AEROSPACE STANDARD

AS6512™	REV. B
Issued 2016-12 Revised 2022-03 Superseding AS6512A	

Unmanned Systems (UxS) Control Segment (UCS) Architecture: Architecture Description

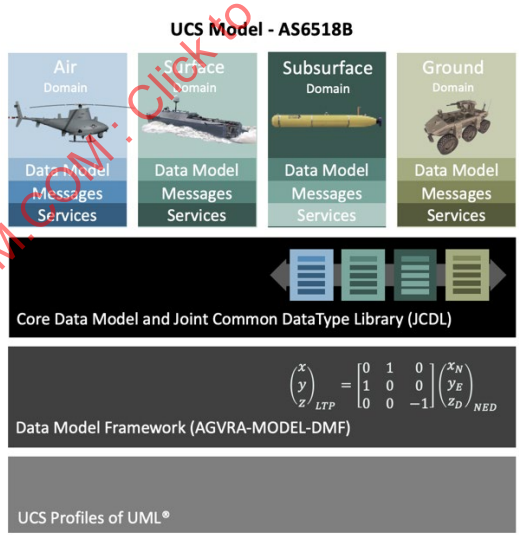
RATIONALE

This revision of AS6512 applies to the UCS Architecture Library, Revision B.

FOREWORD

This Architecture Description (AD) establishes the content of the SAE Unmanned Systems (UxS) Control Segment (UCS) Architecture Library Revision B. The UCS Architecture Library Revision B is expressed by multiple SAE publications, of which this publication is the highest in the publication tree. The official designation of the UCS Architecture Library Revision B is therefore AS6512B. The other SAE publications in the UCS Architecture Library Revision B are AS6513B and AS6518B. One government-owned folder is also distributed with the UCS Library. This is the Autonomous Ground Vehicle Reference Architecture (AGVRA) Data Model Framework (DMF) Version 3.1A. This folder includes the Joint Common DataType Library (JCDL) and core DMF model.

The UCS Architecture was originally applicable to systems that control unmanned aircraft above 10 kg gross take-off weight (nominal); however, it has since been extended to address all unmanned systems whose means of conveyance includes air, water, and ground. The UCS Architecture is concerned with control station software but not the control station software external environment, including information access, communications, and human-computer interfaces.



Elements of the UCS Architecture Model Revision B

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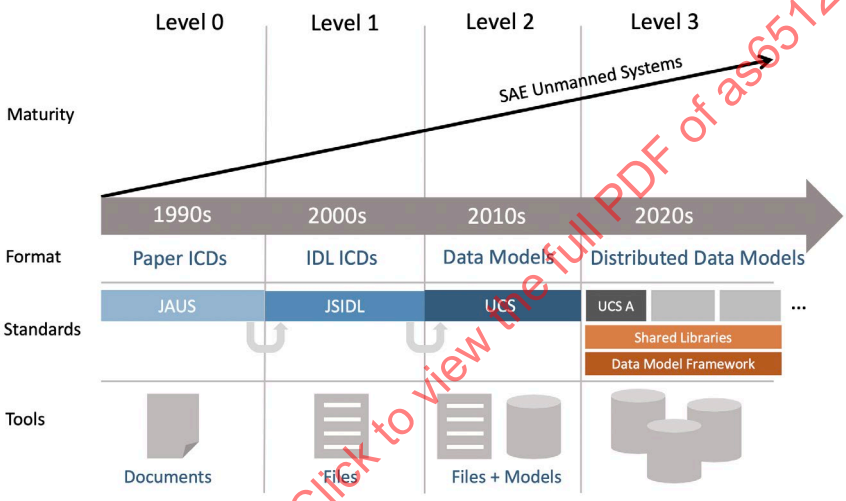
The UCS Architecture is extensible by users, and significant content exists outside of the AS6518B model. Access to this additional content is controlled by the Department of Defense.

The UCS Architecture defines a service-oriented architecture and modeling framework for the specification, integration, implementation, and deployment of control station software. The architecture is centered on a platform-independent model and associated foundational models. Platform independence (independence of the software operating environment) allows the UCS Architecture to be implemented on different computing infrastructures and with different communication protocols. This supports technology insertion and adoption on multiple UCS systems and related architectures. The architecture is deployable on any scale of UxS control station from a hand-held device to a fixed facility with multiple mission planners, operators, and analysts.

From the perspective of the SAE Aerospace Unmanned Systems Committee (AS-4), this revision of the UCS Architecture Library represents “Level 3” maturity in model-based information standards in which data model content is distributed across multiple architecture stakeholders. The shared library is the JCDL and DMF. Both the DMF and JCDL can support multiple architectures.



Evolution in AS-4 Model-Based Information Standards

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1. SCOPE

1.1 Scope and Project Identification

This document is the Architecture Description (AD) for the SAE Unmanned Systems (UxS) Control Segment (UCS) Architecture Library Revision B or, simply, the UCS Architecture. The architecture is expressed by a library of publications as referenced herein. The other SAE publications in the UCS Architecture Library Revision B are AS6513B and AS6518B. The library also includes the government-owned Autonomous Ground Vehicle Reference Architecture (AGVRA) Data Model Framework Version 3.1A.

1.2 Developing Organization

The developing organization for the SAE UCS Architecture is the SAE AS-4UCS Technical Committee. Governance and management of the UCS Architecture Library was transferred from the Office of the Undersecretary of Defense for Acquisition, Technology and Logistics (OUSD/AT&L) to the SAE in April 2015.

1.3 Architecture Packaging

AS6518B is a zipped project folder containing multiple files. The tables, formulas and definitions of AS6518B are expressed in the Unified Modeling Language (UML) in MagicDraw files denoted by the extension mdzip. The main UML model within AS6518B is **AS6518-MODEL.mdzip**. This UML model incorporates all the other UML models in AS6518B as project usages.

Bundled with the UCS Architecture Library is the government-owned project folder AGVRA-MODEL-DMF v3.1A. This folder contains two further UML models called **JCDL.mdzip** and **AGVRA-MODEL-DMF.mdzip**. These UML models are incorporated into the UCS UML models as project usages. The instructions for configuring the UML models for a local file environment are provided in **AS6518B.pdf**.

The fully assembled model containment tree (less MagicDraw's auxiliary resources) is shown in figure 1.

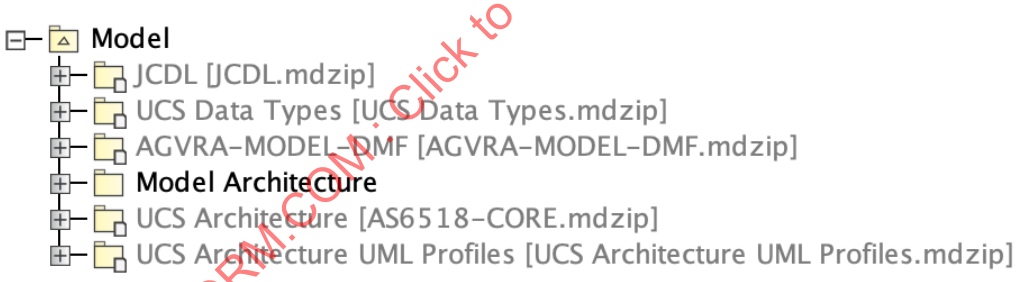

Figure 1 - AS6518-MODEL containment tree

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The stated issue of publications shall apply. In the event of conflict between the text of this document and the references cited herein, the reference takes precedence. Nothing in this document supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS6513B Unmanned Systems (UxS) Control Segment (UCS) Architecture: Conformance Specification

AS6518B Unmanned Systems (UxS) Control Segment (UCS) Architecture: UCS Architecture Model

AS6969B Data Dictionary for Quantities Used in Cyber Physical Systems.

2.1.2 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

These government-owned publications are bundled with the UCS Architecture Library.

AGVRA-MODEL-DMF v3.1A Autonomous Ground Vehicle Reference Architecture (AGVRA) Data Model Framework

3. SYSTEM OF INTEREST

The UCS Architecture system of interest is the control segment for any unmanned system including unmanned aircraft, surface and subsurface unmanned vessels, and unmanned ground vehicles. The system of interest can be a single operational node or it can be distributed across multiple nodes via local-area or wide-area networks. The system of interest can be located in fixed and transportable facilities, in vehicle crew cabins, or it can be a human-carried device.

4. STAKEHOLDERS

The principal stakeholder for the UCS Architecture is the U.S. Department of Defense and its international partners. The UCS Architecture is therefore primarily intended for the Defense and Security Sector.

5. ADDRESSED CONCERNS

The principal concerns addressed by the UCS Architecture are market accessibility, interoperability, software portability, and software reusability.

6. ENVIRONMENTAL INFLUENCES

The primary environmental influences on the evolution of the UCS Architecture have been the planned proliferation of robotic vehicles in military concepts of operation and the drive towards Capability Based Acquisition (CBA) and Model Based System Engineering (MBSE).

This revision extends the base UCS Architecture (AS6518) into a multi-domain architecture for the control of single or multiple heterogenous robotic vehicles. The UCS Architecture is a model that can be incorporated into a developer's system model or product-line model. Model-to-model integration across the robotics community is a key attribute of the UCS Architecture.

7. VIEWS

The UxS Control Segment views provided in the UCS Architecture conform to the Information, Dictionary, and Services viewpoints. These views are expressed at both the conceptual and logical levels of abstraction. At the conceptual level, the structure of property values is not provided. In principle, a conceptual model can be refined into multiple logical models, each based on a different value structure. For example, using an East-North-Up or North-East-Down coordinate reference system for velocity values.

The Information views comprise entity models and message models. A message is a particular view of the entity model that is required by one or more service participants. The Information views are support by Dictionary views. A dictionary is a library of definition objects that may be referenced in an Information view. In the UCS Architecture, a service is a capability that is accessed via a service interface. UCS service interfaces exchange signals that are parameterized by UCS messages. The architecture provides a library of service interfaces and service roles, which may be deployed onto any architecture of service participants.

These views are supported by an optional library of non-functional properties. Non-functional properties in this cross-cutting view may be assigned to elements in the UCS Architecture when it is bound to a specific system architecture.

8. ARCHITECTURE FRAMEWORK

The UCS Architecture UML Profile is contained in AS6518B in the file **UCS Architecture UML Profiles.mdzip**. The construction of the UCS Architecture Model is governed by policies established in the file **UCSTechGov.mdzip** and supporting documents contained in **TECHGOVPolicies.zip**

The UCS Architecture also conforms to the government-owned architecture framework established AGVRA-MODEL-DMF V3.1A. The file **AGVRA-MODEL-DMF**.mdzip contains two metamodels. These are the Family of Dictionaries Metamodel and the Value Properties Metamodel. Each metamodel package contains profiles and policies.

9. CONFORMANCE

The conformance concern is addressed by the UCS Architecture Conformance Specification (AS6513B).

The specification applies to all conformant UCS Software Components, UCS Software Configurations, and UCS Systems that are described in a UCS Product Registry or UCS Product Repository. The document is applicable to the complete lifecycle of UCS Products, including requirements definition, acquisition and development, deployment and maintenance, and obsolescence.

10. VERSION DESCRIPTION

The version description of the UCS Architecture Model is provided with AS6518B by the UCS Architecture Version Description Document, **AS6518B-VDD.pdf**. The VDD describes the principal changes in the UCS Architecture Model from revision to revision.

11. MODELS

The UCS Architecture Model (**AS6518-MODEL.mdzip**) is principally a container that incorporates the other models as project usages with the exception of **UCSTechGov.mdzip**, which must be opened separately. The package **UCS Architecture** is supplied by the file **AS6518-CORE.mdzip**, which in turn incorporates the models **UCS Architecture UML Profiles.mdzip**, **UCS Data Types.mdzip** and **JCDL.mdzip**. The full details of the file structure are provided in **AS6518.pdf**.

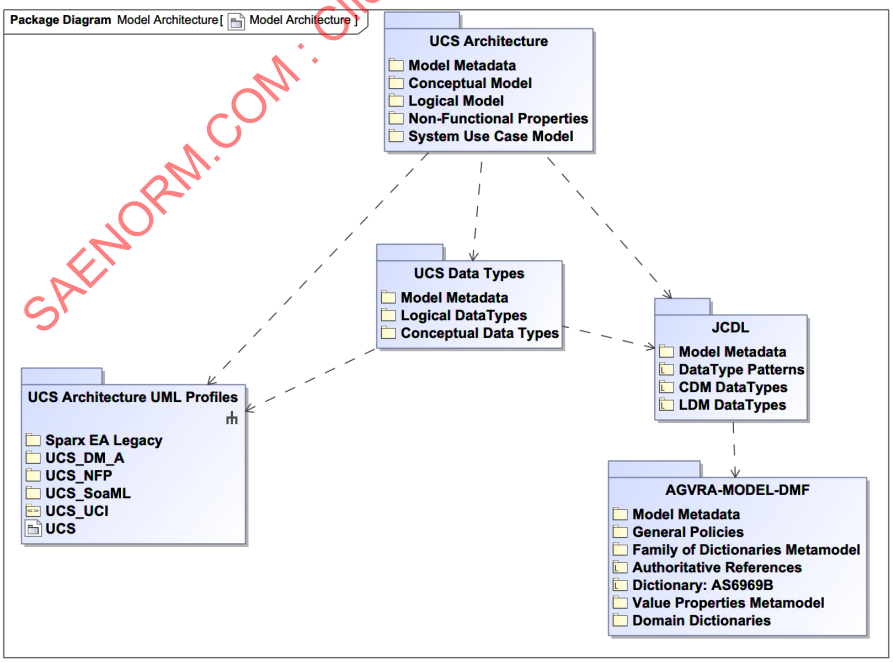

Figure 2 - UCS model architecture