Appendix C

# AIRCRAFT WORK BREAKDOWN STRUCTURE (WBS) LEVELS (FROM MILITARY SPECIFICATION 881)

| Level 1 | Level 2 | Level 3 |
|---|---|---|
| Aircraft System | | |
| | Air Vehicle (AV) | Airframe |
| | | Propulsion |
| | | AV Applications Software |
| | | AV System Software |
| | | Communications/Identification |
| | | Navigation/Guidance |
| | | Central Computer |
| | | Fire Control |
| | | Data Display and Controls |
| | | Survivability |
| | | Reconnaissance |
| | | Automatic Flight Control |
| | | Central Integrated Checkout |
| | | Antisubmarine Warfare |
| | | Armament |
| | | Weapon Delivery |
| | | Auxiliary Equipment |
| | System Engineering/ Program Management | |

| | |
|---|---|
| System Test and Evaluation | Development Test and Evaluation |
| | Operational Test and Evaluation |
| | Mock-ups |
| | Test and Evaluation Support |
| | Test Facilities |
| Training | Equipment |
| | Services |
| | Facilities |
| Data | Tech Publications |
| | Engineering Data |
| | Management Data |
| | Support Data |
| | Data Depository |
| Peculiar Support Equipment | Test and Measurement Equipment |
| | Support and Handling Equipment |
| Common Support Equipment | Test and Measurement Equipment |
| | Support and Handling Equipment |
| Operational/Site Activation | System Assembly, Installation, and Checkout on Site |
| | Contractor Technical Support |
| | Site Construction |
| | Site/Ship/Vehicle Conversion |
| Industrial Facilities Construction/Conversion/ Expansion | Equipment Acquisition or Modernization |
| | Maintenance (Industrial Facilities) |
| Initial Spares and Repair Parts | |

## DEFINITIONS

### Aircraft System

The complex of equipment (hardware/software), data, services, and facilities required to develop and produce air vehicles.

**Includes:**

- those employing fixed, movable, rotary, or compound wing
- those manned/unmanned air vehicles designed for powered or unpowered (glider) guided flight

### Air Vehicle

The complete flying aircraft.

**Includes:**

- airframe, propulsion, and all other installed equipment
- design, development, and production of complete units—prototype and operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use
- Subelements to the air vehicle

### Airframe

The assembled structural and aerodynamic components of the air vehicle that support subsystems essential to designated mission requirements.

**Includes, for example:**

- basic structure—wing, empennage, fuselage, and associated manual flight control system
- rotary wing pylons, air induction system, thrust reversers, thrust vector devices, starters, exhausts, fuel management, inlet control system

- alighting gear—tires, tubes, wheels, brakes, hydraulics, etc.
- secondary power, furnishings—crew, cargo, passenger, troop, etc.
- instruments—flight, navigation, engine, etc.
- environmental control, life support and personal equipment, racks, mounts, intersystem cables and distribution boxes, etc., which are inherent to, and nonseparable from, the assembled structure
- dynamic systems—transmissions, gear boxes, propellers, if not furnished as an integral part of the propulsion unit
- rotor group and other equipment homogeneous to the airframe

In addition to the airframe structure and subsystems, this element includes:

1) Integration, assembly, test, and checkout:

**Includes:**

- common elements to provide the integration, assembly, test, and checkout of all elements into the airframe to form the air vehicle as a whole
- all administrative and technical engineering labor to perform integration of level 3 air vehicle and airframe elements; development of engineering layouts; determination of overall design characteristics, and determination of requirements of design review
  - — overall air vehicle design and producibility engineering
  - — detailed production design; acoustic and noise analysis
  - — loads analysis; stress analysis on interfacing airframe elements and all subsystems
  - — design maintenance effort and development of functional test procedures
  - — coordination of engineering master drawings and consultation with test and manufacturing groups

  - — tooling planning, design, and fabrication of basic and rate tools and functional test equipment, as well as the maintenance of such equipment
  - — production scheduling and expediting
  - — joining or installation of structures such as racks, mounts, etc.
  - — installation of seats, wiring, ducting, engines, and miscellaneous equipment and painting
  - — setup, conduct, and review of testing assembled components or subsystems prior to installation
- all effort associated with the installation, integration, test, and checkout of the avionic systems into the air vehicle including:
  - — design of installation plans
  - — quality assurance planning and control including material inspection
  - — installation
  - — recurring verification tests
  - — integration with nonavionics airframe subsystems
- ground checkout prior to flight test; production acceptance testing and service review; quality assurance activities and the cost of raw materials, purchased parts, and purchased equipment associated with integration and assembly

2) Nonrecurring avionics system integration which is associated with the individual avionics equipment boxes and avionics software in a functioning system.

**Includes:**

- the labor required to analyze, design, and develop avionics suite interfaces and establish interface compatibility with nonavionics support equipment systems, aircraft systems, and mission planning systems
- drawing preparation and establishment of avionics interface equipment requirements and specifications

- technical liaison and coordination with the military service, subcontractors, associated contractors, and test groups

**Excludes:**

- development, testing, and integration of software (which should be included in air vehicle applications and system software)
- avionics system testing (included in System Test and Evaluation) and aircraft systems engineering efforts (included in Systems Engineering/Program Management)
- all effort directly associated with the remaining level 3 WBS elements

## Propulsion

That portion of the air vehicle that pertains to installed equipment (propulsion unit and other propulsion) to provide power/thrust to propel the aircraft through all phases of powered flight.

**Includes, for example:**

- the engine as a propulsion unit within itself (e.g., reciprocating, turbo with or without afterburner, or other type propulsion) suitable for integration with the airframe
- thrust reversers, thrust vector devices, transmissions, gear boxes, and engine control units, if furnished as integral to the propulsion unit
- other propulsion equipment required in addition to the engine but not furnished as an integral part of the engine, such as booster units
- the design, development, production, and assembly efforts to provide the propulsion unit as an entity

**Excludes:**

- all effort directly associated with the elements and the integration, assembly, test, and checkout of these elements into the air vehicle

- all ancillary equipments that are not an integral part of the engine required to provide an operational primary power source—air inlets, instruments, controls, etc.

## Air Vehicle Applications Software

**Includes, for example:**

- all the software that is specifically produced for the functional use of a computer system or multiplex database in the air vehicle
- all effort required to design, develop, integrate, and check out the air vehicle applications computer software configuration items (CSCIs)

**Excludes:**

- the nonsoftware portion of air vehicle firmware development and production (ref. ANSI/IEEE Std. 610.12)
- software that is an integral part of any specific subsystem and software that is related to other WBS level 2 elements

## Air Vehicle System Software

That software designed for a specific computer system or family of computer systems to facilitate the operation and maintenance of the computer system and associated programs for the air vehicle.

**Includes, for example:**

- operating systems—software that controls the execution of programs
- compilers—computer programs used to translate higher-order language programs into relocatable or absolute machine code equivalents
- utilities—computer programs or routines designed to perform the general support function required by other application software, by the operating system, or by system users (ref. ANSI/IEEE Std 610.12)

- all effort required to design, develop, integrate, and check out the air vehicle system software, including all software developed to support any air vehicle applications software development
- air vehicle system software required to facilitate development, integration, and maintenance of any air vehicle software build and CSCI

**Excludes:**

- all software that is an integral part of any specific subsystem specification or specifically designed and developed for system test and evaluation
- software that is an integral part of any specific subsystem, and software that is related to other WBS level 2 elements

## Communications/Identification

That equipment (hardware/software) installed in the air vehicle for communications and identification purposes.

**Includes, for example:**

- intercoms, radio system(s), identification equipment (IFF), data links, and control boxes associated with the specific equipment
- integral communication, navigation, and identification package (if used)

## Navigation/Guidance

That equipment (hardware/software) installed in the air vehicle to perform the navigational guidance function.

**Includes:**

- radar, radio, or other essential navigation equipment, radar altimeter, direction-finding set, doppler compass, computer, and other equipment homogeneous to the navigation/guidance function

### Central Computer

The master data processing unit(s) responsible for coordinating and directing the major avionic mission systems.

### Fire Control

That equipment (hardware/software) installed in the air vehicle which provides the intelligence necessary for weapon delivery such as bombing, launching, and firing.

**Includes, for example:**

- radars and other sensors, including radomes
- apertures/antennas, if integral to the fire control system, necessary for search, target identification, rendezvous, and/or tracking
- self-contained navigation and air data systems
- dedicated displays, scopes, or sights
- bombing computer and control and safety devices

### Data Display and Controls

The equipment (hardware/software) which visually presents processed data by specially designed electronic devices through interconnection (on- or offline) with computer or component equipment and the associated equipment needed to control the presentation of the necessary flight and tactical information to the crew for efficient management of the aircraft during all segments of the mission profile under day and night all-weather conditions.

**Includes, for example:**

- multifunction displays, control display units, display processors, and on-board mission planning systems

**Excludes:**

- indicators and instruments not controlled by keyboard via the multiplex data bus and panels and consoles which are included under the airframe

## Survivability

Those equipments (hardware/software) installed in, or attached to, the air vehicle which assist in penetration for mission accomplishment.

**Includes, for example:**

- ferret and search receivers, warning devices and other electronic devices, electronic countermeasures, jamming transmitters, chaff, infrared jammers, terrain-following radar, and other devices typical of this mission function

## Reconnaissance

Those equipments (hardware/software) installed in, or attached to, the air vehicle necessary to the reconnaissance mission.

**Includes, for example:**

- photographic, electronic, infrared, and other sensors
- search receivers
- recorders
- warning devices
- magazines
- data link

**Excludes:**

- gun cameras

### Automatic Flight Control

Those electronic devices and sensors which, in combination with the flight control subsystem (under airframe), enable the crew to control the flight path of the aircraft and provide lift, drag, trim, or conversion effects.

**Includes, for example:**

- flight control computers, software, signal processors, and data-transmitting elements that are devoted to processing data for either primary or automatic flight control functions
- electronic devices required for signal processing, data formatting, and interfacing between the flight control elements; the data buses, optical links, and other elements devoted to transmitting flight control data
- flight control sensors such as pressure transducers, rate gyros, accelerometers, and motion sensors

**Excludes:**

- devices—linkages, control surfaces, and actuating devices—covered under the airframe WBS element
- avionics devices and sensors—central computers, navigation computers, avionics data buses, and navigation sensors—which are included under other avionics WBS elements

### Central Integrated Checkout

That equipment (hardware/software) installed in the air vehicle for malfunction detection and reporting.

### Antisubmarine Warfare

That equipment (hardware/software) installed in the air vehicle peculiar to the antisubmarine warfare mission.

**Includes, for example:**

- sensors, computers, displays, etc.

### Armament

That equipment (hardware/software) installed in the air vehicle to provide the firepower functions.

**Includes, for example:**

- guns, high-energy weapons, mounts, turrets, weapon direction equipment, ammunition feed and ejection mechanisms, and gun cameras

### Weapon Delivery

That equipment (hardware/software) installed in the air vehicle to provide the weapon delivery capability.

**Includes, for example:**

- launchers, pods, bomb racks, pylons, integral release mechanisms, and other mechanical or electromechanical equipment specifically oriented to the weapons delivery function

**Excludes:**

- bombing/navigation system (included in the fire control element)

### Auxiliary Equipment

Auxiliary airframe, electronics, and/or armament/weapon delivery equipment not allocable to individual element equipments, or which provides the ancillary functions to the applicable mission equipments.

**Includes, for example:**

- auxiliary airframe equipment such as external fuel tanks, pods, and rotodomes
- multiuse equipment like antennas, control boxes, power supplies, environmental control, racks, and mountings, not homogeneous to the prescribed WBS elements