Position Classification Flysheet for Aerospace Engineering Series, GS-0861

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SERIES DEFINITION

This series includes professional aerospace engineering positions involved in planning, research, development, design, test and evaluation, analysis, production, fabrication, operation, type certification, and/or maintenance of aerospace vehicles or integrally associated equipment. It also includes positions involved in investigating phenomena encountered in aerospace flight, monitoring and analyzing unknown or unfamiliar aerospace vehicles, piloting aerospace vehicles, developing aviation safety standards and regulations, and positions providing staff leadership and guidance related to aerospace engineering programs. The work requires application of scientific and engineering principles in the field of aeronautics and astronautics, such as aerodynamics, aeroacoustics, astrodynamics, computational fluid dynamics, fluid mechanics, flight dynamics, flight structures, thermodynamics, flight propulsion, and energy conversion and use.

This series coverage standard supersedes the standard for the Aerospace Engineering Series, dated June 1969, TS-80.

EXCLUSIONS

1. Classify positions that involve practical, rather than professional, knowledge of aerospace engineering principles and methods to the Engineering Technician Series, GS-0802.

2. Classify positions that involve working on aerospace guidance and control, ground tracking radar, or other electronically driven systems to the Electronics Engineering Series, GS-0855, when the primary professional knowledge is of principles, techniques, and practices of electronics engineering.

3. Classify positions that involve development, design, and fabrication of aerospace structures to the Materials Engineering Series, GS-0806, when the primary professional knowledge is of properties, uses, and behavior of engineering materials.

4. Classify positions that involve development, administration, or enforcement of regulations and standards concerning civil aviation safety to the Aviation Safety Series, GS-1825, when the work requires technical, rather than professional, knowledge of the operation, maintenance, or manufacture of aircraft.

5. Classify positions that involve collecting, analyzing, interpreting, and providing specialized information related to aircraft equipment or parts to the Equipment Services Series, GS–1670, when the work requires a practical, rather than professional, knowledge of the design, production, operation, and maintenance of aircraft equipment and parts.

6. Classify positions that involve piloting aircraft to the Aircraft Operation Series, GS-2181, when the work does not require application of professional aerospace engineering knowledge.

7. For other similar but excluded work, see the following series:
   Astronomy and Space Science Series, GS-1330;
   Computer Engineering Series, GS-0854;
   Electrical Engineering Series, GS-0850;
   General Engineering Series, GS-0801;
   Mechanical Engineering Series, GS-0830; and
   Physics Series, GS-1310.

GLOSSARY

Terms used in this series coverage standard may have different meanings among agencies. The glossary is provided to assist in understanding the material presented in the occupational information.

AEROSPACE VEHICLE - is any device that is used or intended to be used for flight (e.g., aircraft, missiles, spacecraft, rotorcraft).

COMPOSITE MATERIALS - are structural materials, generally nonorganic and nonmetallic, that have high strength and low weight characteristics.

PROJECT ENGINEERS - are aerospace engineers who have responsibility for planning, organizing, controlling, coordinating, reviewing, and approving work related to assigned projects or functions. Oversight functions include, for example, developing schedules and cost estimates for project completion, assigning work to specialist engineers, monitoring work progress, and resolving problems or conflicts that interfere with progress. In addition to the above, project engineers often have their own technical area of responsibility. Project engineers also are called project managers and project officers.

SPECIALIST ENGINEERS - are aerospace engineers who work within a specialty area. They include, for example, aerospace engineers who specialize in avionics systems, mechanical systems, structures, missiles, etc., associated with a specific type/model/version of aerospace vehicle or equipment. For example, an aerospace engineer might specialize in the structures of landing gear systems on all versions of a particular fighter jet.

TYPE/MODEL/SERIES - Type means a specific aircraft, rotorcraft, or spacecraft design. Examples of types of aircraft include a transport/cargo, bomber, or fighter air vehicle. Model means the specific kind of cargo, fighter, or bomber, such as a C-5, F-14, or B-1. Related versions of a particular type and model are differentiated by series, such as a C-5A and C-5B; or an F-14A and F-14B. A type/model/series designation is also used to identify specific engine designs.

OCCUPATIONAL INFORMATION

Aerospace Engineering Disciplines

Aerospace engineering is concerned with the understanding, analysis, design, and operation of aerospace vehicles operating within, above, and beyond earth's atmosphere. Aerospace vehicles range from helicopters and other vertical take-off aircraft at the low speed end of the flight spectrum to spacecraft operating at thousands of miles per hour during entry into the atmospheres of earth and other planets. In between are remotely piloted vehicles, general aviation, and commercial transports flying at speeds well below and close to the speed of sound; and supersonic transports, fighters, and missiles that cruise at many times the speed of sound. Although each speed regime (e.g., subsonic, supersonic, and hypersonic), each flight environment/operational regime, and each vehicle poses its own special research, analysis, design, and operational problems, each can be addressed by a broad grouping of technical specialties or disciplines. They are aerodynamics, aeroacoustics, astrodynamics, computational fluid dynamics, fluid mechanics, flight dynamics, flight structures, thermodynamics, flight propulsion, and energy conversion and use. Many aerospace engineers also have to apply knowledge of related disciplines in mathematical, physical, or engineering sciences.

Within these broad specialty areas, aerospace engineers typically specialize and work in relatively narrow areas. For example, in the area of flight propulsion, there are considerable differences between the specialized knowledge required for engineering work on jet engines and the knowledge required for work on solid rocket propellants. In the area of flight structures, there may be different considerations depending on speed or operating regimes. Aerospace engineers working in a specialty area are frequently concerned with a specific kind of propulsion, electrical, avionic, or mechanical system (e.g., the propulsion system used in medium-sized helicopters and produced by a specific manufacturer). Other aerospace engineers may specialize in equipment that is an integral part of a system or an integral part of the design and operating requirements of the vehicles, such as environmental controls, life support systems, landing and arresting gear systems, etc. Still others work on developing systems capable of operating for extended periods of time in multiple environments (e.g., developing astronautical vehicle systems that can operate in and out of earth's atmosphere, require miniaturization of systems because of weight restrictions, and have extended flight periods).

Functional Areas

Aerospace engineer positions are located in a variety of work situations. Broad functional areas include research, development, education, research grants review, test and evaluation, production, post-production/maintenance, and aircraft certification. All of these functional areas, except maintenance engineering and aircraft certification, are discussed in detail in other guides.[1]

Maintenance Engineering

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[1] For a list of these guides, see the section on Evaluating Positions in this Series Coverage Standard.

Maintenance engineering work involves the design, overhaul, repair, operation, and age monitoring of aerospace vehicles that are primarily in the post-production stage; i.e., aerospace vehicles already operational/in service. The work is also referred to as post-production, operational, or sustaining engineering. Some maintenance engineering work may involve providing advice or input during the development or production stages. For example, aerospace engineers may be asked to review design proposals or problems to determine what effect they might have during the operational stage.

The primary purpose of maintenance engineering work is to ensure assigned aerospace vehicle systems, components, or parts are safe, reliable, maintainable, and operational. Aerospace engineers perform various duties to maintain optimum mechanical condition of aerospace vehicles in service. For example, they--

- review, approve, and oversee design changes performed in-house or under contract;

- advise on and approve the substitution of parts, materials, processes, and waivers of requirements;

- investigate, analyze, and recommend corrective action related to mishaps, failures, performance problems, or other malfunctions;

- perform analysis to develop and enhance preventive maintenance programs;

- analyze and evaluate safety and reliability of assigned aerospace vehicle, systems, or components through a review of data in management information systems and deficiency reports and/or through flight tests or other means;

- evaluate engineering changes to determine what effect they have on aerodynamics, flight dynamics, etc., in terms of the performance, stability, and control of an aerospace vehicle;

- prepare engineering changes and modifications to equipment, structures, or operating procedures;

- apply computer technology to measure damage or effects of certain stresses on aerospace vehicle structures and systems, predict how changes in design will affect vehicle operation, or simulate certain conditions;

- provide technical expertise and advice to field, depot, or other personnel regarding operation, overhaul, repair, and modification of assigned flight systems and equipment; and/or

- develop plans, statements of work, specifications, cost estimates, and selection criteria that will be used to solicit and award contracts to purchase critical aerospace vehicle parts or systems, extend the life of an aerospace vehicle, incorporate new technologies, improve reliability, or increase competition.

Maintenance engineering, while often characterized as conventional rather than developmental, can nonetheless be quite difficult. At the higher levels, the work may involve resolving conflicts or problems that require considerable planning, coordination, and analysis because of the nature, scope, impact, and complexity of the issues. Some maintenance engineering work may involve developing new methods and techniques that are beyond conventional practice.

Aircraft Certification

Aircraft certification programs were established to ensure that civil aeronautic products sold on the commercial market, such as aircraft, aircraft engines, and propellers comply with applicable Federal airworthiness rules and standards and are safe designs. Aerospace engineers working in aircraft certification programs--

- review and analyze industry applications to identify problems with overall safety of proposed design and areas requiring special exemptions from rules or coordination with others;

- determine or assist in determining the Federal regulations that aerospace vehicles must meet for certification;

- evaluate test proposals to determine if methods and techniques suggested by the manufacturer will provide sufficient data to demonstrate compliance with Federal regulations;

- evaluate and approve or disapprove design data or aerospace products;

- investigate reports of maintenance and service problems and conduct technical evaluations of reports or defective equipment to determine the need for design changes and the need for issuance of airworthiness directives to ensure an adequate level of safety;

- review technical approvals prepared by designated engineering representatives to ensure compliance with Federal regulations; and

- recommend the establishment or amendment of Federal standards, regulations, and advisory material that pertains to the design and certification of aircraft, aircraft engines, or propellers.

Aerospace engineers working in aircraft certification programs also perform duties similar to aerospace engineers in other functional areas (e.g., participate in accident investigations, witness tests).

Some Department of Defense components also have certification responsibility. This work involves, for example, flight test and engineering analysis of munitions, pods, dispensers, tanks, and suspension equipment carried on aerospace vehicles.

Organization of Work

Aerospace engineering work is organized in a variety of ways. Most aerospace engineers work within a specialty area, and have responsibility for a particular system, component, or part in a specific type and model(s) of aerospace vehicle. In some organizations, aerospace engineers perform a range of functions related to a specialty area, specific system, and specific model and version of aerospace vehicle or engine (e.g., writing specifications, resolving performance problems, designing modifications, and investigating mishaps in support of electronic flight control systems in C-5A aircraft). In other organizations, engineers perform only one or a few functions related to a specialty area and specific system, but the work may involve all versions of a type and model of aerospace vehicle or engine (e.g., resolving performance problems in support of electronic flight control systems for all versions of C-5 aircraft). Still others operate as technical specialists with broad areas of responsibility (e.g., responsibility for resolving the most difficult problems related to a system in one or more types, models, or versions of aerospace vehicles).

Aerospace engineers may work as specialist engineers or as project managers with responsibility for direction and oversight of overall project resources and timeframes. Sometimes aerospace engineers alternate as specialist engineers on some projects and project managers on others.

Some organizations use a matrix management approach to resolve problems or carry out projects. Under the matrix management approach, aerospace engineers officially assigned to one unit may be selected to participate in projects being managed by a project engineer from another unit. The aerospace engineer continues to be assigned officially to the supervisor of record but reports to the project engineer for the duration of the project. Other organizations use a similar approach except that it involves the use of interdisciplinary teams. Users of the matrix management approach believe it allows for greater mobility and better control of project resources.

Computers As Analytical Tools

Aerospace engineers use computer systems as tools for project or program management, structural analysis, thermal analysis, image processing, air dynamics analysis, guidance and control analysis, and a variety of other functions. For example, program management information systems may be used to record data pertaining to aircraft usage, maintenance, and operational problems. Aerospace engineers may review and analyze these data to determine trends, identify possible causes of problems, and prevent potential mishaps or failures.

Computer programs are analytical tools that allow for broader, more indepth, and/or rapid analysis of problems. Computers may be used to simulate real-world situations, ask "what if?" questions, and predict conditions. For example, the data in a management information system may show that an aerospace vehicle is performing more or different missions than was anticipated when the aerospace vehicle was being developed. Aerospace engineers may need to determine the effect of this increased or different usage on structural integrity. To determine this, aerospace engineers may build mathematical models to define the problem and predict, for example, when the vehicle will become unsafe or require a major modification. These models are then run through structural analysis programs. The results of these analyses may be used to determine changes in maintenance review or parts replacement intervals. In the long run, such analysis may eliminate the need for early fleet replacement or other costly measures.

In other phases of aerospace engineering, such as during the research or development phase, computer technology may be used in a similar manner; i.e., to simulate or predict conditions and determine the effects of these conditions on aerospace vehicle structures and systems, or to identify possible cause and effect relationships. The use of computer technology for aerospace engineering work augments the analysis and extends the evaluation of aerospace vehicle performance and reliability well beyond the scope of practical testing. It allows for broader or more intensive investigation because parameters and data points can be greatly extended, manipulated, and tested in short time periods. Aerospace engineers can work faster and analyze problems more completely. Decisions can be based on much more thorough information.

The use of computers in aerospace engineering work normally does not affect the series or grade of aerospace engineer positions. The technology, by itself, typically is regarded as another analytical or informational tool at the engineer's disposal. The series and grade of a position are still determined by factors such as the primary knowledge required by the work, and the nature, complexity, and scope of the assignments.

Impact of Changing Technology

In recent years, significant changes have been taking place in the areas of aerospace avionics, control systems, and structures. Additionally, aerospace engineers are studying and developing sophisticated computer technology (e.g., robotics, artificial intelligence systems, and fuzzy logic).

Advances in avionics/control systems include using computers as an integral part of flight control, navigation, powerplant, and armament systems.

Advances in the structures area include more use of composite materials in portions of airframes or other structures. Composite materials are lighter than the traditional metallic materials used in many aerospace vehicles. The reduced weight has some advantages, such as allowing for increased speed of aerospace vehicles. It's use also has posed some special problems for aerospace engineers, particularly concerning the area of safety. Concerns about how to test and evaluate the strength or structural integrity of composite materials under varying climatic conditions, including evaluating the effect of lightening strikes, or how to repair composite materials are some of the many important questions being studied.

Other advances include the use of artificial intelligence systems and robotics to perform various functions on spacecraft while in space. For example, robotics technology is used or is being considered for use in space programs to launch and capture satellites, and to perform maintenance, construction, and repair activities. Evaluating the impact of changed technology on aerospace engineering positions requires careful consideration of any special problems the technology presents from an aerospace engineering perspective, the amount of guidance available, and the applicability of that guidance.

Changes in technology may or may not impact on factors such as complexity, knowledge, or judgment required. Whether they do depends, to a great extent, on the state of the art in question. For example, some computer driven systems, while considered advanced, have been operational for a relatively long time. In that time, much information may have been gathered that can assist aerospace engineers in resolving development, production, or operational problems as they relate to those systems.

TITLES

Aerospace Engineer is the title for nonsupervisory positions.

Aerospace Engineer and Pilot is the title for positions that involve piloting aerospace vehicles.

Add the prefix "Research" to the above titles for positions that meet the criteria in the Research Grade-Evaluation Guide.

Add the prefix "Supervisory" to the above titles for positions that meet the criteria contained in the appropriate supervisory evaluation guide.

Agencies may add parenthetical titles when further distinctions in the work are necessary for recruitment or other purposes. For more information, see titling instructions in the Introduction to the Position Classification Standards.

EVALUATING POSITIONS

Evaluate nonsupervisory aerospace engineering positions using the--

- General Grade-Evaluation Guide For Nonsupervisory Professional Engineering Positions along with other appropriate guides and standards when the work involves the use of professional aerospace engineering knowledge to perform functions not specifically covered by other guides or standards (e.g., maintenance/operational aerospace engineering).

- Research Grade-Evaluation Guide when the work involves the use of professional aerospace engineering knowledge to perform basic and applied research;

- Research Grants Grade-Evaluation Guide when the work involves the use of professional aerospace engineering knowledge to review, evaluate, and recommend approval of research grants and contracts;

- Equipment Development Grade-Evaluation Guide when the work involves the use of professional aerospace engineering knowledge to develop vehicles, equipment, and techniques;

- Grade Level Guide for Test and Evaluation Work in Engineering and Science Occupations when the work involves the use of professional aerospace engineering knowledge to plan, perform, evaluate, and report tests of vehicles and equipment;

- Grade Level Guide for Instructional Work when the work involves the use of professional aerospace engineering knowledge to establish or conduct educational programs; or the

- Grade-Evaluation Guide for Engineer Positions Concerned With Production when the work involves the use of professional aerospace engineering knowledge to ensure the quality and adequacy of production processes and procedures in the manufacture, overhaul, repair, and assembly of vehicles and equipment.

Evaluate nonsupervisory positions involving mixed work (e.g., aerospace engineers doing both equipment development and maintenance aerospace engineering) using the appropriate guide for each kind of work. Determine the final classification based on the principles of mixed series/grade. (See Introduction to the Position Classification Standards and The Classifier's Handbook.)

Apply the General Schedule Supervisory Guide to positions that meet the criteria for coverage by the guide.