/thermal control and life support equipment and systems for human space flight vehicles, extravehicular astronaut life support systems, and intravehicular flight crew equipment and spacesuits. The work primarily involves the development of human-tolerant systems and equipment necessary to sustain life in a space flight environment. The work is concerned with such categories as atmospheric composition, atmospheric pressure, humidity and temperature control, carbon dioxide removal, trace contaminants control, oxygen generation and storage, heat collection and rejection, water and waste management, and biological life support systems.

### ***Specialty Knowledge***

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical sciences disciplines, e.g., aerospace, aeronautical, electrical, electronics, mechanical, and chemical with an emphasis on mechanical and/or chemical engineering to support or accomplish environmental control in manned spacecraft. Additionally, an understanding of the physical sciences and processes as they apply to developing environmental control systems is desirable.

### ***725-20 Classification***

NASA Title: AST-Experimental Manufacturing Techniques

Class Code: 725-20

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes positions that involve the conception, research, and development of methods, processes, and techniques for the manufacture of aerospace hardware. Incumbents in these positions evaluate new fabrication and assembly methods, machinery, and new materials for application to the manufacture of aerospace hardware and support equipment.

Responsibilities include defining the development, acceptance, and engineering requirements for processes used on aerospace hardware. Incumbents in positions in this specialty often work closely with hardware researchers and designers to develop tools, techniques, and processes for the fabrication and assembly of prototype complex equipment and components for aerospace use.

### ***Specialty Knowledge***

This work requires an understanding of manufacturing principles applicable to material systems typical of aerospace hardware and support equipment. Also, an understanding of the effects of the space environment and the performance requirements that these effects place upon aerospace systems is required.

## *725-22 Classification*

NASA Title: AST-Quality Assurance

Class Code: 725-22

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes professional work to establish, maintain, and evaluate quality assurance programs through all phases of the development of aeronautical and aerospace systems, launch vehicles, spacecraft, payloads, and associated ground support equipment from design through operational use. Incumbents in these positions are responsible for the development and implementation of technical concepts and procedures required to ensure space systems, and all their elements, will perform satisfactorily in space flight operations. These positions are concerned with quality assurance operations at Government installations where experimental work is conducted or the complete space systems are assembled, checked out, launched, and operated; and in the technical direction of contractors' quality assurance efforts where industry and Government know-how and experience are partnered.

The incumbents develop basic procedures for quality assurance programs and inspection systems for all phases of space systems hardware development. They work closely with program and project managers and design, development, fabrication, and process engineers to provide direction and advice to insure an optimum quality assurance program. They establish the criteria for a satisfactory quality assurance program in connection with contract specifications and participate in contract reviews and negotiations for the purpose of ensuring NASA and industry quality assurance standards are met. They monitor contractors' quality assurance programs in both preflight and flight operations. Quality assurance is intimately involved with receiving, inspecting, selecting and processing materials, fabricating, assembling, testing, and checking out component parts through the total space system.

### *Specialty Knowledge*

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical science disciplines; e.g., aerospace, aeronautical, electrical, electronics, mechanical, chemical; with the principal concern being to accomplish quality assurance functions.

NOTE: AST-Quality Assurance is distinguished from AST-Reliability by the emphasis on product quality rather than emphasis on the design process.

### ***725-30 Classification***

NASA Title: AST-Electrical Systems

Class Code: 725-30

OPM Title: Electrical Engineer

Series Code: GS-850

### ***Definition of Work***

This specialty includes positions which involve the research, development, checkout, evaluation, and the establishment of operational requirements for the electrical integration of aerospace systems, multistage space vehicles, space payloads, and space experiments, including the required support facilities and equipment. This involves an analysis of the overall vehicle and systems design and operational requirements including such major subsystems as guidance and control, propulsion, instrumentation, and tracking including multistage vehicle considerations such as interface problems, staging, and separation mechanisms, and power systems compatibility and integration.

It also involves analysis of the operational and electrical requirements of payloads and experiments and their development and integration into space transportation systems. The electrical integration of the various systems includes the development of the integration systems by in-house or contractor personnel, and requires a continuous coordination with and monitoring of the activities of the numerous organizations involved in the development of the various flight and ground support systems.

### ***Specialty Knowledge***

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical science disciplines, e.g., aerospace, aeronautical, electrical, electronics, mechanical, chemical, and computer.

### **725-31 Classification**

NASA Title: AST-Automation and Robotics Systems

Class Code: 725-31

OPM Title: Aerospace Engineer

Series Code: GS-861

#### *Definition of Work*

This specialty includes positions responsible for research, requirements definition, analysis, design, development, integration, simulation, test, verification, operation, and flight support of teleoperated and autonomous robotics systems, artificial intelligence technologies, advanced software technologies and autonomous and autonomous/conventional (hybrid) software systems for human and robotic space vehicle, system and subsystem application, for human and robotic lunar and planetary surface applications, and for earth-based development, and for flight support applications. Positions may perform research and studies in human interfaces to effectively integrate humans with teleoperated and autonomous robotic systems and autonomous/hybrid software systems. Positions may establish, operate, and maintain flexible, capable high technology laboratories and facilities to support teleoperated and autonomous robotic systems and advanced, autonomous software technology investigations. Specific teleoperated and autonomous robotics systems roles include surrogate astronauts (EVA and IVA) and augmentation and assistance of human astronauts (EVA and IVA). Specific teleoperated and autonomous robotic systems applications include assembly, inspection, maintenance, transport, and retrieval of space vehicle and /or planetary surface equipment; exploitation of planetary resources; exploration and remote science operations; and performance of hazardous or repetitive tasks. Specific advanced software systems applications include fault detection, isolation, and recovery; monitoring and controlling; planning and scheduling; procedures development and execution; system design analysis, failure mode and effect analyses, and machine vision.

#### *Specialty Knowledge*

Knowledge required to perform this work are interdisciplinary and span conventional engineering (e g , computer, electronics, electrical, aerospace, mechanical, software, and systems engineering), physical science, and mathematics disciplines with an emphasis on the application and utilization of these knowledge in the design, development, test, and operation of automation and robotic systems.

## **725-40 Classification**

NASA Title: AST-Safety and Mission Assurance

Class Code: 725-40

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions that advise on, coordinate, monitor, maintain surveillance over, and/or perform duties concerned with the Safety, Reliability, and Quality Assurance program for aerospace and aeronautical programs through advanced mission study, preliminary analysis, definition, design and development, handling and transportation, and operations of space systems; launch, aerospace, and aeronautical vehicles; and/or associated ground and support equipment. These positions typically include responsibility for:

- A. Performing detailed assessments of hazard reports and safety data packages for assigned systems/elements, determines compliance with design and operations safety requirements,
- B. Conducting analyses, evaluations, and approving failure modes and effects analysis/critical items list (FMEA/CIL) and reliability and maintainability predictions, and verifying the design of systems and components; identifies deficiencies; and recommends design modifications that are required to correct deficiencies and enhance safety, reliability, and maintainability, and quality,
- C. Conducting critical reviews of design verification and/or certification plans to assure they meet established criteria,
- D. Analyzing designs during major milestone reviews to assure compliance with established safety, reliability, maintainability, and quality engineering design requirements as well as provide oversight of other performance requirements, and/or
- E. Developing and implementing plans for accomplishment of product quality assurance functions by reviewing test and manufacturing procedures and schedules to assure full compliance with product requirements, specifications, and procedures.

### *Specialty Knowledge*

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical science disciplines such as aerospace, physics, chemistry, mechanical, electrical, and electronics, with the principal emphasis being aerospace flight systems Safety and Mission Assurance engineering applications.

## **725-41 Classification**

NASA Title: AST-Fluid Systems Test

Class Code: 725-41

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions that involve the development, evaluation, and establishment of operational requirements and checkout procedures for the integrated operation of fluid systems of aerospace systems, space vehicles, space payloads, and space experiments, including the required support facilities and equipment. This work supports major subsystems such as propulsion (including cryogenics), power, hydraulics, life support, and orbital maneuvering and reaction control (including hypergols), and payloads. This work involves the:

- A. Analysis of
  - 1. Overall vehicle and systems design,
  - 2. Processing operations, and/or
  - 3. Test and performance data, including
    - a. Interface problems,
    - b. Timing and functionality, and/or
    - c. Separation and connection mechanisms;
- B. Integration of payloads into space transportation systems;
- C. Continuous coordination and monitoring of development and processing activities for flight and ground support systems;
- D. Test of flight fluid system control and monitoring systems; and/or
- E. Pre-launch servicing of payloads.

### *Specialty Knowledge*

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical science disciplines, e.g., aerospace, mechanical, electrical, computer science and chemical, with the principal concern to accomplish fluid systems assembly and checkout.

## *725-42 Classification*

NASA Title: AST-Flight Systems Engineering

Class Code: 725-42

OPM Title: Aerospace Engineer

Series Code: GS-861

### *Definition of Work*

This specialty includes positions that involve requirements definition, research, technology development, test analysis, integration, and/or operation of aerospace and aeronautical flight systems in the overall development of flight vehicle programs or projects. This includes:

- A. Defining, developing, and evaluating flight systems operational requirements and objectives, mission requirements, and human factor design considerations,
- B. Identifying and establishing flight systems level guidelines, techniques, and methodologies necessary to integrate components, assemblies, subsystems, and systems into the overall flight system or vehicle. These are established for such functions as systems requirements, testing, integration, operations, and analysis,
- C. Analyzing, testing, evaluating, validating, and certifying flight hardware, software, and system capabilities based on systems requirements, mission objectives, design, operational, and safety requirements. Applies also to analyzing, testing, evaluating, and validating new flight systems and/or component capabilities during research and technology developments,
- D. Designing and developing integrated flight vehicle systems including the resolution of such issues as configuration and component definition, mission and system operations and performance requirements, systems reliability and safety, software definition, test analysis, and operational accomplishments, and/or
- E. Evaluating in-house and contractor proposals for flight systems and components and providing technical management and direction of contracts involving the design, development, integration, test, evaluation, and improvement of flight systems.

### *Specialty Knowledge*

Knowledge required to perform work of this specialty are interdisciplinary and span the conventional engineering disciplines, e.g., aerospace chemical, electrical, electronic, industrial, or mechanical, but the principal requirement is the application of these disciplines to accomplish flight systems engineering functions.

NOTE: This specialty includes positions in which incumbents perform work primarily in functional or line organizations rather than program or project organizations; and perform work primarily requiring interdisciplinary engineering and/or physical sciences knowledge rather than contract management skills. Incumbents of positions performing work identifiable with a specific subgroup such as propulsion and power, control and guidance, structures and materials, etc., should be classified to a specialty within that subgroup.

## 730 MEASUREMENT AND INSTRUMENTATION

**DEFINITION:**

Includes positions engaged in research, development, design, fabrication, test, and evaluation of equipment, systems, or techniques for detecting, referencing, computing, recording, and measuring physical conditions and environment, as well as communication, control, test, calibration, and operations related to space and ground systems.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
730-05	Sensors and Transducers	Electronics Engineer	GS-855
730-09	Measurement and Instrumentation (Entry-level GS-7 and GS-9 Only.)	Electronics Engineer	GS-855
730-10	Electronic Instrumentation Systems	Electronics Engineer	GS-855
730-15	Optical Physics	Physicist	GS-1310
730-16	Electro-Optical Sensor Systems	Electronics Engineer	GS-855
730-25	Control Systems	Control Systems	GS-801
730-37	Tracking and Telemetry Systems	Electronics Engineer	GS-855
730-55	Telecommunications	Electronics Engineer	GS-855
730-57	Electronics of Materials	Physicist	GS-1310
730-65	Microwave Physical Electronics	Physicist	GS-1310
730-70	Nanotechnology Systems	Physical Scientist	GS-1301
730-71	Experimental Electrical Equipment and Techniques	Electrical Engineer	GS-850
730-72	Optical Engineering	Electronics Engineer	GS-855
730-90 thru 730-99	*	*	*

\*At the Center’s discretion

### ***730-05 Classification***

NASA Title: AST-Sensors and Transducers

Class Code: 730-05

OPM Title: Electronics Engineer

Series Code: GS-855

### ***Definition of Work***

This specialty includes positions that involve aeronautical and space research, design development, test, and evaluation of basic sensing devices, transducers, components, and related circuitry for application to aerospace research and development endeavors. Typical types of items include pressure cell diaphragms, semiconductor transducers, gyroscopes, strain gages, electro-optical cells, thermocouples, nuclear counters, bolometers, inertial sensors, and laser sensors. These devices involve principles of sensing by means of a physical, electrical, chemical, optical, etc., activated change in property or characteristics such as displacements, inertia, flow of electricity, gas excitations, pressure differentials, chemical, color, or other changes. Oversight of contract effort in these areas may also be required.

### ***Specialty Knowledge***

Knowledge required include the fundamental properties of materials and their effect on the basic characteristics of sensing elements and devices; an awareness of aerospace environmental peculiarities and the limitations and specialized requirements of aerospace programs as they affect the basic measurement and instrumentation approach to the problems involved, as well as a detailed knowledge of the scientific uses to which the devices are directed.

### *730-10 Classification*

NASA Title: AST-Electronic Instrumentation Systems

Class Code: 730-10

OPM Title: Electronics Engineer

Series Code: GS-855

### *Definition of Work*

This specialty includes positions which involve engineering, research, development and technology development of equipment and/or systems for detecting, recording, measuring, or controlling physical conditions, phenomena, and environments encountered in aeronautical and aerospace research and development programs. This involves conceptualization, studies and analyses, design, test, performance validation, and calibration of electronic instrumentation components, devices, and systems including the following:

- A. Instrumentation systems used on board or in direct support of aeronautical and aerospace vehicles and spacecraft, such as power conversion, storage, and distribution devices, signal/data processing and storage systems, electromechanical devices, safety and hazard controls, health monitoring and control systems, telecommand systems, radio frequency (RF), video and communications systems,
- B. Instrument systems for Earth, atmospheric, planetary, and other extraterrestrial remote sensing over the full range of the electromagnetic spectrum; ground, airborne, suborbital, and spacecraft instrumentation systems for remote control and motion control, signal conditioning, data acquisition, data handling, RF, video and image acquisition and data recording in aerospace research programs and in aircraft based science experiments; supporting electronic systems for spacecraft attached payloads and free-flying satellites, such as systems for power conditioning and distribution, motion control, mass storage of information, computing and processing, digital control, signal conditioning, signal processing, data acquisition, data handling, RF, video and image acquisition, and communications, and/or
- C. Measurement and control system techniques and standards used in ground-based calibration simulation and research facilities to support aerospace research and flight programs. Measurement disciplines covered include temperature, pressure, power, voltage, current, resistance, radiation, force, velocity, mass, distance, flow, and gas parameters.

Oversight of contract efforts in these areas may also be required.

### *Specialty Knowledge*

Applied knowledge of electronics and electrical, optical, electro-optical, electro-mechanical, software/firmware and computer engineering, thermal analysis; electromagnetic theory, magnetic designs, alternating current (AC) and direct current (DC) machines, motion control, robotics, micromachines, bioelectronics, Electronic Design Automation (EDA), simulation languages, image and digital signal processing, video systems, RF and/or microwave design, advanced sensors and components and microelectronics, acoustics, communications systems, physics, advanced mathematics, or measurement techniques.

### **730-15 Classification**

NASA Title: AST-Optical Physics

Class Code: 730-15

OPM Title: Physicist

Series Code: GS-1310

#### *Definition of Work*

This specialty includes positions, which involve fundamental and applied research of the electromagnetic spectrum in the wavelengths from approximately the x-ray to the l-millimeter region and those concerned with the development, design, test, evaluation, application, and use of optical techniques, components, and systems for measurement and sensor applications. Oversight of contracted efforts in these areas may also be required. The work includes:

- A. Spectroscopy of natural and artificial sources of optical radiation,
- B. Scientific investigation of both coherent and incoherent optical radiation and the development of systems for its use in aerospace applications,
- C. Theoretical and experimental investigation of the interaction of optical radiation with matter,
- D. Investigation of the physical phenomena, in solids, liquids, and gases, relating to the generation, modulation, transmission, and amplification of coherent and incoherent light,
- E. Theoretical study of optical communication concepts and systems using mathematical and simulation techniques,
- F. Research, development, design, test, and evaluation of techniques and equipment to generate, modulate, transmit, receive, and process optical signals,
- G. Investigation into the use of optical techniques and systems in the millimeter, sub-millimeter, and vacuum ultraviolet, and x-ray regions of the electromagnetic spectrum,
- H. Theoretical and experimental investigation of lasers and the associated technology including the investigation of the underlying natural laws and processes and their application in aerospace missions,
- I. Research and development of the science of photographic science and imaging technology for aerospace applications,
- J. Theoretical and experimental investigation of the phenomena and processes, which effect the propagation optical radiation and optical signals in aerospace environments, and/or
- K. Theoretical and experimental studies of the interaction of optical materials, devices, and systems with the aerospace environments, including the theoretical and experimental investigation of single-element and image-forming optical detection techniques, devices, and systems. This includes television for all optical wavelengths.

#### *Specialty Knowledge*

Applied knowledge required includes optical physics, optical science, physics, applied physics, spectroscopy, electrodynamics, quantum electronics, solid-state physics, semiconductor physics, and laboratory experimental and calibration techniques associated with these knowledge specialties.

### **730-16 Classification**

NASA Title: AST-Electro-Optical Sensor Systems

Class Code: 730-16

OPM Title: Electronics Engineer

Series Code: GS-855

#### *Definition of Work*

This specialty includes positions which involve research and development related to electro-optical devices, sensors, and sensor systems in the spectral range from the x-ray to the l-millimeter region, including the design, analysis, fabrication, test, evaluations, and use of electro-optical techniques, components, systems, and devices for the generation, detection, or processing of electromagnetic energy in the infrared, visible, and ultraviolet spectrum for aerospace measurement and sensor applications. Oversight of contract efforts in these areas may also be required. The work includes:

- A. Theoretical and experimental investigation of the interaction of optical radiation with matter, and of physical phenomena in solids, liquids, and gases relating to the generation, modulation, transmission, reception, detection, amplification, and processing of coherent and incoherent radiation,
- B. Research and development of single-element detector, arrayed detector, image forming, television and photographic optical techniques, components, devices, and systems for aerospace missions,
- C. Research and development of active and passive electro-optical and laser systems for remote sensing of physical parameters, including measurement of parameters in aerospace simulators and space remote sensing of the Earth's surface, the Earth's atmosphere, and extraterrestrial phenomena,
- D. Investigation of optical communication and optical signal processing techniques, concepts, systems, and components including fiber optics, and optical networks, and/or
- E. Research and development of lasers and associated electro-optical technology such as nonlinear optics including investigation of underlying natural laws and processes and their application in aerospace missions.

#### *Specialty Knowledge*

Knowledge required include digital and analog electronics; electrodynamics; optics; quantum electronics; solid state and semiconductor physics; the properties of optical and electro-optical equipment and materials; electronic and/or optical signal processing techniques; microprocessors; and design, test, and calibration-methods for electro-optical systems, devices, components, and materials.

### *730-25 Classification*

NASA Title: AST-Control Systems

Class Code: 730-25

OPM Title: AST-Control Systems

Series Code: GS-801

### *Definition of Work*

This specialty includes positions that involve research, design, development, test, and evaluation of all types of open-loop control systems, closed loop control systems, and health management systems for use in aerospace systems. Typical functions include:

- A. The development and/or implementation of new theories for control and/or health management of aerospace systems,
- B. Theoretical studies of aerospace systems and subsystems to determine their dynamic characteristics and the various control and/or health management parameters necessary for their optimum operation,
- C. Experimentation either to verify theoretical studies of control, and/or health management systems, or to establish data from which theoretical studies can be made
- D. Development of performance criteria, or design specifications for control, and/or health management systems,
- E. Evaluation of control and/or health management systems design through the use of mathematical models and associated test techniques,
- F. Implementation and experimental evaluation of real-time control and/or health management systems and their components including sensors, displays, instruments, and actuators,
- G. Evaluation and technical direction of contractors doing research, development, and evaluation of controls and/or health management systems, and/or
- H. Studies to efficiently integrate human controller capabilities into control system design.

### *Specialty Knowledge*

Knowledge required to perform this work is interdisciplinary. Required discipline-specific knowledge includes control theory and control system design or prognostic and diagnostic techniques for aerospace systems. Other required knowledge includes numerical analysis, advanced mathematics, principles of physics, and computer programming.

NOTE: Positions engaged in research, development, design, test, and evaluation of integrated systems for the control, guidance, and navigation of aerospace vehicles are properly assigned to AST-Navigation, Guidance, and Control Systems, 710-15.

### ***730-37 Classification***

NASA Title: AST-Tracking and Telemetry Systems

Class Code: 730-37

OPM Title: Electronics Engineer

Series Code: GS-855

### ***Definition of Work***

This specialty includes positions that involve research, design, advanced technology development, fabrication, test, and evaluation of tracking and/or telemetry systems. Included are positions that monitor or direct contractors for research, development and design, test and evaluation, and operation of tracking and telemetry systems. This involves electronic devices, components, and systems for use in tracking the flight of aerospace vehicles, e.g., radar, lidar, monopulse and interferometer tracking systems, and includes necessary research and development to design range and range rate tracking systems, which will achieve the objectives, required to support specific mission or space exploration requirements.

Also, included are systems integration, interfaces with communications, telemetry, and data handling and related systems, and site selection use in transmitting and receiving commands, telemetry, and data between space vehicles and the ground and/or one space vehicle and another space vehicle. Typical work includes:

- A. Design and development of telemetry systems or components to meet the requirements of missions and operations,
- B. Research and develop work designed to advance telemetry technology or to overcome problems encountered in advance telemetry systems and operations,
- C. Conceptual and feasibility studies for telemetry systems, and/or
- D. Integration of telemetry with related data processing and instrumentation systems.

### ***Specialty Knowledge***

Requires applied knowledge of electronic, electrical, and electro-mechanical engineering; physics; transmission and propagation theory, or electronic design.

### ***730-55 Classification***

NASA Title: AST-Telecommunications

Class Code: 730-55

OPM Title: Electronics Engineer

Series Code: GS-855

### ***Definition of Work***

This specialty includes positions that involve research and technology, design and development, utilization, and/or operational control of aerospace communications systems and facilities. These systems are used for transmitting, receiving, and processing experimental data, and for command control, tracking, and observation of aerospace missions. This specialty involves a variety of communications technologies, techniques and protocols, such as all types of radio frequency (RF) and optical communications systems, data, image, video and voice processing systems, and terrestrial and space communications systems. Positions in this specialty are concerned with the research and development of communications networks, fundamental and emerging technologies support aerospace programs and projects. These positions may also establish, arrange and direct operating procedures and schedules to provide communications support of aerospace operations.

### ***Specialty Knowledge***

These positions utilize professional scientific and engineering knowledge and experience in aerospace telecommunications research, development, and mission operations.

### ***730-57 Classification***

NASA Title: AST-Electronics of Materials

Class Code: 730-57

OPM Title: Physicist

Series Code: GS-1310

### ***Definition of Work***

This specialty includes positions that involve basic and applied research into the electronics and physical properties of materials and the effect of radiation upon materials, parts, and subsystems used in aerospace electronics systems. Typical areas of work include:

- A. Investigation of the physical electronics, acoustic, and chemical properties of materials,
- B. Investigation of the effects of radiation and the space environment upon materials and electronic devices,
- C. Investigation of electronics properties of materials and the means of applying these to aerospace design problems,
- D. Establishment of design criteria for radiation-resistant components, and/or
- E. Development of techniques and methods for the design of electronic parts, systems and equipment making use of research in the electronics properties of materials.

Incumbents in positions in this specialty may direct research work performed by contractors in this subject. They may also design and develop special experimental equipment for use in research.

### ***Specialty Knowledge***

This work requires knowledge of solid state physics, electromagnetic propagation, and (NDT) transducers/instrumentation.

### *730-65 Classification*

NASA Title: AST-Microwave Physical Electronics

Class Code: 730-65

OPM Title: Physicist

Series Code: GS-1310

### *Definition of Work*

This specialty includes positions that involve research into the electromagnetic spectrum wavelengths from approximately the one-millimeter region through the radio frequency regions. Also included are those positions concerned with the development, design, test, evaluation and utilization of microwave communication techniques, components, and systems. Typical functions include:

- A. Investigation of microwave transmission through terrestrial and space environment,
- B. Investigation of the interaction of microwaves and plasma and the effect of plasma on microwaves,
- C. Theoretical and experimental investigation of associated technology including the investigation of the underlying natural laws and processes and their application in terrestrial and space missions,
- D. Theoretical study of microwave communication concepts and systems using mathematical and simulation techniques,
- E. Investigation of all types of electronic and optical, both active and passive devices, both vacuum and solid state, to understand the basic principles of their operation and to develop criteria for the development of improved devices, and/or
- F. Research into the application of microwave techniques of the modulation and demodulation of light.

The work includes technical oversight of work performed under contract, cooperative agreements and research grants, and the participation in space act agreements to further NASA's goals.

### *Specialty Knowledge*

Incumbents of these positions use various techniques of mathematical analysis and physical principle analysis. They also design instrumentation to be used in connection with their experiments.

### **730-70 Classification**

NASA Title: AST, Nanotechnology Systems

Class Code: 730-70

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of Work*

This specialty includes positions that perform theoretical and experimental research and development on a nanometer scale to exploit the unique properties of materials to create nanoscale devices, systems, and functional materials. Nanotechnology is the science of control of matter on the nanometer (atomic) scale and the exploitation of novel phenomena and properties (physical, chemical and biological) at that length scale. Nanotechnology is not simply working at the nanoscale nor is it simply another step toward 'top-down' miniaturization. Nanotechnology represents a fundamental change in approach that takes advantage of molecular and material properties dominated by quantum mechanics, highly specific molecular interactions, material confinement, and nanoscale integration. Examples of research areas include:

- A. Fundamental studies of carbon and other nanotubes and nanorods, including nanotube growth, device integration and functionalization; fundamental studies of protein nanotubes and other nanoscale biomolecular materials and composites; molecular motors, engineered enzymes and lipid nanovesicles; and development of nano-scale devices for decoding the sequence of nucleic acids; and encoding and decoding of information (data) at the nanoscale;
- B. Design, fabrication, and characterization of molecular electronics platforms; nanoelectromechanical systems (NEMS); nanoscale and mesoscale self assembly; manufacturing techniques for nanoscale structures and devices; fundamental research in quantum computers;
- C. Large scale computational modeling of the behavior and assembly of nanoscale systems; computational electronics and computational modeling of nanofabrication processes and performance of nanostructure devices; and/or
- D. Design and development of medical applications, including diagnostic tools, drug delivery systems, and minimally invasive manipulators, which are dependent on nanoscale devices.

#### *Specialty Knowledge*

This work is interdisciplinary and involves the application of knowledge and expertise in physics, chemistry, materials science, electrical, chemical and mechanical engineering, computer science, biophysics, biochemistry, genomics, molecular biology, and molecular modeling.

### *730-71 Classification*

NASA Title: AST–Experimental Electrical Equipment and Techniques

Class Code: 730-71

OPM Title: Electrical Engineer

Series Code: GS-850

### *Definition of Work*

This specialty includes positions responsible for the planning, design, development, testing or evaluation of electrical and electronic equipment and instrumentation systems for the acquisition and reduction of experimental data and the control of process systems, experimental test articles and facilities. The equipment and systems are integrated or associated with research testing in facilities such as wind tunnels, test stands, scientific laboratories, space environment chambers, launch and ground support equipment, specialized test systems, flight systems, and data gathering facilities. Typical equipment includes special instrumentation, transducers, digital and analog control systems, computer equipment, automated computer controlled systems and test equipment.

To fulfill program objectives, specific responsibilities may include:

- A. The design, development or integration of specialized instrumentation, control or data acquisition systems,
- B. The procurement, checkout and acceptance of equipment and systems,
- C. Procedures, techniques, and methods to optimize experimental testing,
- D. The modification of test article or facility electrical or electronic systems to fulfill test requirements, and/or
- E. The analysis and validation of experimental test data.

### *Specialty Knowledge*

This work requires knowledge of electrical and electronic systems, experimental programs, and consideration of phenomena peculiar to aerospace research and development. Knowledge, although primarily electrical or electronic, spans conventional engineering and physical science disciplines such as computers, aerospace, aeronautical, physics, chemical, and mechanical.

### **730-72 Classification**

NASA Title: AST–Optical Engineering

Class Code: 730-72

OPM Title: Electronic Engineer

Series Code: GS-855

#### *Definition of Work*

This specialty includes positions which involve engineering and applied research and development of optical equipment and/or systems covering the electromagnetic spectrum in the wavelengths from approximately the x-ray to the I-millimeter region and those concerned with the development, design, test, evaluation, application, and use of optical techniques, components, and systems for both measurement and space-flight instrumentation. Oversight of contract efforts in these areas may also be required. The work includes:

- A. Engineering and development of a variety of imaging and non-imaging optical component and optical instrument system designs through the use of computer-aided software packages. This includes the design of stray light suppression hardware (baffles, etc.),
- B. Analysis of optical component, subsystem, and system level performance using computer-aided software packages. This includes the analysis of stray light suppression performance,
- C. Engineering and development of adaptive/active optical methods, techniques, and ground equipment for the development and test of wave-front sensing and control algorithms and hardware for space-flight optical instrumentation,
- D. Engineering and development of optical fabrication methods, techniques, and ground equipment for application to the fabrication and test of optical components and subsystem from various materials (glass, metal, crystals, etc.). This includes strictly the optic itself,
- E. Engineering and development of opto-mechanical design and fabrication methods, techniques, and ground equipment for application to the fabrication and test of lens/mirror mounts, optical benches, etc; This includes the mechanical interfaces between the optic itself and the instrument,
- F. Engineering, development, research, and characterization of optical materials,
- G. Engineering, and development of thin film deposition and characterization methods, techniques, and apparatuses for application to the fabrication and test of optical components (mirror coatings, filters, etc.),
- H. Engineering, development, research, design, analysis, alignment, and test of spectroscopic and hyper-spectral components and systems,
- I. Engineering and development of optical testing methods, techniques, and ground equipment for in-process optics, component-level, optical instrumentation subsystems and systems, optical instrumentation subsystems and systems,
- J. Engineering and development of optical metrology methods, techniques, and ground equipment for optical instrumentation subsystems, systems, and spacecraft-level integration,
- K. Engineering, development, research, design, analysis, alignment, and test of space-flight optical interferometers,
- L. Engineering, development, design, alignment, and test of existing and new optical sources, both coherent and incoherent,

- M. Engineering, development, design, test, and evaluation of techniques and equipment to generate, modulate, transmit, receive, and process optical signals, and/or
- N. Engineering, development, and application of photographic science and imaging technology for aerospace applications.

*Specialty Knowledge*

Applied knowledge required include optical engineering, optical science, optical physics, physics, applied physics, opto-mechanical engineering, mechanical engineering, electrical engineering, spectroscopy, solid state physics, semiconductor physics, and laboratory experimental and calibration techniques associated with these knowledge specialties.

## 735 DATA SYSTEMS AND ANALYSIS

**DEFINITION:**

This includes positions engaged in research, development, design, test, analysis, and evaluation of data handling and computing equipment for aerospace and aeronautical purposes (hardware) and the research and development of systems for reducing and computing data (software), or simulating aerospace and/or flight conditions by use of mathematical models, automation, and robotics. This subgroup also includes information technology work that is directly linked to aerospace flight and/or ground data systems.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
735-02	Data Systems	Computer Engineer	GS-854
735-03	Software Systems	Computer Engineer	GS-854
735-05	Data Analysis	Computer Scientist	GS-1550
735-06	Data Systems Analysis	Computer Engineer	GS-854
735-07	Flight Data Systems	Computer Engineer	GS-854
735-08	Ground Data Systems	Computer Engineer	GS-854
735-09	Data Systems and Analysis (GS-7 and GS-9 - Only)	Computer Engineer	GS-854
735-10	Theoretical Simulation Techniques	Aerospace Engineer	GS-861
735-13	Data Hardware Systems	Electronics Engineer	GS-855
735-16	Computer Research and Development	Computer Scientist	GS-1550
735-17	Avionic Systems	Electronics Engineer	GS-855
735-20	Aerospace Information Technology	Computer Engineer	GS-854
735-25	Engineering Optimization	Mathematician	GS-1520
735-90 thru 735-99	*	*	*

\*At the Center’s discretion

### **735-02 Classification**

NASA Title: AST-Data Systems

Class Code: 735-02

OPM Title: Computer Engineer

Series Code: GS-854

#### *Definition of Work*

This specialty includes those positions which involve the conception, planning, specification, design, analysis, development, installation, test, modification, operation, maintenance and use of data handling and computing systems for aerospace, aeronautical, space science and/or earth science vehicles, spacecraft and/or instruments, their support equipment and/or experiment systems (involving both the hardware and software), and data systems for acquiring, reducing, computing, and producing data products to meet end-to-end data systems needs.

Also, included are positions concerned with the development and evaluation of flight data systems, their prototypes, performance requirements, planning and developing simulation analysis systems, and the establishment of design criteria and specifications for system and subsystems. Also, included in this specialty are positions concerned with hardware and software for both flight and ground systems not elsewhere classifiable. Positions concerned with technically planning and directing contracts for the performance of this work are classifiable to this specialty.

#### *Specialty Knowledge*

This specialty requires knowledge and application of several interdisciplinary engineering and physical science disciplines, including knowledge of digital computer systems including computers, peripherals, data handling equipment, interfacing techniques, and data communications systems used to support aerospace, aeronautical, space science and/or earth science instruments and/or experiments, their support equipment and data systems research. Also, knowledge of advanced mathematics and programming techniques for data acquisitions, software development processes and practices, systems engineering, engineering practices and principles, computing, and simulation of these types of systems is required.

### ***735-03 Classification***

NASA Title: AST-Software Systems

Class Code: 735-03

OPM Title: Computer Engineer

Series Code: GS-854

#### *Definition of Work*

This specialty includes those positions that are concerned with the conception, planning, design, development, integration, test, validation and verification, operation and maintenance of software systems for use in flight and ground data systems. Included in this specialty are software systems (including operating systems) used to operate or control aerospace, aeronautical, space science and/or earth science vehicles, spacecraft and/or instruments, their support equipment and/or experiment systems, software systems for in-flight data handling, flight-borne software systems, and ground system command, control, and data acquisition/and processing operations.

Also included in this specialty are positions concerned with the design, development, documentation, and control of the software development process and software development tools, as well as positions requiring analyses of issues relating to ground/flight software and data system tradeoffs. Positions in this specialty may also be concerned with oversight and/or monitoring of contractors engaged in this work.

#### *Specialty Knowledge*

This specialty requires knowledge of software development methodologies, software engineering, programming languages, operating systems and engineering practices and principles as they apply to the development and operation of aerospace, aeronautical, space science and/or earth science vehicles, spacecraft and/or instruments and their subsystems, development and operation of flight hardware (including electronics, electrical and electromechanical systems) ground support equipment, data acquisition and processing systems and launch/launch-related systems. Also required is skill in the application of aerospace engineering practices and principles used in the design, development, documentation, test, validation and verification and operation of aerospace, aeronautical, space science and/or earth science vehicles, spacecraft and/or instruments and supporting ground systems.

### *735-05 Classification*

NASA Title: AST-Data Analysis

Class Code: 735-05

OPM Title: Computer Scientist

Series Code: GS-1550

### *Definition of Work*

This specialty includes positions, which involve the application of mathematics, numerical analysis, data analysis, computational methods or computer science for the solution of aerospace, aeronautical, space science and/or earth science problems. Included in this specialty is:

- A. The development of data reduction, analysis, and visualization software for use by other aerospace, aeronautical, and/or science research development personnel,
- B. The development of procedures and methods for receiving, editing, and converting aerospace and/or science data to quantities and forms that can be analyzed and reported,
- C. The application of computer science methods and techniques to store, manipulate, transform, or present information from aerospace or science systems by means of information systems,
- D. The study of aerospace and/or science problems to understand and develop the most feasible and efficient methods of modeling and solving them,
- E. The analysis of computer models to study physical processes or optimize aerospace system performance, and/or
- F. The development and application of computer simulation techniques; and the evaluation and monitoring of software systems and methods for processing, reducing, and analyzing data to ensure that aerospace and/or science project requirements are met and that equipment is effectively utilized.

Positions in this specialty may also be concerned with oversight and/or monitoring of contractors engaged in this work.

### *Specialty Knowledge*

The work requires knowledge of computer systems, software development practices, statistical methods, advanced mathematics, numerical analysis, and computational methods as used in analyzing, and solving aerospace, aeronautical and/or science research and development problems and an understanding of the aerospace, aeronautical, space science and/or earth science problems involved.

### ***735-06 Classification***

NASA Title: AST-Data Systems Analysis

Class Code: 735-06

OPM Title: Computer Engineer

Series Code: GS-854

### ***Definition of Work***

This specialty includes positions, which involve the end to end planning, design, specification, development and analysis for flight and ground systems and subsystem elements. Positions may include analysis of new or existing data systems architectures including integration and trade-off studies of new technologies and approaches required to meet system requirements. Incumbents of these positions may perform analytical studies of end-to-end engineering data systems including workflow analysis, cost/performance modeling, system capacity planning, process re-engineering, systems integration, and the development of information technology and standards. Also they may specify, design, and develop alternate data systems architectures, which achieve required cost and performance objectives. Included are positions concerned with monitoring contractors engaged in this work, management of complex information technology projects and systems, development of acquisition strategies, documentation of work, and the evaluation of technical proposals.

### ***Specialty Knowledge***

These positions require a broad knowledge of digital computers, computer simulation, and modeling techniques. In addition, knowledge of designing end-to-end systems, capacity planning and performance tuning; plus applicable engineering including information management, computer science concepts, and aerospace problems being investigated.

### ***735-07 Classification***

NASA Title: AST-Flight Data Systems

Class Code: 735-07

OPM Title: Computer Engineer

Series Code: GS-854

#### ***Definition of Work***

This specialty includes positions responsible for conception, specification, analysis, planning, development, installation, test, modification, and use of aerospace pre-mission and launch flight data systems such as flight computers, interconnecting data bus network, input/output processors, and bus interface components for aerospace purposes. This specialty also requires analyzing, studying, and evaluating flight data system concepts and prototypes to determine their capability to meet projected requirements or actual space flight mission performance requirements; planning and developing simulation analysis programs or other ground-based data systems required to test, checkout, or evaluate the performance of proposed flight data systems. Other requirements include integrating independent subsystem components and software with the flight data system into a compatible vehicle system and the establishment of design criteria and specifications for subsystem interfaces; and/or evaluating contractors' proposals for flight data systems and the technical management of contracts involving the design, development, test, and evaluation of flight data systems.

#### ***Specialty Knowledge***

Knowledge required to perform this work are interdisciplinary and span conventional engineering and physical science disciplines, e.g., aerospace, aeronautical, computer, electrical, and electronics, and application of digital computers and software development, as they apply to development, and operation of flight hardware and software systems, including the constraints and reliability requirements of the flight operating environment. Knowledge is also required of engineering practices and principles used in the design, development, test, checkout, and operation of aerospace vehicles, structures, and instrumentation to ensure proper systems development.

### ***735-08 Classification***

NASA Title: AST-Ground Data Systems

Class Code: 735-08

OPM Title: Computer Engineer

Series Code: GS-854

#### *Definition of Work*

This specialty includes positions involving the conception, specification, design, analysis, planning development, installation, test modification and use of both aerospace hardware and pre-mission and launch software ground data systems associated with aerospace hardware. Positions associated with evaluating contractors' proposals, monitoring contracts and evaluating contractors for the performance of this work are classifiable to this specialty.

#### *Specialty Knowledge*

This specialty requires knowledge and application of digital computers, software engineering, and systems engineering principles as they apply to development and operation of aerospace launch and launch-related equipment and ground systems. Knowledge is also required of engineering practices and principles used in the design, development, test, checkout, and operation of aerospace vehicles, structures and instrumentation to ensure proper systems development.

### ***735-10 Classification***

NASA Title: AST-Theoretical Simulation Techniques

Class Code: 735-10

OPM Title: Aerospace Engineer

Series Code: GS-861

### ***Definition of Work***

This specialty includes positions that involve the formulation and study of theoretical and experimental models of aerospace and/or aeronautical research and development problems and the development of corresponding digital computer software. This includes the formulation and reformulation of theoretical models as dictated by computer capacities; supporting research through real-time simulations by programming, developing simulation programs, and interfacing to simulations by programming, developing simulation programs, and interfacing to simulators and hardware devices and involves a knowledge of analytical techniques in fluid and flight mechanics, and other aerospace fields as required. This specialty also involves the determination of specifications of digital computer systems to be programmed for simulation and analysis projects utilizing these theoretical models. Included are positions concerned with monitoring contractors engaged in this work.

### ***Specialty Knowledge***

Incumbents of these positions require detailed knowledge of the aerospace and/or aeronautical problems being investigated, such as knowledge of numerical analysis, advanced mathematics, principles of physics, aerospace engineering, and computer system hardware and software technology.

### ***735-13 Classification***

NASA Title: AST-Data Hardware Systems

Class Code: 735-13

OPM Title: Electronics Engineer

Series Code: GS-855

#### ***Definition of Work***

This specialty includes positions that involve the research, conception, specification, analysis, planning, development, design, installation, test, modification, operation, maintenance, and use of hardware for information transportation, computation and control, including operating systems, for both flight-borne and ground-based applications. This work is concerned with all of the hardware elements associated with information computation, transportation, and control, including processing, communications, networks, input/output systems, subsystem interfaces, systems software, reconfiguration/evolvable hardware, and embedded systems. Also included are positions concerned with working with, monitoring, and assessing contractors engaged in this work.

#### ***Specialty Knowledge***

This work requires a broad knowledge of electrical, electronics, and computer engineering and of systems-level programming principles and practices. In addition, work requires knowledge of computer architecture, logic design, hardware description languages, communications, networking, subsystem interfaces, modeling and simulation techniques, and operating systems concepts. Also required are knowledge of the purpose in which these systems are to be used, the problems to be solved, information to be processed or transported, operational requirements to be met and the constraints associated with the flight and/or ground operating environments.

### ***735-16 Classification***

NASA Title: AST-Computer Research and Development

Class Code: 735-16

OPM Title: Computer Scientist

Series Code: GS-1550

### ***Definition of Work***

This specialty includes positions primarily engaged in professional research or development work involving the theoretical foundations of computer science to evolve new methods and techniques to store, manipulate, transform, or present information related to aerospace systems by means of computer systems. Also of interest is research on the algorithmic aspects of unorthodox and emerging computing paradigms such as neural, DNA, molecular, and quantum computation. The work may involve investigation of fundamental problems of computer architectural facets such as pipeline and parallel processing, language theory, construction, and linguistics in general, artificial intelligence techniques and robotics, machine learning and statistics; quantum computation; collaborative systems design; networking and communications; human machine interface, data management and computer graphics; and software engineering.

### ***Specialty Knowledge***

This specialty requires professional competence in computer science, including such areas as theoretical foundations, system architecture, system software organization, application of computer technology to aerospace vehicle or payload control, data handling and interpretation, mathematical and statistical sciences, hardware and software interfaces and protocols, and design, analysis, and evaluation of software-intensive mission operations systems.

### ***735-17 Classification***

NASA Title: AST-Avionic Systems

Class Code: 735-17

OPM Title: Electronics Engineer

Series Code: GS-855

#### *Definition of Work*

This specialty includes positions that involve the conception, specification determination, analysis, planning, development, installation, testing, modification, and use of avionic systems for both flight and ground applications. This work is concerned with the hardware and software elements required for avionic systems, including system components, component/system interfaces, operating systems, and applications software. The work also requires monitoring, providing technical direction, and evaluating of contractors engaged in this work.

This specialty also includes positions that provide project management of avionic systems. This work includes: leading a team to define, develop, and deliver an avionic system; interface with the customer to define and negotiate technical and programmatic requirements; and planning/managing project activities to deliver products that meet technical specifications within budget and schedule.

#### *Specialty Knowledge*

The work requires a broad knowledge of electrical, electronics, and systems engineering; computer science principles and practices; digital computers, digital logic design, data handling techniques, instrumentation; data acquisitions; and operating systems concepts. Also, required is knowledge of the purpose for which systems are to be used, and the operational requirements to be met. The Project management activities also require knowledge of project management functions such as requirements development, budget planning/execution, and schedule/execution.

Note: This specialty is for positions that require work on systems representing more than one AST electronics engineer sub-group or specialty. They include, but are not limited to the following: communications, instrumentation, commanding, data handling/computing, RF guidance and navigation, tracking, and telemetry.

### *735-20 Classification*

NASA Title: AST-Aerospace Information Technology

Class Code: 735-20

OPM Title: Computer Engineer

Series Code: GS-854

### *Definition of Work*

This specialty includes positions that involve the engineering, analysis, design, test and/or mission operations activities associated with a variety of automated data processing systems. Included are positions that involve establishing and implementing the policies, processes, requirements, and standards that will effect and govern the planning, architecture, acquisition, design, development, management, security, utilization, and measurement of Information Technology (IT) systems, which includes all networking and telecommunications. These IT systems operate within the context of extensive aerospace flight data systems as well as the ground data systems that support flight and or testing of Aerospace systems and include data interchange with these systems. Functions performed may include, but are not limited to:

- A. Operations and Maintenance functions involving related computer and data network systems, including those that directly support or exchange information with aerospace flight systems,
- B. Planning, information technology security (including maintaining firewalls of all systems), program integration and implementation, information resources application re-engineering, information technology architecture, and information resources management policy,
- C. Center-wide activities associated w/ establishing and maintaining the vision, policies, requirements, and standards for information technology,
- D. Coordination among all information management systems,
- E. Institutional information technology support used in office automation and administrative/management systems, including NASA-wide administrative systems in support of flight or test activities,
- F. Performing analytical studies of IT systems including IT security monitoring and process/work flow analysis, cost/performance modeling, system capacity planning, and sensitivity analysis, and/or
- G. Specifying, designing, and developing alternate data systems architectures to achieve required cost and performance goals. Included are positions concerned with monitoring contractors engaged in this work.

### *Specialty Knowledge*

Work requires knowledge of professional engineering concepts, practices, and techniques related to a wide variety of computing and communications systems utilizing new technologies, and to the design, development, and implementation of computer systems and services applicable to aerospace systems. It also requires knowledge of computer systems and practices related to acquisition and evaluation proposals for personal computer hardware, software, and peripheral equipment.

### *735-25 Classification*

NASA Title: AST - Engineering Optimization

Class Code: 735-25

OPM Title: Mathematician

Series Code: GS-1520

### *Definition of Work*

This specialty includes positions that involve research, development, implementation and application of formal or heuristic optimization methods to engineering analysis or design problems. Some positions may include the development of in-house or consortium-led research and development programs or the monitoring of in-house or out-of-house research, development, implementation and application of optimization methods. The work includes:

- A. Conception of candidate formulations and algorithms for optimization-oriented analysis and sensitivity analysis, approximation, and optimization of engineering systems,
- B. Development, verification, validation and benchmarking of computer implementations of the candidate formulations and algorithms,
- C. Combination and customization of components of the standard engineering optimization toolbox for in-house or out-of-house application
- D. Tailoring of the algorithms for maximum efficiency on distributed, heterogeneous, multi-site, multi-user computer environment,
- E. Application of existing algorithms or combination of algorithms to agency and industry problems, involving the identification of the engineering optimization problem, the statement of the problem in a format amenable to optimization solution, the analysis of the solution.
- F. Consulting with users on practical optimization problem formulation, optimization software selection, customization and implementation, problem solution.

### *Specialty Knowledge*

The work is multidisciplinary and requires knowledge in theoretical and applied mathematics, computer science, and engineering, namely:

- 1. Numerical analysis, software engineering,
- 2. Approximation, sensitivity analysis, optimization and algorithm theory,
- 3. Optimization applied to engineering systems: structural sizing, aerodynamic optimization, optimal control.

## 740 FACILITIES AND ENVIRONMENTAL FACTORS

**DEFINITION:**

Includes positions engaged in research, development, design, test, evaluation, and construction of facilities, systems, equipment, controls, and support facilities for use in aerospace and aeronautical research, development, testing and operational activities. Also included are positions involved in planning, developing, coordinating and directing operations for assessing the impact of aerospace and aeronautical operations on the environment.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
740-02	Experimental Facilities Development	Experimental Facilities Development	GS-801
740-03	Facilities Systems Safety	Facilities Systems Safety	GS-801
740-09	Facilities and Environmental Factors (Entry-level positions at GS-7 and GS-9 Only.)	Facilities and Environmental Factors	GS-801
740-10	Mechanical Experimental Equipment	Mechanical Engineer	GS-830
740-15	Gas and Fluid Systems	Gas and Fluid Systems	GS-801
740-20	Electrical Experimental Equipment	Electrical Engineer	GS-850
740-25	Experimental Facilities Techniques	Experimental Facilities Techniques	GS-801
740-30	Aerospace Environmental Control Techniques	Aerospace Environmental Control Techniques	GS-801
740-35	Aerospace Experimental Facilities and Test Technologies	Aerospace Experimental Facilities and Test Technologies	GS-801
740-90 thru 740-99	*	*	*

\*At the Center's discretion

### ***740-02 Classification***

NASA Title: AST-Experimental Facilities Development

Class Code: 740-02

OPM Title: AST-Experimental Facilities Development

Series Code: GS-801

### ***Definition of Work***

This specialty includes positions that involve the planning, design, and development of facilities, systems, and equipment used in the conduct of aerospace research, development, and operations programs. Applications may include ground-based experimental facilities; airborne and ground-based instruments; space flight payloads; life science experiments, centrifuges, and chambers; wind tunnels and wind tunnel models; simulators, robotics, prototypes and test beds; aircraft modifications; and launch and ground support equipment. Work may encompass development of new systems or modifications to existing facilities and equipment, and generally extends to include oversight of fabrication, construction, installation, and integration of hardware and systems; planning and performance of verification and acceptance tests; and support of operations activities. Some positions involve project planning, contract management, systems engineering, or general management functions.

### ***Specialty Knowledge***

This specialty requires knowledge that span conventional engineering and physical science disciplines, e.g., mechanical engineering, structural engineering, electrical engineering, civil engineering, aeronautical engineering, environmental engineering, physics, mathematics, and architecture.

### *740-03 Classification*

NASA Title: AST-Facility Systems Safety

Class Code: 740-03

OPM Title: AST-Facility Systems Safety

Series Code GS-801

### *Definition of the Work*

This specialty includes positions responsible for identifying and controlling hazards in aerospace or aeronautical engineering, scientific research, or developmental facilities and facility operations. This includes evaluating, coordinating, monitoring, and performing engineering systems safety analyses of facilities, systems, equipment, and operations. Facilities include wind tunnels, test facilities and stands, laboratories, space environment chambers, vibration and acoustic equipment, launch operation facilities, pressure vessels, static and dynamic flight trainers, etc.

Positions also may be responsible for evaluating safety techniques and procedures associated with the design, development, construction, modification, and/or operation of aerospace or aeronautical facilities, systems, and related equipment. These duties include:

- A. Developing, implementing, and evaluating engineering safety policies, standards, and directives,
- B. Conducting systems safety trade-off studies,
- C. Evaluating configuration management controls,
- D. Reviewing human engineering assessments,
- E. Evaluating hazards, fault-tree, sneak circuit, and failure mode effect analyses, and/or
- F. Providing conceptual safety guidance during the definition phase of programs, providing engineering systems safety analysis during program operations, evaluating incident and mishap investigation results, and recommending systems safety adjustments in research and development activities. Provides safety analysis report (SAR) defining risk being assumed for program management approval.

### *Specialty Knowledge*

The work requires interdisciplinary engineering and/or physical science knowledge appropriate to the specific aerospace facility, system, or equipment with which the position is concerned. Work in this specialty requires consideration of problems peculiar to the aerospace research and development environment, as well as knowledge of aerospace program objectives and the risk management concepts fundamental to accomplishing these objectives. These positions employ and utilize system safety techniques and apply them to ground systems; ground support equipment; research, development, and test facilities; and facility operations.

### ***740-10 Classification***

NASA Title: AST-Mechanical Experimental Equipment

Class Code: 740-10

OPM Title: Mechanical Engineer

Series Code: GS-830

### ***Definition of Work***

This specialty includes positions responsible for planning, developing, designing, testing, or evaluating mechanical, electromechanical, pneumatic, hydraulic, and structural equipment and systems for aerospace programs. The work requires analysis of program objectives in terms of specific requirements and the planning, developing, and/or designing of models, tools, tooling devices, special mechanical devices, articulations, and machinery, e.g., space structural models, flight hardware, arc chambers, remotely controlled models, test sections or stands, required to fulfill program objectives. Included are positions concerned with monitoring contractors engaged in this work.

### ***Specialty Knowledge***

The work requires a detailed knowledge of mechanical and/or structural systems and consideration of phenomena peculiar to aerospace research and development. Knowledge, although primarily mechanical, span conventional engineering and/or physical science disciplines, such as mechanical, structural, aerospace, aeronautical, materials, electrical, chemical, and physics.

### **740-15 Classification**

NASA Title: AST-Gas and Fluid Systems

Class Code: 740-15

OPM Title: AST-Gas and Fluid Systems

Series Code: GS-801

#### *Definition of Work*

This specialty includes positions responsible for the development and design of systems and equipment for achieving, changing, or controlling gases or liquids used in aerospace systems and related support equipment. Work involves the performance of applied research and experimentation to develop new concepts of design and construction specifications for equipment and systems for compressing, storing, piping, evacuating, heating, drying, purifying, purging, cooling, liquefying, sensing, and mixing fluids and/or gases under extreme conditions and performance requirements. Included are positions concerned with monitoring contractors engaged in this work.

#### *Specialty Knowledge*

Knowledge required to perform this work span conventional engineering or physical science disciplines, e.g., structural, chemical, mechanical, control systems, aerospace, and physics. Additionally, positions require detailed knowledge of both the properties and compatibility of gases or fluids and the structural systems work with. Positions must include cognizance of new developments in associated systems, unique safety considerations, and programmatic and policy constraints.

### **740-20 Classification**

NASA Title: AST-Electrical Experimental Equipment

Class Code: 740-20

OPM Title: Electrical Engineer

Series Code: GS-850

#### *Definition of Work*

This specialty includes positions which involve planning, designing, and developing of electrical equipment and systems used to power and control specialized research and development facilities, equipment, and process systems. The equipment and systems developed are integrated or associated with such facilities as wind tunnels, test stands, scientific laboratories, space environment chambers, launch and ground support equipment, arc jets, specialized test systems, flight simulators, computational facilities, and tracking and data gathering facilities. Typical equipment includes special test control panels, servo systems, wind tunnel control systems, high and low voltage power distribution systems, distributed control systems, motor/generator equipment, and primary power substations, with related electronic sensing, measuring, protective relaying, and control devices. Typically, work extends to the modification, construction, checkout, and acceptance of equipment and systems and includes activities associated with the reliability centered maintenance of facilities. Individual positions also may be engaged in the engineering analysis, planning, direction, design, coordination, and evaluation of contracted efforts in this type of work.

#### *Specialty Knowledge*

This work requires a detailed knowledge of electrical systems, electrical codes and standards, experimental programs, and consideration of phenomena peculiar to aerospace research and development. Knowledge, although primarily electrical, spans conventional engineering and physical science disciplines such as electronics, computers, aerospace, aeronautical, physics, chemical, and mechanical.

### **740-25 Classification**

NASA Title: AST-Experimental Facilities Techniques

Class Code: 740-25

OPM Title: AST-Experimental Facilities Techniques

Series Code: GS-801

### *Definition of Work*

This specialty includes positions which involve the operation of experimental facilities and equipment, including the design and development of procedures, techniques, and methods of equipment operations, the design of facility modifications to meet changing research or test requirements, the establishment of test conditions and operations safety and environmental requirements, and the analysis and validation of test data. Typical facilities include human and non-human rated simulators, wind tunnels, hypervelocity ballistic ranges, hyperbaric and hypobaric test facilities-both human and non-human rated, high vacuum-high voltage chambers, vibration and acoustic test facilities, and specialized structural and high/low temperature test facilities with associated power and support equipment; and mechanical, electrical and electronics data sensing, gathering, and reduction devices and instrumentation. Incumbents also may participate in the screening and selection of proposed test projects, the direction and monitoring of contractor operations, and conduct of applied research.

### *Specialty Knowledge*

This work requires a detailed knowledge of the experimental program, as well as a complete knowledge of the physical and operational characteristics of specific facilities and equipment. The work is interdisciplinary and spans engineering and physical science fields such as mechanical, aerospace, aeronautical, electrical, structural engineering, optics, and physics.

### *740-30 Classification*

NASA Title: AST-Aerospace Environmental Control Techniques

Class Code: 740-30

OPM Title: AST-Aerospace Environmental Control Techniques

Series Code: GS-801

### *Definition of Work*

This specialty includes positions whose duties are involved with, but not limited to:

- A. Establishing, maintaining, monitoring, reporting, and making functional assessments of environmental programs through all development and operations phases of space payloads, aerospace or aeronautical systems, launch systems, orbital and sub orbital experimental spacecraft, ground support infrastructure and basic research and development projects in support of NASA's missions,
- B. Investigating environmental contamination resulting from past aeronautics and space systems and processes and design, construction, and operation of remediation systems associated with this contamination,
- C. Establishing policy, budgeting, and interfacing with regulatory agency personnel, planning and designing, engineering analysis, environmental system validation, environmental aspects of program management, and environmental compliance functions to limit pollution releases, that affect agency activities. This includes an understanding of how proposed and existing aerospace systems and processes interact with the environment and the associated regulatory impacts, and/or
- D. Identification and application of pollution control devices that allow aeronautical and space systems and processes to operate in environmental compliance. This also includes the selection, design, construction, and operation of these devices.

The chief objective of these positions is the responsibility for identifying, analyzing, and controlling environmental hazards - short and long term - in aerospace facility and flight systems research, development, test and operations, with the objectives of ensuring environmental regulatory compliance and controlling or reducing pollution, contamination, and deterioration of the soil, water, air, and outer space life system environments of humans and other life forms.

### *Specialty Knowledge*

Knowledge required to perform this work are interdisciplinary and span conventional engineering and natural environmental disciplines, e.g. aerospace, aeronautical, mechanical, civil, chemical, and environmental with the principal emphasis being on ensuring environmental regulatory compliance and protection of air, land, and water resources. Work in this specialty requires consideration of problems peculiar to the aerospace research and development environment being supported, as well as knowledge of aerospace program objectives and risk management concepts. Such work requires (1) professional knowledge of the principles, methods, and techniques of engineering concerned with aerospace facilities and systems for controlling pollution and protecting the quality of resources and the environment, (2) knowledge of environmental and safety regulations, and (3) an understanding of and

the ability to utilize pertinent aspects of chemistry, biological sciences, and public health that pertain to the control or elimination of pollutants/contaminants and the remediation of these contaminants.

### ***740-35 Classification***

NASA Title: AST-Aerospace Experimental Facilities and Test Technologies

Class Code: 740-35

OPM Title: AST-Aerospace Experimental Facilities and Test Technologies

Series Code: GS-801

### ***Definition of Work***

This specialty includes positions which involve the direction of experimental aerospace tests in major research or test facilities and the management of these aerospace research/test facilities; including resource management, planning, and project management of sophisticated experiments and the development of complex test articles as well as the development of new test capabilities or significant modifications to the existing research/test facilities; planning, direction, and management of all aspects associated with the facilities; and assuring safety of all experiments and test facilities; development and implementation of new test technology; and analysis and validation of test data. Incumbents also may participate in the screening and selection of proposed test projects, the direction and monitoring of contractor conducted studies, designs, and facility modifications, and conduct of applied research and or testing.

### ***Specialty Knowledge***

This work requires a detailed knowledge of aerospace testing technology, test facilities, test systems and project management. The work is interdisciplinary and spans engineering and physical science fields such as aerodynamics, thermodynamics, fluid mechanics, structures, systems safety, instrumentation, vacuum systems, cryogenics, rotating machinery, combustion, manufacturing processes, optics, and physics.

## 745 OPERATIONS

**DEFINITION:**

Includes positions responsible for developing and analyzing operational concepts and planning space flight operations; management and integration of the operations activities required to support space flight missions; and positions that develop and validate flight procedures and activity plans, establish requirements for and conduct training of space flight crews. Also covered are members of space flight crews, pilots of research and development aircraft, and robotic operations.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
745-02	Flight Training	Flight Training	GS-801
745-03	Flight Systems Operations	Flight Systems Operations	GS-801
745-04	Mission Support Requirements and Development	Mission Support Requirements and Development	GS-801
745-05	Mission Operations Integration	Mission Operations Integration	GS-801
745-06	Management Astronaut	Management Astronaut **	GS-801** GS-1301**
745-07	Astronaut	Astronaut ** ** Medical Officer	GS-801** GS-1301** GS-401** GS-602**
745-08	Astronaut Pilot	Aerospace Engineer	GS-861
745-09	Operations (GS-7/GS-9 Only)	Operations	GS-801
745-10	Research Pilot	Aerospace Engineer	GS-861
745-11	Launch and Flight Operations	Launch and Flight Operations	GS-801
745-12	Aircraft Mission Operations	Aircraft Mission Operations	GS-801
745-14	Educator Astronaut	Educator Astronaut **	GA-801** GS-1301**
745-15	Flight Systems Training and Operations	Flight Systems Training and Operations	GS-801

745-20	Payload Processing Operations	Payload Processing Operations	GS-801
745-90 thru 745-99	*	*	*

\*At the installation's discretion

\*\*NOTE: This is an interdisciplinary specialty that includes positions that may be incumbered by either engineers or scientists. The final OPM series and title of a specific position is determined by the qualifications of the individual who fills it, and is recorded on the position description.

### **745-02 Classification**

NASA Title: AST-Flight Training

Class Code: 745-02

OPM Title: AST-Flight Training

Series Code: GS-801

### **Definition of Work**

This specialty includes positions responsible for:

- A. Developing training operational concepts, establishing mission-specific technical training requirements and objectives for members of space flight crews and flight control personnel assigned to perform and support manned space flight operations,
- B. Conducting engineering analysis to develop and validate procedures for crew activity performed during human space flights and to produce appropriate cue cards, checklist, and handbooks,
- C. Providing technical training and certification of space flight crews and ground personnel through briefings, classroom instructions, part-task trainers, one-g trainers, water tank facilities, part-task simulators, mission simulators, and other specialized facilities and trainers,
- D. Establishing hardware, software, and physical plant requirements for aeronautical and aerospace training facilities and equipment such as mission trainers, simulators, and related support equipment,
- E. Planning, developing, coordinating, and directing training related real-time trouble shooting operations for human and robotic space flight, and/or
- F. Conducting post-flight mission evaluations to ensure that mission objectives were met, problem areas identified, and corrective action taken.

### **Specialty Knowledge**

Knowledge required to perform this work span conventional engineering or physical science disciplines, such as aerospace, aeronautical, mechanical, electrical, and physics.

### ***745-03 Classification:***

NASA Title: AST-Flight Systems Operations

Class Code: 745-03

OPM Title: AST-Flight Systems Operations

Series Code: GS-801

### ***Definition of Work***

This specialty includes positions responsible for:

- A. Developing operational concepts, plans, procedures, and real time support requirements for spacecraft hardware and software systems as required for the real-time flight control of human space flight and robotic space vehicles. This includes system-related flight control techniques, programs, procedures, documentation, and configuration control and flight data files,
- B. Analysis of integrated spacecraft and payload systems in order to identify potential in-flight malfunctions and contingencies and to develop required detection corrective procedures, and execution plans,
- C. Participating in mission, spacecraft, and on-board systems design activities necessary to ensure compatibility between mission objectives, vehicle capabilities, crew safety, and mission success, and/or
- D. Planning, developing, integrating, and directing real-time operations for human space flight and robotic space vehicles.

### ***Specialty Knowledge***

Knowledge required to perform this work span conventional engineering or physical science disciplines such as aerospace, aeronautical, mechanical, electrical, physics, mathematics, and computer science.

### ***745-04 Classification***

NASA Title: AST-Mission Support Requirements and Development

Class Code: 745-04

OPM Title: AST-Mission Support Requirements and Development

Series Code: GS-801

### ***Definition of Work***

This specialty includes positions responsible for developing and analyzing operational concepts, requirements, plans, schedules, and documentation for planning, conducting, and evaluating spaceflight operations. This includes:

- A. Mission control, payload operations control, and flight control network operational requirements, plans, procedures, and concepts,
- B. Mission and crew operational requirements, data acquisition requirements, and technical documentation requirements for spacecraft systems products,
- C. Spaceflight-related ground support systems requirements for data acquisition and/or mission control management,
- D. Ground support systems and data base concepts and requirements to support pre-mission planning and scheduling, and/or
- E. Integrated computer hardware and software systems to determine suitability to present and future spaceflight mission requirements.

### ***Specialty Knowledge***

Knowledge required to perform this work span conventional engineering or physical science disciplines, such as aerospace, aeronautical, mechanical, electrical, and physics.

### *745-05 Classification*

NASA Title: AST-Mission Operations Integration

Class Code: 745-05

OPM Title: AST-Mission Operations Integration

Series Code: GS-801

### *Definition of Work*

This specialty includes positions responsible for the overall management and integration of the operations activities required to support human space flight missions. Specific areas of responsibility include:

- A. Management and integration of the flight products required to configure flight and ground systems, train flight crews and ground support personnel, conduct mission operations, and accomplish mission objectives,
- B. Development, control, and implementation of flight systems hardware and software operational requirements,
- C. Assessment of the capability of the various NASA centers to support operational requirements,
- D. Planning, directing, and controlling the activities of the ground support team, including certifying flight control team members for initial proficiency and subsequent periodic re-certifications, and/or
- E. Conducting post-flight mission evaluations to ensure that mission objectives were met, problem areas identified, and corrective action taken.

### *Specialty Knowledge*

Knowledge required to perform this work span conventional engineering or physical science disciplines, such as aerospace, aeronautical, mechanical, electrical, and physics.

### ***745-06 Classification:***

NASA Title: AST-Management Astronaut

Class Code: 745-06

OPM Title\*: AST-Management Astronaut

Series Code: GS-801

OPM Title\*: AST-Management Astronaut

Series Code: GS-1301

### ***Definition of Work***

This specialty includes positions performing functions for which space flight experience as an astronaut is required. This includes providing, managing, and/or integrating flight crew insight and input for a wide-range of Agency, National, and International activities associated with the design, development, modification, and operation of spacecraft systems and subsystems, payloads, and flight crew equipment. Duties may also include monitoring contractors engaged in support of this work.

### ***Specialty Knowledge***

Incumbents of these positions require a detailed knowledge of spacecraft and payload systems and their operational characteristics, mission requirements and objectives, spacecraft systems and associated crew interfaces, and supporting systems and equipment; knowledge of the process and life-cycle of training and preparing for a space flight mission; experience serving on a space flight mission; knowledge of unique human flight crew requirements as it relates to design, development, modification and operations of spacecraft systems and subsystems; and/or detailed knowledge of spacecraft and payload systems and their operational characteristics, mission requirements and objectives, spacecraft systems and associated crew interfaces, and supporting systems and equipment.

\*NOTE: This is an interdisciplinary specialty that includes positions that can be encumbered by either engineers or scientist. The final OPM series and title of a specific position is determined by the qualifications of the individual who fills it, and is recorded on the position description.

### *745-07 Classification*

NASA Title: AST-Astronaut	Class Code: 745-07
OPM Title*: AST- Astronaut	Series Code GS-801
OPM Title*: AST- Astronaut	Series Code: GS-1301
OPM Title*: AST-Astronaut	Series Code: GS-401
OPM Title*: Medical Officer	Series Code: GS-602

### *Definition of Work*

This specialty includes positions serving as Astronaut Pilots with responsibility as commander, pilot, or flight engineer during spaceflight missions. During flight, the commander will have on-board responsibility for the space vehicle, crew, mission success, and safety of flight. The pilot and flight engineer will assist the commander in controlling and operating the spacecraft. In addition, pilots and flight engineers may be responsible for extravehicular activities and robotics operations; performing maintenance, modifications, or assembly operations; and assisting in specific experiments and payload operations, as required.

Responsibilities include training as a pilot in various simulator facilities and serving as a crew member aboard training aircraft to become proficient in aspects of aircraft operations including flight planning, communications, nominal and emergency checklist procedures, actual aircraft control as appropriate, and flight crew coordination in the dynamic flight environment. Executes spacecraft flight procedures covering both nominal and malfunction conditions.

During non-flight periods, the pilot astronaut will be involved in activities such as the following:

- A. Undergoing mission-specific training and simulations for future missions
- B. Performing a variety of technical assignments to provide flight crew input for spacecraft design, development, and modification of spacecraft systems and subsystems, operations planning, flight crew equipment development, and participating in hardware and software test and checkout.
- C. Serving as a member of a mission control team as a spacecraft communicator
- D. Providing flight crew and mission support during pre-launch and post-mission activities at various launch and landing sites.

Duties may also include monitoring contractors engaged in this work.

### *Specialty Knowledge*

Incumbents of these positions require a detailed knowledge of spacecraft and payload systems and their operational characteristics, mission requirements and objectives, spacecraft systems and associated crew interfaces, the supporting systems and equipment for each of the experiments conducted on assigned missions, and proficiency in payload operations. They are also expected to maintain excellent physical condition and are required to successfully pass a NASA Class II physical examination annually. In addition, the incumbents will serve as crew members aboard the NASA training aircraft in order to become proficient in many aspects of aircraft operations including flight planning, communications,

nominal and emergency checklist procedures, actual aircraft control as appropriate, and flight crew coordination in the dynamic flight environment.

The work, although primarily aerospace or aeronautical, is interdisciplinary and spans conventional engineering and scientific disciplines. The nature of research assignments and medical monitoring responsibilities specific to positions of Astronaut - Medical Officer require that incumbents hold a degree of Doctor of Medicine from an accredited institution and a current license to practice Medicine.

\* NOTE: This is an interdisciplinary specialty that includes positions that may be encumbered by either engineers, scientists or physicians. The final OPM series and title of a specific position is determined by the qualifications of the individual who fills it, and is recorded on the position description.

### **745-08 Classification**

NASA Title: AST-Astronaut Pilot

Class Code: 745-08

OPM Title: Aerospace Engineer

Series Code: GS-861

#### *Definition of Work*

This specialty includes positions serving as Astronaut Pilots with responsibility as commander, pilot, or flight engineer during spaceflight missions. During flight, the commander will have on-board responsibility for the space vehicle, crew, mission success, and safety of flight. The pilot and flight engineer will assist the commander in controlling and operating the spacecraft. In addition, pilots and flight engineers may be responsible for extravehicular activities and robotics operations; performing maintenance, modifications, or assembly operations; and assisting in specific experiments and payload operations, as required.

Responsibilities include training as a pilot in various simulator facilities and serving as a crew member aboard training aircraft to become proficient in aspects of aircraft operations including flight planning, communications, nominal and emergency checklist procedures, actual aircraft control as appropriate, and flight crew coordination in the dynamic flight environment. Executes spacecraft flight procedures covering both nominal and malfunction conditions.

During non-flight periods, the pilot astronaut will be involved in activities such as the following:

- A. Undergoing mission-specific training and simulations for future missions
- B. Performing a variety of technical assignments to provide flight crew input for spacecraft design, development, and modification of spacecraft systems and subsystems, operations planning, flight crew equipment development, and participating in hardware and software test and checkout.
- C. Serving as a member of a mission control team as a spacecraft communicator
- D. Providing flight crew and mission support during pre-launch and post-mission activities at various launch and landing sites.

Duties may also include monitoring contractors engaged in this work.

#### *Specialty Knowledge*

Incumbents of these positions require a detailed knowledge of spacecraft and payload systems and their operational characteristics, mission requirements and objectives, spacecraft systems and associated crew interfaces, and the supporting systems and equipment for experiments conducted on assigned missions as well as payload operations. They are also expected to maintain excellent physical condition and are required to successfully pass a NASA Class I physical annually. These positions also require proficiency in piloting high performance fixed-wing aircraft and other mission training aircraft.

The work, although primarily aerospace or aeronautical, is interdisciplinary and spans conventional engineering and scientific disciplines.

### **745-10 Classification**

NASA Title: AST-Research Pilot

Class Code: 745-10

OPM Title: Aerospace Engineer

Series Code: GS-861

#### *Definition of Work*

This specialty includes positions which involve the piloting of aircraft used in research, development, and test programs; evaluating test parameters; performing flight and/or ground simulations of advanced missions and aircraft; and actively participating with project engineers and scientists responsible for the development, design, testing, evaluation, and reporting on new aircraft concepts and/or new advanced aircraft systems. This includes:

- A. Piloting one-of-a-kind or highly modified research and development aircraft and/or advanced simulators in conjunction with research and test projects. This includes the definition of requirements pertaining to aircraft stability and control, equipment performance, pilot needs, escape systems, and on-board and ground support equipment,
- B. Conducting reducing gravity research and test projects,
- C. Providing consultation and technical inputs in support of research efforts, offering engineering expertise from the special vantage point of the pilot, and recommending engineering solutions to analyzing and evaluating test results and preparing sections of research reports,
- D. Serving as instructor pilot and/or flight examiner on initial checkout flights, standardization check flights, and instrument check flights for those required to maintain proficiency,
- E. Performing functional check flights following aircraft maintenance and modifications, and/or
- F. Providing real-time aircraft support to manned space flight missions.

#### *Specialty Knowledge*

The work requires a detailed knowledge of, and extensive experience in, aircraft operations, especially high performance, and extended envelope fixed-wing and/or rotary-wing experimental aircraft. In addition, the work also requires knowledge of and proficiency in aeronautical engineering and related engineering and scientific fields.

### **745-11 Classification**

NASA Title: AST-Launch and Flight Operations

Class Code: 745-11

OPM Title: AST-Launch and Flight Operations

Series Code: GS-801

### *Definition of Work*

This specialty includes positions that involve planning, developing, coordinating, and directing aerospace flight vehicle launch and landing operations. Both the launch and flight operations associated with aerospace test flights of short duration, such as probes and ballistic shots, are usually combined and handled by one position. Such positions are also included in this specialty.

Normally, this work involves functions such as:

- A. Planning for pre-launch, launch, and landing activities, which include familiarization with the total space vehicle system, and the flight objectives,
- B. Development of procedures for preflight assembly and checkout of the space vehicle and its major systems,
- C. Development of a launch and landing plan which includes range safety plans and procedures; countdown procedures; arranging necessary range support, such as instrumentation, data handling, range clearance, tracking, and the participation, if required, of cooperating agencies; actual launching of the space vehicle; and the activities immediately following the launch, and/or
- D. Preparation of landing facilities and supporting operations and evaluation of the launch and landing including preparation of reports of the operation.

### *Specialty Knowledge*

Professional engineering knowledge required to perform this work cut across conventional disciplines such as mechanical, electrical, electronics, aerospace, and chemical.

### *745-12 Classification*

NASA Title: AST-Aircraft Mission Operations

Class Code: 745-12

OPM Title: AST-Aircraft Mission Operations

Series Code: GS-801

### *Definition of Work*

This position involves planning, developing, directing, and coordinating the activities necessary to conduct national and international scientific missions aboard aircraft. Such missions employ aircraft as platforms for sensor development and for in situ and remote measurements in fields such as astronomy, earth resources, ocean processes, atmosphere, meteorology, materials processing, life sciences, and communications. Examples of aircraft platforms are the DC-8, the ER-2, and the P-3B aircraft. The work includes elements of the following:

- A. Determining and coordinating investigator requirements for assigned missions, considering such matters as resource availability, aircraft capabilities, experiment technical and scientific requirements, aircraft configuration management, and mission safety,
- B. Coordinating, developing, and/or conducting investigator orientation and training; developing equipment interface and operational constraints; and establishing and monitoring safety procedures,
- C. Coordinating mission experiment payload planning, integration, installation, and safety verification. Preparing and/or making presentations and reviews to NASA management and others for approval,
- D. Coordinating aircraft, flight, and ground crews; mechanical and electronic design engineers; remote and in situ instrumentation scientists; and shop technicians. Assist or serve as a Mission Director during flights,
- E. Coordination of engineering design changes and modifications necessary to meet the needs of the investigators or facility upgrades, and/or
- F. Coordination and/or determination of deployment sites to meet the mission objectives, Arranging for logistics support at deployment sites, domestic and foreign, and obtaining necessary diplomatic clearances.

### *Specialty Knowledge*

The work requires knowledge of aircraft operations, aircraft performance capabilities, aircraft systems, and safety requirements, together with knowledge in engineering and/or the physical sciences in order to understand the nature of the investigator's instruments and requirements. The work also requires an ability to work effectively in a team environment with investigators, domestic and foreign; with domestic organizations, (i.e., other Government agencies, universities, and airport officials) and with overseas organizations, such as U.S. embassies and foreign officials. In addition to technical and teaming skills, management and leadership skills are required to meet schedules, budgets, and objectives. The work also requires extensive periods of travel and the ability to work at remote sites in areas of extreme weather conditions.

### *745-14 Classification*

NASA Title: AST-Educator Astronaut	Class Code: 745-14
OPM Title*: AST-Educator Astronaut	Series Code: GS-801
OPM Title*: AST-Educator Astronaut	Series Code: GS-1301
OPM Title*: Other	Series: Other

### *Definition of Work*

This specialty includes positions responsible for serving as Educator Astronauts during space flight missions. Educator Astronauts may serve as flight engineers, payload operators, or scientists during space flight. In these roles, they may have the overall responsibility for the operation of spacecraft and payload systems, and may also perform extravehicular activities and robotics operations. In addition, they will perform or assist in specific experiment operations, and perform maintenance, modifications, or assembly operations. During periods between flight assignments, the Educator Astronauts undergo training and simulations for future missions and will be involved in activities such as the following:

- A. Communicating their pre-flight, in-flight, and post-flight experiences to educators, students and the public to demonstrate the relevance and rewards of study in the fields of science, technology, engineering and mathematics and inspire the next generation of explorers by connecting these concepts to human spaceflight, NASA's various missions and other real world applications.
- B. Working with educators and education organizations to develop education materials (e.g., print and multi-media supplementary curricula) and professional development strategies supporting accepted curriculum standards based on their space flight experience.
- C. Assisting in developing education strategies and procedures to be used to support the needs of the education community.
- D. Providing flight crew input into the design, development, or modifications of spacecraft systems, subsystems and payloads, operations planning, and flight crew equipment development. Participating in hardware and software test and checkout.
- E. Serving as a member of mission control teams as a spacecraft communicator.
- F. Providing flight crew, mission, and vehicle support during pre-launch and post-mission activities at various launch and landing sites.

### *Specialty Knowledge*

The work, although primarily aerospace or aeronautical, is interdisciplinary and spans conventional engineering and scientific disciplines to include educator competencies sufficient to promote study in the fields of science, technology, engineering and mathematics. The incumbents must possess the ability to communicate their experiences to educators, students and the public for the purpose of promoting study in the fields of science, technology, engineering and mathematics. Incumbents of these positions also require a detailed knowledge of spacecraft and payload systems and their operational characteristics, the mission requirements and objectives, the spacecraft systems and associated crew interfaces, as well as the supporting equipment for each of the experiments conducted on assigned

missions, including proficiency in payload operations. In addition, they require proficiency to serve as crew-members in a high-performance fixed-wing aircraft. They are also expected to maintain excellent physical condition and are required to successfully pass a NASA Class II physical examination annually.

\*NOTE: This is an interdisciplinary specialty that includes positions that may be encumbered by either engineers or scientists. The final OPM series and title of a specific position is determined by the qualifications of the individual who fills it, and is recorded on the position description.

### *745-15 Classification*

NASA Title: AST-Flight Systems Training and Operations

Class Code: 745-15

OPM Title: AST-Flight Systems Training and Operations

Series Code: GS-801

### *Definition of Work*

This specialty includes positions responsible for developing training and real-time operational mission concepts; conducting engineering analysis to validate human space flight activities; developing certification training for flight control teams; and participating in human space flight mission operations. Specifically:

- A. Developing operational concepts, plans, procedures, and real time support requirements for spacecraft hardware and software systems as required for the real-time flight control of human space flight, robotic space vehicles (including payloads) and space-based science instruments. This includes system-related flight control techniques, procedures, documentation, flight data files and configuration management of flight operations products.
- B. Developing training operational concepts, establishing mission-specific technical training requirements and objectives for certification of space flight crews and flight control personnel assigned to perform manned space flight operations,
- C. Conducting engineering analysis to develop and validate procedures for on-board crew and ground activities performed during human space flights, to produce appropriate procedures, cue cards, checklists, and handbooks, to identify potential in-flight malfunctions and contingencies, and to develop required real-time and training execution plans,
- D. Providing technical training and certification of space flight crews and ground personnel through briefings, classroom instruction, part-task trainers, one-g trainers, water tank facilities, mission simulators, and other specialized facilities and trainers,
- E. Participating in mission, spacecraft, on-board systems, and mission trainers requirements definition and design activities necessary to ensure compatibility between mission objectives, vehicle capabilities, crew safety, and mission success,
- F. Planning, developing, integrating, and directing real-time and training operations for human space flight and robotic space vehicles, and/or
- G. Conducting post-flight mission evaluations to ensure that mission objectives were met, problem areas identified, and corrective actions taken.

### *Specialty Knowledge*

Knowledge required to perform this work span conventional engineering or physical science disciplines such as aerospace, aeronautical, mechanical, electrical, physics, mathematics, and computer science; and requires detailed knowledge of space flight training and operations required to support human space flight missions.

### ***745-20 Classification***

NASA Title: AST-Payload Processing Operations

Class Code: 745-20

OPM Title: AST-Payload Processing Operations

Series Code: GS-801

### ***Definition of Work***

This specialty includes positions that involve planning and developing overall site support, coordination and integration of aerospace payload and experiment processing. These responsibilities begin prior to the time hardware arrives at launch center integration facilities and carry through launch and post-landing activities. Work includes elements of the following:

- A. Coordinating resources scheduling for personnel, skills, equipment, and facilities,
- B. Conducting payload integration activities,
- C. Preparing and developing technical requirements and integrated test procedures for payload test and checkout of flight and GSE systems, and/or
- D. Ensuring payload processing activities are integrated with launch vehicle operations planning.

### ***Specialty Knowledge***

The knowledge required by incumbents of these positions includes a broad interdisciplinary professional engineering background involving all disciplines, practices, and procedures associated with payload processing and launch preparations, including payload systems, facilities, and supporting equipment. In addition, the incumbents must have a working knowledge of launch center policies, regulations, and procedures associated with payload planning and processing.

## 770 MANAGEMENT

### DEFINITION:

Includes positions engaged in program development, direction, and coordination of aerospace and aeronautical research, development, design, test, and operations efforts. The work includes determination and evaluation of project/program requirements; overall long- and short-range planning; formulation and implementation of project/program management systems and controls; management of resources; identification and resolution of interface, integration, and technical problems; conduct and/or participation in status reviews; and documenting and reporting the status, results, problems, concerns, etc., and assessment of contractor performance.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
770-01	Senior Executive	**	**
770-10	Engineering Project Management	Engineering Project Management	GS-801
770-11	Science Project Management	Physical Scientist	GS-1301
770-29	Physical Science Technical Management	Physical Scientist	GS-1301
770-30	Technical Management	Technical Management	GS-801
770-32	Technical Resources Management	Technical Resources Management	GS-801
770-33	Physical Science Technical Resources Management	Physical Scientist	GS-1301
770-34	Technical Engineering Operations Management	Technical Engineering Operations Management	GS-801
770-40	Engineering Technology Utilization and Commercialization	Engineering Technology Utilization and Commercialization	GS-801
770-41	Science Technology Utilization and Commercialization	Physical Scientist	GS-1301
770-56	Launch Site Support Management	Launch Site Support Management	GS-801
770-60	Engineering Program Management	Engineering Program Management	GS-801

770-61	Science Program Management	Physical Scientist	GS-1301
770-77	Logistics Engineering Management	Logistics Engineering Management	GS-801
770-90 thru 770-99	*	*	*

**NOTE:** Specialties in this subgroup are to be used only when no other specialty appropriately describes the work being performed. Also, the work must clearly influence management considerations with respect to research, development, or operations in the aerospace field, be directly related staff work, and/or provide direct technical support.

\*\* At the Center's discretion

\* The Agency Executive Personnel Office approves the OPM Title and Series. Positions in this Specialty are restricted to professional series within the OPM engineering and science Groups.

NASA Class Code	NASA Specialty Title	OPM Series Title	OPM Series
795-00	Expert		
796-00	Consultant		
799-00	Student Trainee (Engineering)	Student Trainee (Engineering)	GS-899
799-01	Student Trainee (Physical Science)	Student Trainee (Physical Science)	GS-1399

### ***770-01 Classification***

NASA Title: AST-Senior Executive

Class Code: 770-01

OPM Title: (See Note Below for OPM Title and Series)

Series Code: ----

### ***Definition of Work***

This specialty includes NASA AST positions that are subject to Presidential appointment with Senate confirmation and are paid on the Executive Schedule (EX); and positions in the Senior Executive Service (SES), paid on the SES Pay Schedule (ES).

Positions in the SES generally cover managerial, supervisory, and policy positions above grade GS-15 that are not filled by Presidential appointment with Senate confirmation. A position meets the SES functional criteria if its incumbent engages in any of these activities:

- A. Directs the work of an organizational unit,
- B. Is held accountable for the success of one or more specific programs or projects,
- C. Monitors progress toward organizational goals, and periodically evaluates and makes appropriate adjustments to such goals,
- D. Supervises the work of employees (other than personal assistants), and/or
- E. Otherwise exercise important policy-making, policy determining, or other executive functions.

### ***Specialty Knowledge***

Incumbents in positions in this specialty require exceptional managerial skills and broad professional engineering, scientific, or other technical knowledge.

NOTE: OPM Series and Title are established and approved by the NASA Office of Human Capital Management, Executive Resources Office.

### **770-10 Classification**

NASA Title: AST-Engineering Project Management

Class Code: 770-10

OPM Title: AST-Engineering Project Management

Series Code: GS-801

#### *Definition of Work*

This specialty includes positions responsible for the overall technical and administrative direction of projects assigned to NASA centers. Center management usually establishes an organizational entity or other functional grouping providing recognition of this project responsibility. These project offices or other organizational entities are typically and relatively small in size, and typically draw upon other “line” or “functional” organizations or contractors for support, e.g., feasibility studies, design, development, applied research, fabrication, integration, testing, operations, and usually perform one or more of these functions within the project organization.

For the purpose of this specialty definition, a “project” is an undertaking with a scheduled beginning and ending for the purpose of accomplishing a specific agency objective. This typically would include the design, development, and demonstration/operation of a new equipment system or major subsystem hardware that would require several years to complete. Applied research, technology development, test and evaluation, and other related functions performed by other line organizations in support of a “project” should be assigned to other appropriate NASA specialties, within the AST 700 Subgroups. Similarly, managers of sub-functions within a project reporting to the project manager should be assigned to the specialty appropriate for the work.

Project managers assigned to this specialty are responsible, personally or in directing others, for the following typical functions:

- A. Determination of the project requirements by participating in committee and panel meetings with agency personnel.
- B. Developing a staffing plan, establishing organizational and functional assignments, selecting and appointing personnel to key positions, and monitoring the position management and staffing plans.
- C. Preparation of cost estimates for budget purposes.
- D. Determination of the requirements for development work, support services, data handling and reduction, and launch and tracking and supporting services.
- E. Preparation of schedules for the complete project and establishment of a system to review and maintain a record of the project’s status.
- F. Negotiation for service with other NASA and Government agencies to accomplish the project.
- G. Determination, or assisting in the determination, or what phases of the project will be performed by contractors, and reviewing request for bids, contractors, proposals, and contract specifications.
- H. Participation in design reviews, contract negotiations, and technical and business discussions with NASA Headquarters and contractors.

- I. Continual review and assessment of the effectiveness of contractors in meeting the technical and administrative requirements of the contract.
- J. Participation in project reviews and readjustment of money, schedules, and work for accomplishing the project.
- K. Resolution of interface and integration problems relating to the project and coordination of the several phases of the project.
- L. Translation of program guidelines and functioning allocations into suitable statements of work for implementing project activity.

AST-Engineering Project Management positions have subordinate positions either on their staffs or in line/matrix organizations that are responsible for discrete phases of the project. Managers of sub-functions within a project office should normally be assigned to AST-Aerospace Flight Systems, NC 725-12, or a more specific specialty appropriate for the work.

#### *Specialty Knowledge*

Work in this specialty requires the application of professional engineering and scientific knowledge and skills associated with the technical aspects of the project, coupled with managerial and supervisory skills required in developing project plans, resources and programming plans; developing and execution of budget plans; providing direction and guidance to supporting organizations and contractors; evaluating project progress and establishing schedules; performing supervisory and personnel management functions for staff reporting directly to the project office; and other related managerial functions.

### **770-11 Classification**

NASA Title: AST-Science Project Management

Class Code: 770-11

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of Work*

This specialty includes positions responsible for the overall technical and administrative direction of physical science projects assigned to NASA centers. Center management usually establishes an organizational entity or other functional grouping providing recognition of this project responsibility. These project offices or other organizational entities are typically relatively small in size, and typically draw upon other “line” or “functional” organizations or contractors for support, e.g., feasibility studies, design, development, applied research, fabrication, integration and testing, operations, and usually perform one or more of these functions within the project organization.

For the purpose of this specialty definition, a “project” is an undertaking with a scheduled beginning and ending for the purpose of accomplishing a specific agency objective. This typically would include the design, development, and demonstration/operation of a new equipment system or major subsystem hardware that would require several years to complete. Applied research, technology development, test and evaluation, and other related functions performed by other line organizations in support of a project should be assigned to the appropriate specialty within the AST 700 Subgroups.

Project managers assigned to this specialty are responsible, personally or in directing others, for the following typical functions:

- A. Determination of the project requirements by participating in committee and panel meetings with agency personnel, or
- B. Developing a staffing plan, establishing organizational and functional assignments, selecting and appointing personnel to key positions, and monitoring the position management and staffing plans, or
- C. Preparation of cost estimates for budget purposes, or
- D. Determination of the requirements for development work, support services, data handling and reduction, and launch and tracking and supporting services, or
- E. Preparation of schedules for the complete project and establishment of a system to review and maintain a record of the project’s status, or
- F. Negotiation for service with other NASA and Government agencies to accomplish the project, or
- G. Determination, or assisting in the determination, or what phases of the project will be performed by contractors, and reviewing request for bids, contractors, proposals, and contract specifications, or
- H. Participation in design reviews, contract negotiations, and technical and business discussions with NASA Headquarters and contractors, or
- I. Continual review and assessment of the effectiveness of contractors in meeting the technical and administrative requirements of the contract, or

- J. Participation in project reviews and readjustment of money, schedules, and work for accomplishing the project, or
- K. Resolution of interface and integration problems relating to the project and coordination of the several phases of the project, and/or
- L. Translation of program guidelines and functioning allocations into suitable statements of work for implementing project activity.

AST-Science Project Management positions have subordinate positions either on their staffs or in line/matrix organizations that are responsible for discrete phases of the project. Managers of sub-functions within a project reporting to a Project Manager or other managerial personnel in project offices should normally be assigned to AST-Aerospace Flight Systems, 725-12, or to a more specific specialty appropriate for the work.

#### *Specialty Knowledge*

Work in this specialty requires the application of professional physical science and engineering knowledge and skills associated with the science aspects of the project, coupled with managerial and supervisory skills required in developing project plans, resources and programming plans; developing and execution of budget plans; providing direction and guidance to supporting organizations and contractors; evaluating project progress and establishing schedules; performing supervisory and personnel management functions for staff reporting directly to the project office; and other related managerial functions.

### ***770-29 Classification***

NASA Title: AST-Physical Science Technical Management

Class Code: 770-29

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of Work*

This specialty includes scientific specialist positions which advise, coordinate, monitor, maintain surveillance over, supervise and/or perform a variety of managerial scientific/technical functions typically involving two or more management specialties such as physical sciences technical resources management, technical engineering operations management, science technical management systems, configuration management, or serving as assistant to a scientific/technical program or project manager or higher level line supervisor.

Most positions are engaged in scientific and technical activities that directly support the management process whether within the context of a line organization, direction of a contracted effort, or management of an academic grant.

Although the word “management” generally implies supervision or direction, positions in this Specialty normally do not exercise supervision or direction of technical programs.

#### *Specialty Knowledge*

Positions require professional knowledge of scientific and engineering principles and practices for performing the science technical management functions. In addition, these positions require effective management and communication skills.

NOTE: Positions which require competence in a definitive NASA 700 Group Specialty, but the incumbents are incidentally concerned with the functions discussed above, should be classified to the other AST specialty.

### ***770-30 Classification***

NASA Title: AST-Technical Management

Class Code: 770-30

OPM Title: AST-Technical Management

Series Code: GS-801

### ***Definition of Work***

This specialty includes positions which are to advise on, coordinate, monitor, maintain surveillance over, supervise and/or perform a variety of technical managerial functions typically involving two or more areas of management functions such as resources analysis, technical management systems, technical engineering operations management, configuration management, or serving as assistant to a technical program manager, project manager, or higher level line supervisor.

Most positions are engaged in technical activities that directly support the management process whether within the context of a line organization, direction of a contracted effort, or management of an academic grant.

Although the word “management” generally implies supervision or direction, positions in this Specialty normally do not exercise supervision or direction of technical programs.

### ***Specialty Knowledge***

Positions require a professional knowledge of engineering and scientific principles and practices for performance of the technical management functions of these positions. In addition, these positions require effective management and communication skills.

NOTE: Positions that require competence in a definitive NASA 700 Group Specialty, but the incumbents are incidentally concerned with the functions discussed above, should be classified o that other AST specialty.

### *770-32 Classification*

NASA Title: AST-Technical Resources Management

Class Code: 770-32

OPM Title: AST-Technical Resources Management

Series Code: GS-801

### *Definition of Work*

This specialty includes positions that are to advise on, coordinate, monitor, maintain surveillance over, supervise, or perform work in all phases of technical resources planning and programming, such as program or project planning, development, presentation, execution, analysis, forecasting and coordination, and technical management advisory services. In addition, positions may involve managerial functions relating to design and revision, implementation, and maintenance of technical resource management systems, in-house and/or contractor systems. Generally, the following functions are accomplished by positions in this specialty:

- A. Analysis, coordination and implementation of overall program or project resource planning, or
- B. Evaluation of programmatic or project objectives, plans, and resources for compatibility with the overall program or project, or
- C. Assessment of possible differences or changes in program content and recommending possible courses of action, or
- D. Converts technical goals into budget and management terms, or
- E. Evaluation of proposals with respect to resources feasibility and resources compatibility with indicated scope of work, or
- F. Participating in assessing overall resources requirements that may be necessary for carrying out work through such phases as feasibility, definition, conceptual design, design development, test, evaluation, flight testing, and operational support, or
- G. Planning work so that resources available are compatible with the schedules indicated, or
- H. Preparing and/or coordinating preparation of programmatic or project and resources data including milestones, funding, and human resources for various management purposes, such as program reviews, and/or
- I. Providing technical analysis and assessment of project resource status, and investigating critical areas for the purpose of defining technical and administrative problems.

Employees in this specialty usually are identified with "line" management. They work with and for a manager administering approved programs and determine technical resources requirements for planned programs or projects.

Although the word "management" generally implies supervision or direction, positions in this specialty normally do not exercise supervision or direction of technical programs or projects. For the most part these positions are engaged in activities that directly support the "management process" whether by direct supervision of a line organization or direction of a contracted effort.

### *Specialty Knowledge*

These positions require the use of professional engineering knowledge and skills in performing their technical management functions.

NOTE: Positions that require competence in a definitive AST specialty, but the incumbents are incidentally concerned with the above functions, should be classified to that AST specialty.

### **770-33 Classification**

NASA Title: AST-Physical Science Technical Resource Management

Class Code: 770-33

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of Work*

This specialty includes scientific specialist positions which are to advise on, coordinate, monitor, maintain surveillance over, supervise, or perform work in all phases of technical resources planning, and programming, such as program or project planning, development, presentation, execution, analysis, coordination, and forecasting, and technical management advisory services. In addition, positions may involve managerial functions relating to design and revision, implementation, and maintenance of scientific/technical resource systems, in-house and/or contractor systems. Generally, one or more of the following functions are accomplished by positions in this specialty:

- A. Analysis and coordination of overall program or project plans,
- B. Evaluation of programmatic or project objectives, plans, and resources for compatibility with the overall program or project,
- C. Assessment of possible differences or changes in program content and recommending possible courses of action,
- D. Converts technical goals into budget and management tasks,
- E. Evaluation of proposals with respect to resources feasibility and resources compatibility with indicated scope of work,
- F. Participating in assessing overall resources requirements that may be necessary for carrying out work through such phases as feasibility, definition, conceptual design, design development, test, evaluation, flight testing, and operational support,
- G. Planning work so that resources available are compatible with the schedules indicated,
- H. Preparing and/or coordinating preparation of programmatic or project and resources data including milestones, funding, and human resources for various management purposes, such as program reviews, and/or
- I. Providing scientific/technical analysis and assessment on project resource status, and investigating critical areas for the purpose of defining scientific and/or technical problems.

#### *Specialty Knowledge*

These positions require the following skills: management, effective communication, and professional knowledge of scientific and engineering principles and practices, and the ability to administer and allocate resources for scientific projects. Some positions in this specialty require supervisory and/or technical program management skills.

NOTE: When positions require scientific or technical competence in a definitive AST specialty, but are incidentally concerned with the functions covered by this specialty, they should be classified to the specialty requiring that competency.

### ***770-34 Classification***

NASA Title: AST-Technical Engineering Operations Management

Class Code: 770-34

OPM Title: AST-Technical Engineering Operations Management

Series Code: GS-801

### ***Definition of Work***

This specialty includes positions which are to advise on, coordinate, monitor, maintain surveillance over, supervise and/or perform a variety of work typically involving the conduct of technical staff studies relating to such activities as advanced spacecraft, space missions, program concepts, technical trade-off analysis; the design, development, and adaptation of mathematical, statistical, economic, and other scientific methods and techniques to be used in the conduct of these studies and to provide insight about the technical feasibility, the technical justification and economic comparison of various engineering and scientific advanced concepts; the prediction of schedules for advanced programs; the conduct of cost-effectiveness, cost sensitivity, and schedule analysis; and so on.

Although the word "management" generally implies supervision or direction, positions in this specialty normally do not exercise supervision or direction of technical programs. For the most part, these positions are engaged in activities that directly support the "management" process or management of an engineering system, whether it is direct supervision of a line organization or direction of a contracted effort.

### ***Specialty Knowledge***

These positions require professional knowledge of scientific and engineering principles and practices. The work also requires mathematical and statistical knowledge and skills. In addition, effective management and communication skills are required

NOTE: Positions that require technical competence in a definitive AST specialty, but the incumbents are only incidentally concerned with the functions discussed above, should be classified to the specialty requiring the technical competency.

### **770-40 Classification**

NASA Title: AST-Engineering Technology Utilization and Commercialization      Class Code: 770-40

OPM Title: AST-Engineering Technology Utilization and Commercialization      Series Code: GS-801

#### *Definition of Work*

Positions in this specialty study and evaluate engineering advances in aerospace research and development for the purpose of determining their maximum usefulness and applicability to industry, government, and the public. This specialty applies to positions related to the transfer and commercialization of technology, including marketing, business and partnership development, and commercialization project and program management. It includes:

- A. Overall short- and long-range planning; initiation of research;
- B. Development, marketing, program/project management and other activities related to technology transfer and partnership development. Duties are executed in keeping with overall Agency policy and with a goal of promoting the expedient transfer of NASA technology and expertise to other government organizations and to the private sector;
- C. Evaluation, coordination, and management of plans, projects, studies and programs;
- D. Coordination of collaborative research, development, and technology transfer activities to ensure the best utilization of money, human resources, and facilities and maximize the Government's return on investment;
- E. Providing guidance on technology transfer and commercialization processes, methods, and issues as well as partnership opportunities, strategies, and mechanisms;
- F. Participating in Source Evaluation Boards; contractor design reviews; technology transfer/partnership activity reviews including reviews with licensees and collaborative research partners; and other contractor/external partner-related activities;
- G. Evaluating proposals for contracts and grants including those related to the SBIR and STTR Programs; evaluating business plans, partnership opportunities, collaborative research proposals, and license agreements;
- H. Representing NASA in establishing and maintaining relationships with industry, government, and other related groups and partners for the purposes of exchanging information, facilitating cooperative relationships, and maximizing the nation's benefit from technology transfer and commercialization; and/or
- I. Identifies and manages resolution of technical problems and issues related to technology and/or expertise being transferred; in addition, identifies and manages resolution of business-related problems and issues associated with government/industry/ academia partnerships and/or collaboration.

Implicit in these positions is the responsibility for a wide range of project/program management concerns and partnership development and operations, including defining and or evaluating technical and resource requirements; setting measurable goals and objectives; managing the strategic direction, planning, and implementation of assigned technology transfer/partnership tasks.

### *Specialty Knowledge*

In addition to a high level of expertise in the appropriate field(s) of engineering, work in this specialty requires knowledge of technology development and transfer and of the commercial marketplace; the ability to recognize potential applications, and the knowledge of various means of disseminating available new engineering technology to industry.

### **770-41 Classification**

NASA Title: AST-Science Technology Utilization and Commercialization

Class Code: 770-41

OPM Title: Physical Scientist

Series Code: GS-1301

#### *Definition of Work*

This specialty includes positions engaged in the study and evaluation of science advances in aerospace research and development for the purpose of determining their maximum usefulness and applicability to industry, government, and the public. This specialty applies to positions related to the transfer and commercialization of technology, including marketing, business and partnership development, and commercialization project and program management. This work includes:

- A. Overall short- and long-range planning; initiation of research;
- B. Development, marketing, program/project management and other activities related to technology transfer and partnership development. Duties are executed in keeping with overall Agency policy and with a goal of promoting the expedient transfer of NASA science, technology, and expertise to other government organizations, academia, and to the private sector;
- C. Evaluation, coordination, and management of plans, projects, studies and programs;
- D. Maintains high level of expertise in an applicable field of science and/or engineering;
- E. Coordination of collaborative research, development, and technology transfer activities to ensure the best utilization of money, human resources, and facilities and maximize the Government's return on investment;
- F. Providing guidance on technology transfer and commercialization processes, methods, and issues as well as partnership opportunities, strategies, and mechanisms;
- G. Participating in Source Evaluation Boards; contractor design reviews; technology transfer/partnership activity reviews including reviews with licensees and collaborative research partners; and other contractor/external partner-related activities;
- H. Evaluating proposals for contracts and grants including those related to the SBIR and STTR Programs; evaluating business plans, partnership opportunities, collaborative research proposals, and license agreements;
- I. Representing NASA in establishing and maintaining relationships with industry, government, academia, related groups, and partners for the purposes of exchanging information, facilitating cooperative relationships, and maximizing the nation's benefit from technology transfer and commercialization; and/or
- J. Identifies and manages resolution of scientific and technical problems and issues related to technology and/or expertise being transferred; in addition, identifies and manages resolution of business-related problems and issues associated with government/industry/academia partnerships and/or collaboration.

Implicit in these positions is the responsibility for a wide range of project/program management concerns and partnership development and operations, including defining and or evaluating technical and resource requirements; setting measurable goals and objectives; managing the strategic direction, planning, and implementation of assigned technology transfer/partnership tasks.

### *Specialty Knowledge*

In addition to a high level of expertise in the appropriate field(s) of science, work in this specialty requires knowledge of technology development and transfer and of the commercial marketplace; the ability to recognize potential applications, and the knowledge of various means of disseminating available new scientific technology to industry.

### ***770-56 Classification***

NASA Title: AST-Launch Site Support Management

Class Code: 770-56

OPM Title: AST-Launch Site Support Management

Series Code: GS-801

### ***Definition of Work***

This specialty includes positions engaged in managing activities to support Shuttle, next generation human spaceflight launch vehicles, or expendable vehicle payload processing at the launch site (Launch Site Support Process). This includes, but is not limited to:

- A. Advising payload project management on the launch operations processes, policies, and concepts,
- B. Developing plans for and obtaining payload support services, facilities, equipment, and interface verification required at the launch site,
- C. Serving as the launch site focal point for payload projects relative to system design and processing, requirements, and integration into the launch system.

NOTE: Incumbents of positions in this specialty normally do not require exercise of supervision or direction of technical programs. For the most part these positions are engaged in activities that directly manage the Payload Launch Site Support Process whether it is direct supervision of a line organization or direction of a contracted effort.

### ***Specialty Knowledge***

The knowledge required by incumbents of these positions includes a broad interdisciplinary professional engineering background involving all disciplines, practices, and procedures associated with payload processing and launch preparations including the supporting equipment, facilities, and systems. In addition, the incumbents must have a thorough knowledge of launch center policies, regulations, and procedures

### *770-60 Classification*

NASA Title: AST-Engineering Program Management

Class Code: 770-60

OPM Title: AST-Engineering Program Management

Series Code: GS-801

### *Definition of Work*

NASA Engineering Programs are activities within an Enterprise that have defined goals, objectives, requirements, and funding levels; are consistent with NASA's Strategic Plan; are normally endorsed by the Agency Program Management Council and approved by the NASA Administrator; normally report to the NASA Program Management Council; and may consist of Projects. Programs vary significantly in their complexity, cost, and criticality; however, they are the core of the work NASA delivers to the American public. The program manager is responsible for the successful accomplishment of the program that meets the needs of the customer; for the total range of program activities from supporting formulation of requirements through delivery of the final products; and is responsible for the program cost, schedule, technical performance, and the management system requirements. Tasks within this specialty include:

- A. Ensuring delivery of programs, products or services and technology to the customer that are compliant with all program requirements for technical, cost, schedule and quality performance,
- B. Providing program control, developing, integrating, and providing direction and exercising control over budgets, schedules and procurement,
- C. Maintaining and implementing contact with the customer in order to understand customer objectives, plans and requirements,
- D. Decomposition of higher level programmatic requirements into "implementable packages" and communication of specific requirements to the implementing projects,
- E. Ensuring the overall program development by supporting projects of specific technology needs and or systems design, manufacturing, testing, verifying, and establishing the systems supporting infrastructure for sustaining engineering, logistics, and operations,
- F. Ensuring the development and implementation of a Program Risk Management Plan which identifies, analyzes, tracks, controls and mitigates identified programmatic risks,
- G. Resolving development and operational problems resulting from multi-center, interagency, or international participation; and other matters related to assigned programs,
- H. Developing, leading, and integrating a diverse team of skilled and competent members throughout the formulation, approval, implementation, and evaluation sub-processes involved in managing programs,
- I. Coordinating with various review teams responsible for performing evaluations or independent assessments aimed at enhancing program performance,
- J. Ensuring appropriate safety, mission success, environmental, security, and export control requirements are included in program requirements and plans, and/or
- K. Incorporating prior lessons learned into program planning, and documenting new lessons learned to benefit future programs.

Implicit in these positions is the responsibility for a wide range of managerial concerns, including preparing, evaluating, and defending budgets to senior management, establishing priorities, and ensuring deadlines are met. Participation on various boards and committees concerned with management of flight systems is normally required.

*Specialty Knowledge*

The work requires professional engineering knowledge and management skills appropriate for the scope and subject matter of the specific position.

## **770-61 Classification**

NASA Title: AST-Science Program Management

Class Code: 770-61

OPM Title: Physical Scientist

Series Code: GS-1301

### *Definition of Work*

NASA science programs address major areas of research activity within an Enterprise having defined goals, objectives, and funding levels. Science programs are the core of NASA's Generate Knowledge process. The science program manager's position is managerial in nature and involves planning and coordination of NASA programs in research, development, operations of missions and instrumentation, and utilization of available resources in one of the fields of NASA program science, including Space Sciences, Earth Sciences, Biological and Physical Research, and Aerospace Technology. The position involves definition and implementation of programs dedicated to the advancement of knowledge in a wide range of biological, chemical, physical, and computational science disciplines and advanced technology. The research involved uses experimental, theoretical, and numerical computational approaches in ground-based facilities as well as airborne and space-borne research platforms. It also includes interpretation, analysis and application of the data obtained. This work includes:

- A. Overall short and long-range planning,
- B. Initiation of research, development, and operations programs in keeping with overall agency policy and to ensure the best use of funding, human resources, and facilities,
- C. Development of research solicitations, leadership of the proposal evaluation process, and development of recommendations for funding made to selecting official(s),
- D. Evaluation and coordination of plans, programs, and budget levels, including development and tracking of performance metrics,
- E. Keeping abreast of developments in applicable science and technology, including interacting with relevant scientific communities and science advisory bodies,
- F. Coordination of inter-center/interagency research, development, and operations programs. Also, coordination within NASA between Headquarters and Field Centers, between strategic enterprises, and between the strategic enterprises and functional offices,
- G. Providing guidance to centers and NASA-affiliated academic institutes,
- H. Participating in proposal review panels, program review committees, Source Evaluation Boards, contractor design reviews, and other review panels as required, and/or
- I. Resolving development, implementation and operational problems resulting from multi-center participation, other agency participation, industry or academic partner involvement, and other matters related to the assigned programs.

Implicit in these positions is the responsibility for a wide range of management concerns, including preparing and/or evaluating budgets, defending budgets to top management, establishing priorities, ensuring that deadlines are met and ensuring that reporting requirements are met. Incumbents also serve on various boards and committees concerned with strategic planning and management of NASA research programs.

*Specialty Knowledge*

The work requires professional scientific knowledge and management skills appropriate for the scope and subject matter of the specific position.

### *770-77 Classification*

NASA Title: AST-Logistics Engineering Management

Class Code: 770-77

OPM Title: AST-Logistics Engineering Management

Series Code: GS-801

### *Definition of Work*

This specialty includes positions concerned with directing, developing, or performing logistics management functions that involve planning, coordinating, or evaluating the actions required to support aerospace flight and ground operations. The work involves (1) identifying the specific requirements for budget, workforce, material, facilities, contracts, and technical services needed to support aerospace programs and (2) correlating those requirements with engineering oriented program/project plans to assure efficient and effective support. Key to this specialty is the ability to technically assess the unique aerospace hardware characteristics that drive most of the key logistics functions. Examples of such work include:

- A. Identifying, developing, and reviewing aerospace program logistics support requirements,
- B. Formulation, preparation, and implementation of logistics management policies and strategic planning,
- C. Special aerospace engineering and logistics operations problem resolution,
- D. Studies required for effective logistics support of aerospace flight hardware/payload processing, and/or
- E. Development, planning, integration, and implementation of logistics support systems, equipment, and processes. These include:
  1. Analysis of life-cycle supportability of hardware and systems,
  2. Development of logistics models,
  3. Analysis of declining repair and materials sources,
  4. Logistics process development/analysis,
  5. Metrics development/analysis,
  6. Operational logistics planning,
  7. Logistics information systems,
  8. Logistics planning for system upgrades, and/or
  9. Contract development and assessment.

### *Specialty Knowledge*

The work requires knowledge of professional engineering, aerospace, and scientific principles, concepts, and practices, and knowledge of contract management. It also requires an understanding of general logistics principles, and the versatility to work in varied project frameworks while satisfying tailored customer requirements.

Date	NCC	Change	Notes
11/13/08	715-35	Changed OPM title and series FROM: Ceramics Engineer, GS-0892 TO: Materials Engineer, GS-0806	New OPM JFS for Engineers, 0800
11/13/08	745-08	Changed OPM title FROM: Aerospace Engineer and Pilot, GS-861 TO: Aerospace Engineer	New OPM JFS for Engineers, 0800
11/13/08	745-10	Changed OPM title FROM: Aerospace Engineer and Pilot, GS-861 TO: Aerospace Engineer	New OPM JFS for Engineers, 0800
10/13/10	799-01	Added: Graduate Co-op (Physical Science), GS-1399	Per Center request
11/14/12	799-00	Changed OPM and NASA Title FROM: Graduate Co-op (Engineering),GS-899 TO: Student Trainee (Engineering), GS-899	As a result of Pathways
11/14/12	799-01	Changed OPM and NASA Title FROM: Graduate Co-op (Physical Science),GS-1399 TO: Student Trainee (Physical Science ), GS-1399	As a result of Pathways.
5/17/13	745-07	Changed NASA Title FROM: AST-Mission Specialist Astronaut TO: AST-Astronaut  Changed OPM title and added series FROM: AST-Mission Specialist Astronaut, GS-801 and GS-1301 TO:  AST-Astronaut, GS-801 AST-Astronaut, GS-1301 AST-Astronaut, GS-401 Medical Officer, GS-602  Revised Definition of Work in Specialty Description	Per Center request
5/17/13	745-08	Changed NASA Title FROM: AST-Pilot Astronaut TO: AST-Astronaut Pilot  Revised Definition of Work in Specialty Description	Per Center request