ADatP-32
Edition 2.0

THE LAND C2 INFORMATION EXCHANGE DATA MODEL

31 March 2000

RECORD OF CHANGES

Edition	Date	Comments
1.0	1 Oct 99	Draft for submission to NDAG.
1.5	11 Mar 00	Draft incorporating changes through AWG IV-15
1.8	15 Mar 00	Changes to 2.4.7, 3.3.5, 3.3.6, Chap 6, 8.1
1.9	21 Mar 00	Incorporation of new examples to illustrate concepts

Configuration Control Authentication:

Contributing Nations/Agencies:

PREFACE

Military Environment

NATO operations require deployed forces to form part of combined and joint coalition formations. Earlier operations focused on war requirements, however NATO forces are becoming increasingly employed in operations other than war (OOTW). The complex environment of multinational operations involves potentially rapid changes to operational areas, procedures, and force structures.

Such operations require all participating national units to operate in co-operation with each other. To operate effectively, force commanders need a common view of the operational area that is both timely and accurate, requiring supporting C2 systems to pass information within and across national and language boundaries. Moreover, command-and-control information must be provided to the strategic levels of command including national organisations. Additionally, NATO forces are conducting operations with (and must be able to share information with) Partners for Peace nations as well as other coalition partners and Non-Government Organisations (NGOs). The latter also embraces a wide range of international and national aid organisations.

Concept of Interoperability

The concept of interoperability is based on the direct transfer of standardised Command and Control (C2) data using a common data interchange specification called the Land C2 Information Exchange Data Model (LC2IEDM). This effectively lays the foundation for Degree 3 Interoperability (Structured Information Exchange) as defined in the NATO C3 Interoperability Policy. The associated ATCCIS Replication Mechanism (ARM) allows for the selective and automated sharing of this information through the establishment of Level 5 of System Connectivity.

Nations use the common data model to relate and understand data crossing national boundaries. They are free to extend the C2 data structures for national use and also to modify the specifications for physical databases to attain operating efficiency. However, they retain the responsibility to map from national structures to the common information exchange structure for multinational transfers. Development of C2 applications is also a purely national responsibility. In a NATO context for common or partially common-funded systems, such as the ACE Automated Command and Control Information System (ACE ACCIS), the LC2IEDM provides a solid basis for the establishment of the Data Interchange Services in the NATO C3 Technical Architecture Technical Reference Model (NC3TATRM).

The Way Ahead

This proposed STANAG is the basis for the further development of rigorous C3 semantics to address additional operational requirements in the joint battlespace. The generic and flexible nature of the model has already enabled nations to extend it to satisfy the requirements in numerous other domains and environments at both the strategic and tactical levels of command. Immediate areas for future exploitation include logistics and further joint and combined operations functionality.

The establishment of a generic data standard is also leading to the emergence of international industrial standards (in the Object Management Group and the World-Wide-Web Consortium) that should result in the production of information commercial off the shelf products

(COTS) that will directly support NATO C3. Furthermore, the establishment of an information exchange standard is the foundation for an infostructure that can lead to the establishment of alliance knowledge management and further enhanced decision support and continued information superiority.

The realisation of this potential will be contingent on the continued co-operation of the NATO nations and the establishment of an effective data and information management structure.

CONTENTS

Annexes

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Evolution of the Generic Hub Data Model

1.1.1 General

1.1.1.1 Achievement of NATO automated information exchange first requires the common specification and then common structuring of the information to be exchanged.

1.1.1.2 The structure of the information is expressed in a data model, built and documented in accordance with an accepted methodology. This model defines the standard elements of information (data) that form the basis for interoperability between those automated NATO national Command and Control Information Systems (C2ISs) that accommodate the model's information structure.

1.1.1.3 The data model structure describes not only the information/data (Tank T14C and Location ZT123456) but also captures the relationships between the information such as Tank T14C is located at ZT123456.

1.1.1.4 The NATO information requirement is to define only the information that is to be exchanged, rather than model all of the information that would normally be required by a national system. Current information exchange requirements (IERs) will change over time, and for that reason there was a need to design a flexible generic model that could adapt over time to changing information needs as well as serve as a basis or hub, if nations desired, for new national systems. For these reasons the data model is formally known as the Generic Hub (GH) Data Model.

1.1.1.5 It is important to understand that the GH Data Model is first and foremost an ***information exchange data model***. Consequently the Data Model can also act as a coherent basis for other information exchange mechanisms currently lacking a unified information structure such as messaging.

1.1.1.6 As a minimum, the NATO nations wish to have the GH Data Model preserve the meaning and relationships of the information exchanged and thereby attain the interoperability associated with NATO Level 5 of System Interconnection (automated exchange of data, with user-imposed constraints, between C2IS databases).

1.1.1.7 The structured data specifications for agreements on meaning and relationships of data have two major components that are the subject of ADatP-32:

a. A data model that specifies agreed data requirements together with their structure in the form of entities, attributes, and relationships; and

b. A physical scheme that specifies agreed metadata.

1.1.2 Fundamental Information Structure/Data Modelling Concepts

1.1.2.1 Trying to create an information structure that represents all of the information contained in the Battlespace is an understandably complex task. Data modeling methodologies have adopted several conventions that parallel the military staff processes in many ways. There are three actual models that are presented in ADatP-32, namely the Conceptual, Logical and Physical Data Models.

1.1.2.2 **Conceptual Data Model.** The Conceptual Data Model represents the high level view of the information in terms of generalized concepts such as Actions, Organizations, Materiel, Personnel, Features, Facilities, Locations and the like. This model is of interest to senior commanders wishing to verify the scope of the information structure;

1.1.2.3 **Logical Data Model.** Logical Data Model that, in our case, represents all of the information and is based upon breaking down (or sub-typing) the high level concepts into information that is regularly used. For example a tank is an armoured fighting vehicle that is a piece of equipment that is a piece of materiel. This breakdown follows human reasoning patterns and allows command and control systems to generalize by, for instance, recognizing that tanks are equipment. A logical data model specifies the way data are structured with an entity-attribute-relationship diagram and supporting documentation. This model is of interest to Staff Officers ensuring that the information content and structure is complete; and

1.1.2.4 **Physical Data Model.** Physical Data Model that handles the implementation concerns of the Logical Data Model and is strongly rooted in technical database theory and concepts (e.g. optimization, performance, indexing et cetera). This model is of significance to C2IS system developers building LC2IEDM-compliant systems.

1.1.3 The Notion of a Generic Hub Data Model

The data model encompasses the information requirements of several specific functional areas—referred to as "subfunctional" areas of the battlespace land tactical functional area. Since the data specific to a subfunctional area may be considered as attached to the common core as "spokes on a wheel," the common core data model was termed the Battlespace Generic Hub or simply the Generic Hub. Use of the Generic Hub as the basis for subfunctional area models ensures that the data common across all subfunctional areas is viewed and structured in a standard way and that the data model views can be readily integrated into one coherent structure. The concept of the interdependence of the generic hub and the specialty subjects represented by subfunctional areas is illustrated in Figure 1 below.

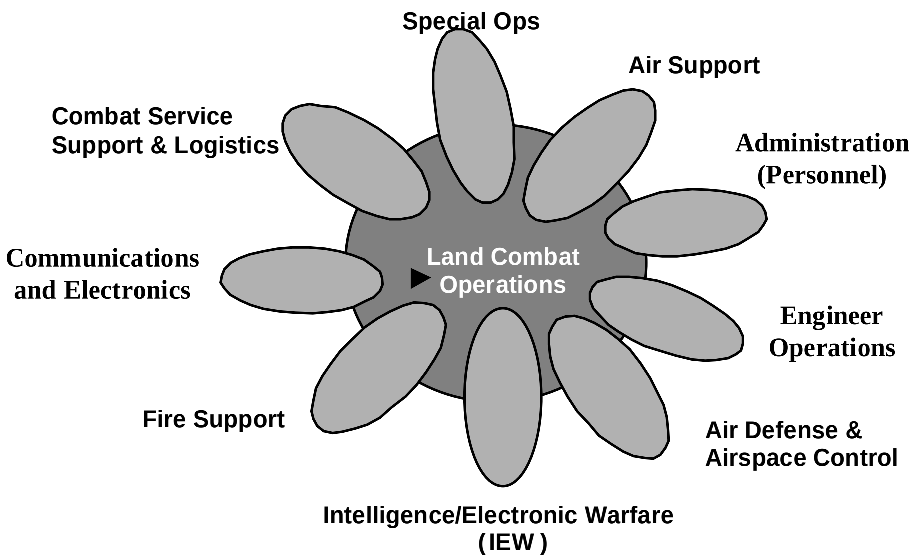


Figure 1. Hub and Its Relationship to Subfunctional Areas

1.1.3.3 The model includes inputs from the following subfunctional areas:

a. Fire Support (Conventional);

b. Engineer Operations (Barriers);

c. Communications and Electronics, and

d. Administration (Personnel).

1.2 Purpose of ADatP-32

The aim of this document is to provide the following:

a. A description of the common data in an overall model that contains all relevant data abstracted in a well-structured and normalised way, unambiguously reflecting their semantic meaning.

b. A base document that can be used as a reference for future amendments to the model. ADatP-32 is the configuration management tool for the data model.

c. A core upon which nations can base their own modelling efforts of chosen areas and onto which specialized area models can be attached or "hung."

d. A basic document that nations can use to present and validate subfunctional data model views with their own specialist organisations.

e. A specification of the physical schema required for database implementation.

1.3 Scope

The scope of the analysis carried out in the development of the Generic Hub Data Model is principally directed at producing a corporate view of the data that reflects the multinational information exchange requirements for multiple echelons in wartime operations and operations other than war (OOTW). The data model currently tends to focus its scope primarily on the information requirements that support the operations planning and execution activities of a military headquarters or a command post.

1.4 Structure of This Document

1.4.1 The organisation of the main body of this paper is summarised as follows:

a. Introduction (Chapter 1).

b. Overview of the **Conceptual Data Model** (Chapter 2). The overview provides a general statement of requirements that the data specification attempts to meet; a general description of design considerations underlying the data model, a brief description of the model in operational terms, and a summary description of the model concepts in technical terms.

c. Details of the **Logical Data Model** (Chapters 3 through 16). Each of the expository chapters may cover the following topics: *Introduction* (highlights of the data structures, operational requirements for the structure, and design considerations); *Subject Area Exposition* (structure, entity and attribute definitions, explanation of the structure, illustrative sample instance tables, appraisal of the ways in which the data specification meets the requirements, and pointers to operational uses of the data specification); *Business Rules* (additional restrictions that are needed for interoperability but cannot be readily captured within the formal modelling methodology); and *Comments* (any further topics that are worthy of inclusion but do not fit into any of the categories cited above).

d. Details of **Physical Data Model** Specification (Chapters 17 through 19). These chapters provide the rationale for the physical specification and promulgate some of these specifications. The remainder are contained in the annexes.

1.4.2 The following annexes are provided:

a. Annex A—Data Model Documentation—IDEF1X Data Model Diagram

b. Annex B—Data Model Documentation—Entity Definitions and Attributes

c. Annex C—Data Model Documentation—Entity Relationships

d. Annex D—Data Model Documentation—Attribute Definitions

e. Annex E—Data Model Documentation—Specifications for Enumerated Domains

f. Annex F—Compendium of Business Rules

g. Annex G—Data Model Naming Conventions and Class Words

h. Annex H—IDEFIX Diagram of Physical Schema

i. Annex I—Specification of Physical Schema

j. Annex J—Physical Domain Specifications

k. Annex K—Summary of IDEF1X Methodology and Notation.

The document concludes with a list of references and a glossary.

2. OVERVIEW OF THE LC2IEDM DATA SPECIFICATION

2.1 Introduction

2.1.1 This chapter focusses on the Conceptual Data Model and the operational requirements it is based upon. Included in this chapter are:

(a) An overview of the operational requirements;

(b) An explanantion of the concepts underlying the data model;

(c) An extended overview of the principal features of the data model; and

(d) Example of potential uses.

2.1.2 This chapter serves as an introduction to the detailed exposition of the data model specification to be found in Chapters 3 through 17.

2.2 Operational Requirements Underlying the LC2IEDM Specification

2.2.1 While there is no universally accepted statement of information requirements, Table 1 is the base set of information that was considered in the specification.

Table 1. Summary of Battlespace Information Requirements

Major Topic	Information Category
Forces (friendly and enemy)	Force composition Force disposition Force sustainment Mobility and transportation Weapons systems C4I and other information systems
Environmental conditions—physical	Land Sea Air Space
Environmental conditions—civil	Political Cultural Economic
Situational information	Mission C3 conditions Intelligence Targeting Deployment, movement, and manoeuvre Protection Sustainment
Operational context	——

2.2.2 Table 2 provides further detail, and an assessment of the relevance to the specification. This assessment should be viewed in the context of applicability for the *international exchange* of information between national C2 elements as well as the potential use of LC2IEDM for exchange of information between C2 elements of *multinational* formations.

Table 2. Categories of Battlespace Information

Information Category		Definition	Relevance to LC2IEDM
1. Friendly or Enemy Forces			
1.1 Force Composition		Types and numbers of military and non-military forces.	High
1.2 Force Disposition		Locations of military forces.	High
1.3 Force Sustainment		Capabilities for logistical support (supply, maintenance, medical, etc.).	Medium
1.4 Mobility and Transportation		Capability for inter- and intra-theatre movement of forces and materiel.	Medium
1.5 Weapon Systems		Type, number, capabilities, and limitations of weapon systems.	High
1.6 C4I and Other Information Systems		Type, number, capabilities, and limitations of C4I and other information processing systems.	Medium
2. Environmental Conditions			
2.1 Physical		Factors arising from nature and the physical environment as modified by man. Includes land, sea, air, and space.	Medium
	2.1.1 Land	General characteristics of natural and man-made terrain and geological features. Includes information on buildings and infra-structure (roads, communications, etc.) appropriate to the mission.	High
	2.1.2 Sea	General characteristics of the ocean surface and subsurface, harbours, and littoral (coastal) waters.	Low
	2.1.3 Air	General characteristics of the lower atmosphere, including climate, visibility, and weapon effects on the atmosphere.	Medium
	2.1.4 Space	General characteristics of the upper reaches of earth's atmosphere.	None
2.2 Civil		Information about political, cultural, and economic conditions in the areas (hostile, friendly, and neutral) of military interest.	Low
	2.2.1 Political	Information relating to the people, their national government, and international and non-government organisations.	Low
	2.2.2 Cultural	Information relating to language, customs, laws, and religion.	Low
	2.2.3 Economic	Information relating to manpower, materiel, and money.	Low
3. Situational Awareness Information			
3.1 Mission Information		Factors that frame and influence the execution of the mission. Includes instructions and policies; rules of engagement; status of preparations for the mission; description of the theatre; and time constraints.	High
3.2 Command, Control, and Communications		Command relationships and procedures for effective management of forces and accomplishment of the mission. Includes planning, communications systems connectivity, and interoperability.	High
3.3 Intelligence		Threat-related information and general information regarding the enemy which affects mission accomplishment. Includes enemy doctrine, probable courses of action, and vulnerabilities.	High
3.4 Targeting		Information relating to targets. Includes dispersion, camouflage, hardness, identification, mobility, and range from potential attacking forces.	High
3.5 Deployment, Movement, and Manoeuvre		Status of lines of communication and planning for deployment, movement or manoeuvre.	High
3.6 Force Security		Information regarding rear area security; and air, maritime, and land superiority.	High
3.7 Sustainment		Information relating to the sustainment of forces in conducting the mission.	High
4. Operational Context			
——		Scenarios and missions involved Phases of operation (peace, crisis, war) Stress and threat levels. Organisations and locations affected Operational perspective (national, theatre, tactical).	High

2.3 Concepts Underlying the Data Model

2.3.1 The Generic Hub data model is intended to represent the core of the data identified for exchange across multiple subfunctional areas and multiple views of the requirements. Toward that end, it lays down a common approach to describing the information to be exchanged in a command and control (C2) environment.

a. The structure is meant to be generic enough to accommodate all joint, land, sea, and air environment concerns. Currently, the model addresses primarily land operations.

b. The data model describes all objects of interest in the battlespace, e.g., organisations, persons, equipment, facilities, geographic features, weather phenomena, and military control measures such as boundaries.

c. Battlespace objects are generically typed and described in accordance with a military taxonomy and specifically addressed as an ***item***. All battlespace *items* must be classified as being of some *type* (e.g. Tank Callsign T14C is an item of type "Challenger").

d. An object must have the capability to perform a function or to achieve an end. Thus, a description of capability is needed to give meaning to the value of objects in the battlespace.

e. It should be possible to assign a location to any item in the battlespace. In addition, various geometric shapes need to be represented in order to allow a commander to plan, direct, and monitor operations. Examples include boundaries, corridors, restricted areas, minefields, and any other control measures or symbolgy needed by the commanders and their staff.

f. The status of items needs to be maintained.

g. The planned assignment of resources by type to a type of battlespace objects is described as an establishment. These establishments are currently described as tables of organisations, equipment, or personnel, are basically fixed (e.g. standard Canadian Light Infantry Battalion) and must be representable in the model.

h. The actual assignment of resources by type to a specific battlespace item is described as a holding (for example the holding of 1^{e} Battalion Les Voltigeurs). The model must reflect information such as the composition of an organisation in terms of subordinate organisation types, equipment types, and personnel types.

i. There is a need to record relationships between specific battlespace items. Key among these is the specification of command relationships in permanent or temporary organisational and task structures.

j. The model must support the specification of current, past, and future employment of battlespace items or types st be capable of being recorded.

k. The data for all battlespace objects, whether friendly or hostile, should be recorded in the same data structure.

l. Provision must be made for the identification of reporting organisations, the effective and reporting times, and an indication of the validity of the data.

2.3.2 The use of free text is to be avoided as much as possible, since there cannot be an agreed understanding of the contents.

2.3.3 Since some of the important rules for managing information in the battlespace cannot be represented in a data model, reliance needs to be placed on textual supplements, often referred to as “business rules.”

2.3.4 The intent is to specify the *minimum* set of data to be *exchanged*. The nations are free to expand their own data structures to cater to additional data representations. It is also understood that the model is to be structured in such a way so as to easily accommodate any conceivable extension.

2.4 Overview of Specification for Battlespace Situation

2.4.1 Introduction

2.4.1.1 This section describes the major features of the data, e.g., the identification of battlespace objects items or their types, their make-up, status, location, and associations.

2.4.1.2 A basic concept in data modelling is an entity, i.e., any distinguishable person, place, thing, event, or concept about which information is to be kept. The properties of an entity are referred to as attributes. The attributes make explicit the data that are to be recorded for each concept of interest. This chapter describes the data model only at the *entity* level. Subsequent chapters contain descriptions of the fully *attributed* data model.[1]

2.4.1.3 The Generic Hub structure is based on ten independent entities, five of which are key. These key entities are of fundamental importance in generating the structure of the data model and are defined in Table 3. They include OBJECT-ITEM, OBJECT-TYPE, CAPABILITY, LOCATION, and ACTION. The remaining independent entities are introduced in subsequent sections and are CANDIDATE-TARGET-LIST, CONTEXT, REFERENCE, REPORTING-DATA, and RULE-OF-ENGAGEMENT.

Table 3. Five Key Entities and Their Roles

Key Entity	Entity Definition	Information Category
OBJECT-ITEM[2]	An individually identified object that has military significance. Examples are a specific person, a specific item of materiel, a specific geographic feature, a specific co-ordination measure, or a specific unit.	Contents (Who and What)
OBJECT-TYPE	An individually identified class of objects that has military significance. Examples are a type of person (e.g., by rank), a type of materiel (e.g., self-propelled howitzer), a type of facility (e.g., airfield), a type of feature (e.g., restricted fire area), or a type of organisation (e.g., armoured division).	
CAPABILITY	The potential ability to do work, perform a function or mission, achieve an objective, or provide a service.	
LOCATION	A specification of position and geometry with respect to a specified frame of reference. Examples are point, sequence of points, polygonal line, circle, rectangle, ellipse, fan area, polygonal area, sphere, block of space, and cone. LOCATION specifies both location and dimensionality.	Positioning and Shapes (Where)
ACTION	An activity, or the occurrence of an activity, that may utilise resources and may be focused against an objective. Examples are operation order, operation plan, movement order, movement plan, fire order, fire plan, fire mission, close air support mission, logistics request, event (e.g., incoming unknown aircraft), or incident (e.g., enemy attack).	Dynamics (How)

2.4.1.4 The relationships of the key entities are illustrated in Figure 2. The many-to-many relationships are denoted by a line with a dot at each end. This is permissible at a conceptual level, but must be resolved into one-to-many relationships before a model can be considered complete. The resolution of many-to-many relationships can lead to complex structures and the balance of the paper describes how it has been done for GH4.

---

1 A summary of IDEF1X methodology and notation appears in Annex K.

2 The convention is to annotate the names of entities in capital letters. If the name of an entity is used in plural, then a lower-case “s” is appended to the name without changing the name to conform to standard English usage, (e.g., the plural of CAPABILITY is written CAPABILITYs).

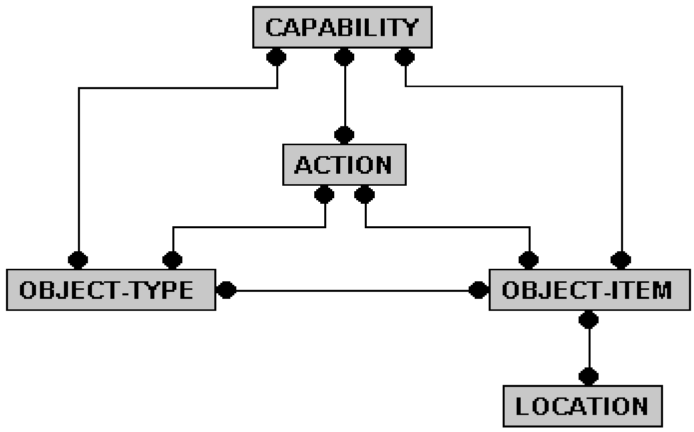


Figure 2. Key Entities of the Generic Hub Data Model[3]

2.4.2 Identification of Battlespace Elements

2.4.2.1 The battlespace consists of a large number of objects, each with its own set of characteristics. Objects may be described as a class or type rather than as individually identified items, for example, a tank, a helicopter, a howitzer, a rifle, an armoured brigade, an infantryman.

2.4.2.2 It is necessary to make the distinction between actual instances and a type in describing objects of interest. Actual instances are catered for by use of OBJECT-ITEM, e.g., 2 (SP) Armoured Cavalry Brigade. Types are recorded as OBJECT-TYPEs (e.g., a Light Infantry Battalion).

2.4.2.3 The distinction between OBJECT-TYPE and OBJECT-ITEM is vital. Implicit in this distinction is the fact that data relating to OBJECT-TYPEs will tend to be *static* (i.e., the values of the attributes are not likely to change very often over time), whereas the values of attributes of OBJECT-ITEMs are likely to be more *dynamic*. For example, if a characteristic is about a type (e.g., M1A1 Abrams Tank), it is an attribute of OBJECT-TYPE. Thus, calibre of main gun, track width, and load class are characteristics of OBJECT-TYPE. However the callsign, actual fuel level, munitions holdings, and current operational status of a specific tank are characteristics of an OBJECT-ITEM.

2.4.2.4 The relationship between the two entities enables each OBJECT-ITEM to be classified as an OBJECT-TYPE, thereby *inheriting* characteristics of the type.

---

[3] A dot at the end of a relationship line denotes “many.” The relationships shown in this diagram are all many to many. For example, the relationship between OBJECT-ITEM and LOCATION is to be interpreted as a pair of statements that an OBECT-ITEM may have zero, one, or more LOCATIONs and that a LOCATION may apply to zero, one, or more OBJECT-ITEMs. The IDEF1X standard permits this type of general statement only in explanatory diagrams such as this one. A fully developed data model must replace the many-to-many relationships with the appropriate structures that admit only one-to-many relationships. An introduction to IDEF1X graphical notation is provided in Annex I.

2.4.3 OBJECT-ITEM Hierarchy

2.4.3.1 OBJECT-ITEM stands at the top of its own hierarchy with ORGANISATION, PERSON, MATERIEL, FACILITY, and FEATURE as its immediate subtypes. This subtyping is illustrated on the right-hand side of Figure 3. The subtypes are defined in Table 4.

2.4.3.2 The properties of an OBJECT-ITEM that are of interest are entered as attributes in the appropriate subtype entities.

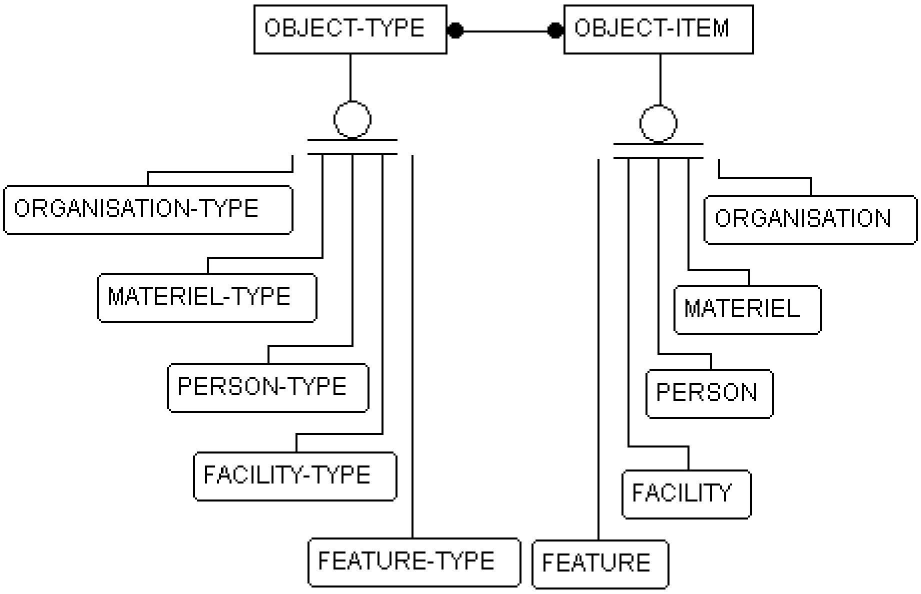


Figure 3. First Two Levels of OBJECT-TYPE and OBJECT-ITEM Subtree Hierarchies[4]

Table 4. Definition of OBJECT-ITEMs

Entity	Entity Definition
FACILITY	An OBJECT-ITEM that is built, installed, or established to serve some particular purpose and is identified by the service it provides rather than by its content (e.g., a refuelling point, a field hospital, a command post).
FEATURE	An OBJECT-ITEM that encompasses meteorological, geographic, and control features of military significance (e.g., a forest, an area of rain, a river, an area of responsibility).
MATERIEL	An OBJECT-ITEM that is equipment, apparatus or supplies without distinction as to its application for administrative or combat purposes (e.g., ships, tanks, self-propelled weapons, aircraft, etc., and related spares, repair parts, and support equipment, but excluding real property, installations, and utilities).
ORGANISATION	An OBJECT-ITEM that is an administrative or functional structure.
PERSON	An OBJECT-ITEM that is a human being to whom military significance is attached.

2.4.4 OBJECT-TYPE Hierarchy

2.4.4.1 OBJECT-TYPE is also treated as a family of five subtype entities: ORGANISATION-TYPE, PERSON-TYPE, MATERIEL-TYPE, FACILITY-TYPE, and FEATURE-TYPE.

---

[4] The circle with two lines underneath it is a symbol for complete subtyping. A subtype is the same thing as its parent, but it has some properties which do not apply to its siblings or to the parent. An incomplete subtyping scheme is denoted by a single line underneath the circle.

2.4.4.2 The first level subtype hierarchy for OBJECT-TYPE is further subtyped in LC2IEDM in order to capture all the attributes needed for information exchange.

2.4.5 Model Structures that Involve only an OBJECT-TYPE or an OBJECT-ITEM

A resolution of the many-to-many relationships between OBJECT-TYPE and OBJECT-ITEM as well as the objects to themselves (e.g., recursive links of OBJECT-TYPE to OBJECT-TYPE) leads to a full data structure. This is described below within the scope of Figure 4.

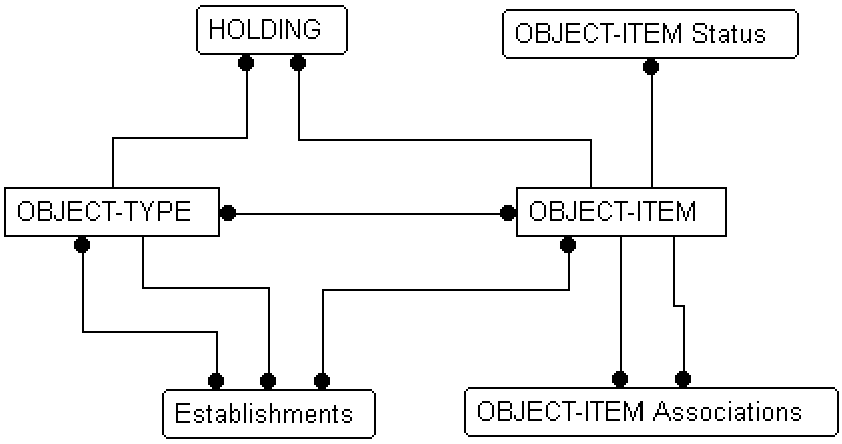


Figure 4. Model Structures That Involve Only OBJECT-TYPE or OBJECT-ITEM[5]

2.4.6 Classification of OBJECT-ITEMs by Type

2.4.6.1 The many-to-many relationship between OBJECT-ITEM and OBJECT-TYPE is resolved by the entity OBJECT-ITEM-TYPE (Figure 5). One of the advantages of this construct is that it permits an instance of OBJECT-ITEM, which has its own descriptive data as an item, to share in the properties of its corresponding OBJECT-TYPE. This minimises the amount of data to be stored on the item side, since the data common to a class can be stored on the type side.

---

5 Some entities at this high level of presentation are referred to as entity clusters because they result in a multitude of entities in the detailed version of the Generic Hub data model. The names of cluster entities are written in lower-case letter with a leading capital in order to distinguish them from entities that are actually specified in the data model.

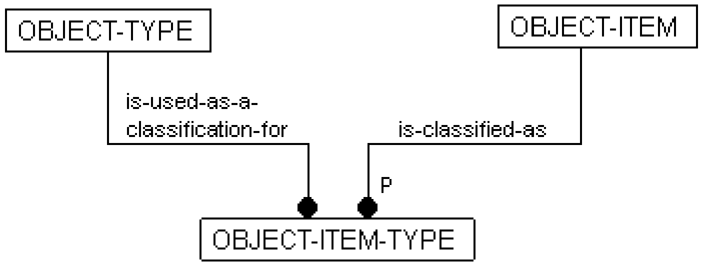


Figure 5. Classifying OBJECT-ITEMs According to Type[6]

2.4.6.2 The entity OBJECT-ITEM-TYPE enables the retention of multiple records of the classification that may be given to a specific OBJECT-ITEM. A history of classifications may be kept, such as that of a moving object whose nature or identity is clarified over a period of time. For example, Unit A may classify an unknown object first as a vehicle, then successively (as better information becomes available) an armoured vehicle, a tank, a main battle tank, and a T72. It also permits the recording of differing interpretations of the same object by different organisations. Unit B may be looking at the same object as Unit A but classify it successively as a vehicle and an APC.

2.4.7 Specifying Status of OBJECT-ITEMs

2.4.7.1 OBJECT-ITEM-STATUS is a record of the perceived condition of a specific OBJECT-ITEM. One of the attributes of OBJECT-ITEM-STATUS records a particularly significant item of information: the perceived hostility classification of a specific OBJECT-ITEM. The entity-level data structure is illustrated in Figure 6. Subtypes of OBJECT-ITEM-STATUS hold the attributes that are tailored to describing the status of subtypes of OBJECT-ITEM. For example, the status of an enemy military ORGANISATION (a unit) could range from *fully operational* to *destroyed*; and the status of a soldier could be *ready*, *incapacitated*, *wounded, absent, missing*, *arrested, captured*, or *killed*. A control feature could be *activated* or *deactivated*.

2.4.7.2 Just as in the case of OBJECT-ITEM-TYPE, the data structures permit multiple records to be kept about the status of an instance of OBJECT-ITEM to reflect changes that occur over time or differing status assessments that may be provided about a single OBJECT-ITEM by several units or organisations.

[6] The letter P at the "many" end stands for "positive." The relationship is read as an OBJECT-ITEM is classified as one or more OBJECT-ITEM-TYPEs. This specification makes the classification of an instance of OBJECT-ITEM mandatory rather than optional.

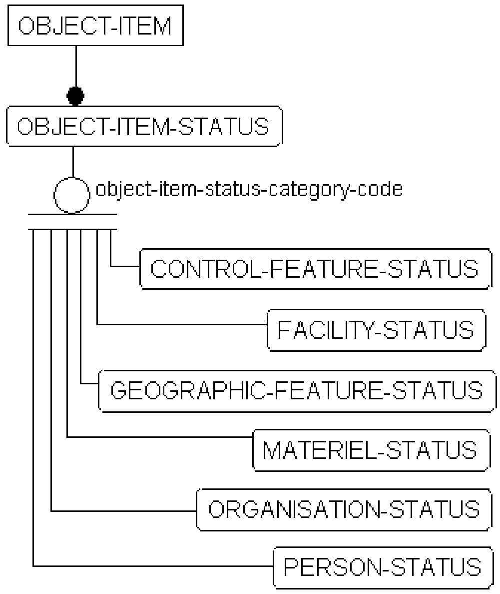


Figure 6. The Specification of Status for an OBJECT-ITEM

2.4.8 Associations between OBJECT-ITEMs

2.4.8.1 There is a clear requirement to link different OBJECT-ITEMs and describe the relationship that exists between them. A specific main battle tank (MBT), for instance, can be owned by a certain armoured infantry brigade. A division may have full command of three brigades, or full command of two and operational command of the third if the third belongs to another nation.

2.4.8.2 Those OBJECT-ITEM associations that are deemed necessary to support C2 are recorded in LC2IEDM as the nine pairs of associations shown as a matrix in Table 5.

Table 5. Valid OBJECT-ITEM Associations

	Object OBJECT-ITEM						
Subject OBJECT-ITEM	FACILITY	FEATURE	CONTROL-FEATURE	GEOG.-FEATURE	MATERIEL	ORGAN-ISATION	PERSON
FACILITY	Yes	Yes	—	—	—	—	—
CONTROL-FEATURE	—	—	Yes	Yes	—	—	—
ORGANISATION	Yes	—	Yes	—	Yes	Yes	Yes

2.4.8.3 These nine OBJECT-ITEM relationships are specified by a category code, for which *example* values are shown to indicate the nature of the association.

a. FACILITY-FACILITY-ASSOCIATION: Connected to, Contains, Utilises.

b. FACILITY-FEATURE-ASSOCIATION: Encloses, Is affected by, Is bounded by, Is contained within, Is partially bounded by, Is partially contained within.

c. CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION: Is contained in, Is end of, Is part of, Is start of, and Is successor of.

d. CONTROL-FEATURE-GEOGRAPHIC-FEATURE-ASSOCIATION: Coincides with, Coincides with part of, Is partially delineated by.

e. ORGANISATION-FACILITY-ASSOCIATION: Controls, Disestablishes, Establishes, Occupies, Uses.

f. ORGANISATION-CONTROL-FEATURE-ASSOCIATION: Controls, Establishes, Is bounded by, Is constrained or enabled by, Is user of.

g. ORGANISATION-MATERIEL-ASSOCIATION: Controls, Employs, Is accounting authority for, Is captor of, Transports.

h. ORGANISATION-ORGANISATION-ASSOCIATION: Has full command of, Has operational command of, Has operational control of, Has tactical command of, Has tactical control of, Has as alternate, Has attached, Has as reserve, Has under command for administration.

i. ORGANISATION-PERSON-ASSOCIATION: Has as a liaison officer, Has on assignment, Has on attachment, Is captor of, Is under command of.

2.4.9 Establishments

2.4.9.1 The primary relationship among subtypes of OBJECT-TYPE is based on the concept of "establishment." "Establishment" consists of the OBJECT-TYPEs that an OBJECT-TYPE is intended or authorised to have, e.g., the tables of organisation and equipment for a unit type or the weapons configuration of an attack helicopter. A specific statement may be that a French engineer regiment type unit has a war-time establishment of 500 regular troops, 150 drivers, 100 vehicles, 20 mine layers, and 20,000 mines.

2.4.9.2 The conceptual structure is illustrated in Figure 7. The cluster entity *Establishment* associates an OBJECT-TYPE with other OBJECT-TYPEs. The various components that make up that *Establishment* are represented in cluster entity *Establishment-Detail*. An Establishment-Detail is the number of a specific OBJECT-TYPE authorised by a specific OBJECT-TYPE Establishment.

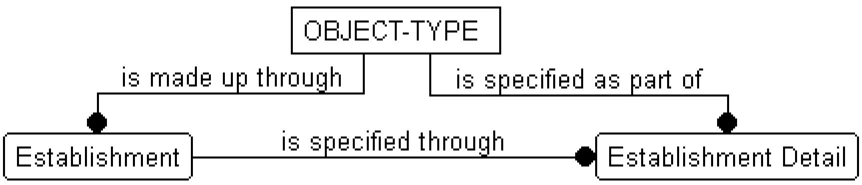


Figure 7. The Concept of Establishment

2.4.9.3 The actual data structure is illustrated in Figure 8, which shows all the *Establishment* entities in grey. There are two entities implementing the Establishment concept both of which are supported by various Establishment Detail entities as follows:

a. ORGANISATION-TYPE-ESTABLISHMENT indicates what OBJECT-TYPEs an organization is supposed to have. These details are specified in several Establishment Detail entities as follows:

(1) ORGANISATION-TYPE-ESTABLISHMENT-**ORGANISATION-TYPE-DETAIL** handling details pertaining to one ORGANISATION-TYPE being composed of other ORGANIZATION-TYPEs

(2) ORGANISATION-TYPE-ESTABLISHMENT-**PERSON-TYPE-DETAIL** that handles the data pertaining to types of persons belonging to an establishment (e.g. Sgt Infantry)

(3) ORGANISATION-TYPE-ESTABLISHMENT-**MATERIAL-TYPE-DETAIL** that handles the data pertaining to types of materiel belonging to an establishment (e.g. Tank Leopard 2)

b. MATERIEL-TYPE-ESTABLISHMENT indicates what Materiel a specicifc MATERIEL-TYPE is supposed to consist of. A standard example would be an equipment parts hierarchy. The details would be stored in the ***Establishment Detail*** entity called MATERIEL-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL.

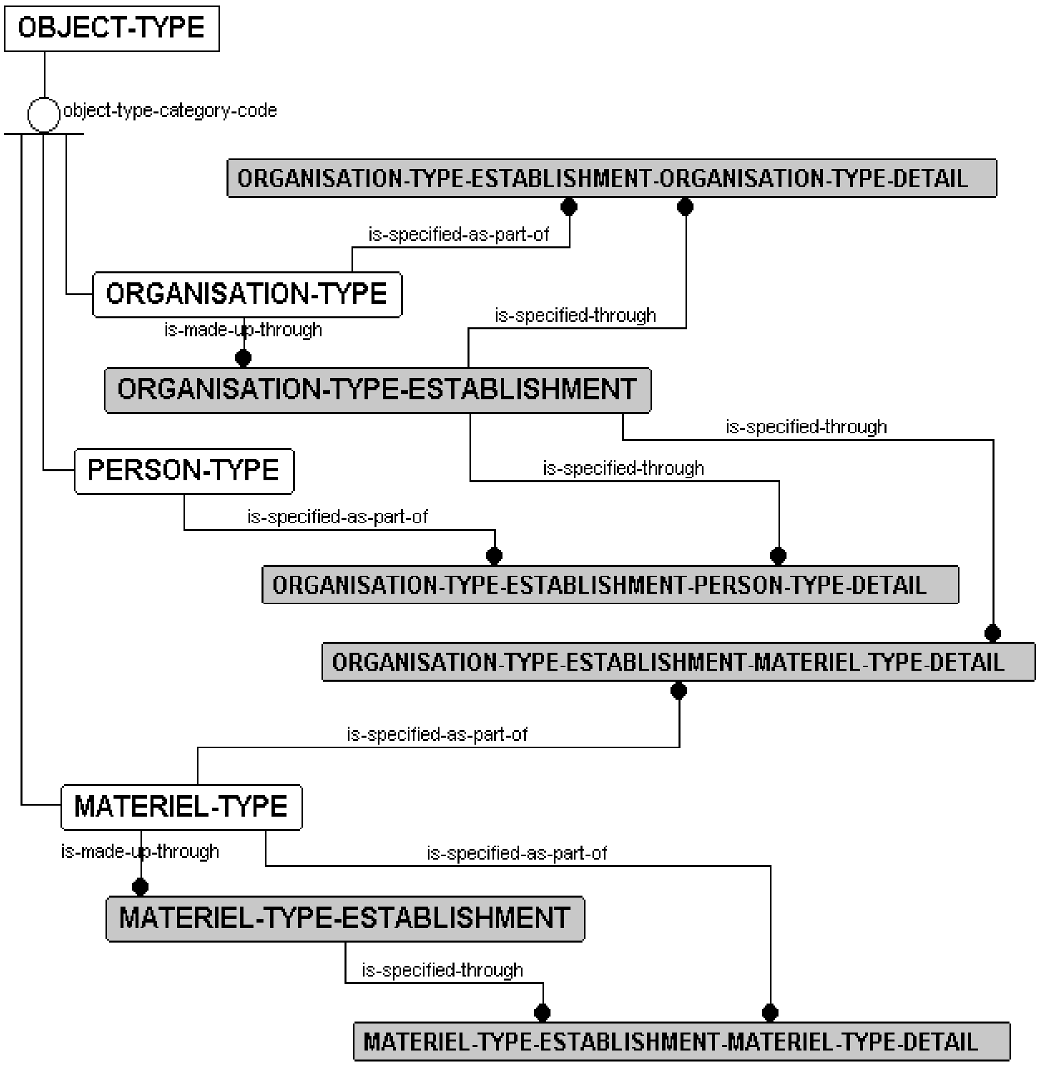


Figure 8. Specifying Establishments for ORGANISATION-TYPE and MATERIEL-TYPE

2.4.10 Assignment of Establishments to OBJECT-ITEMs

A particular OBJECT-TYPE may have more than one *Establishment* at any given time, and a specific OBJECT-ITEM may have more than one *Establishment* associated with it at a given time. This is catered for by the use of MATERIEL-MATERIEL-TYPE-ESTABLISHMENT and

ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENT (see Figure 9). This permits statements of the following kind: As of 1 March 1997, the 19th (US) Mechanized Division is assigned a specific Type Mechanised Division Establishment for war operations in a temperate climate. The establishment data structure (as described in the previous section) would detail the types and numbers of subordinate organisations, equipment, and personnel for that division.

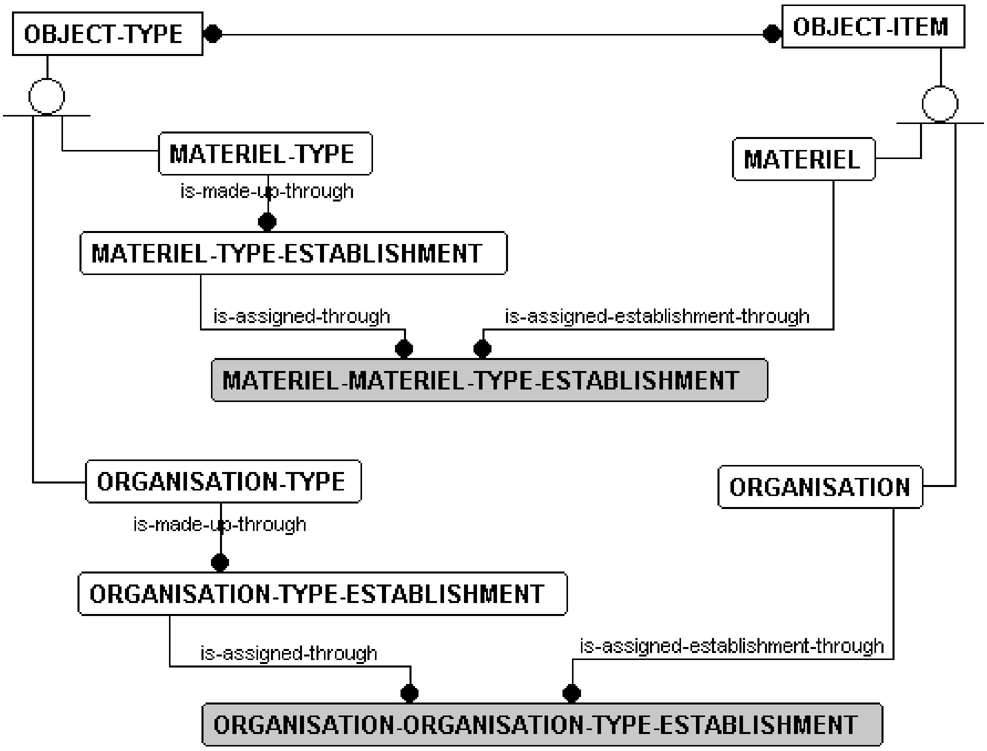


Figure 9. Assigning Establishments to ORGANISATION and MATERIEL

2.4.11 Holdings

2.4.11.1 OBJECT-ITEM and OBJECT-TYPE can be related through a HOLDING, showing how many of each OBJECT-TYPE are held by a specific OBJECT-ITEM together with the status of each. Thus, HOLDING allows quantities of an OBJECT-TYPE (e.g., Challenger MBT) to be attributed to a particular OBJECT-ITEM (e.g., a specific UK Armoured Regiment) that are at a particular status (e.g., operational) at a particular time. The structure of HOLDING is shown in Figure 10.

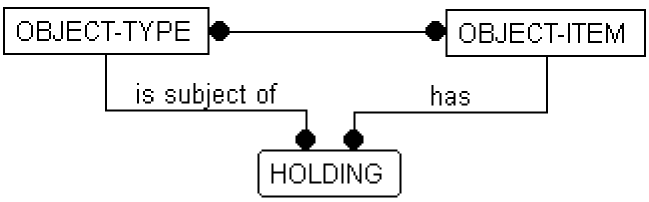


Figure 10. The HOLDING Entity between OBJECT-ITEMs and OBJECT-TYPEs

2.4.11.2 Whereas an ***Establishment*** indicates what an organization or materiel is supposed to be composed of, the ***Holding*** concept captures what the organization or material actually contains. In other words, the difference between HOLDING and Establishment is that whereas Establishment details what an OBJECT-TYPE is authorised to have in terms of other OBJECT-TYPEs, HOLDING details what an OBJECT-ITEM actually has (or is thought to have) at a particular time. For example, at a certain point in time, the 14th FR Engineer Regiment may have 300 regular troops, 100 drivers, 75 vehicles, 10 mine layers, and 16,000 mines. This concept enables the establishment of logistic/personnel replenishment requirements as well as the assessment of organizational capability.

2.4.12 Capabilities

2.4.12.1 There is a requirement to specify and monitor the CAPABILITY of battlespace objects or their types. The entity CAPABILITY can record the potential ability to do work, perform a function or mission, achieve an objective, or provide a service. It allows a set of generic capabilities through category and subcategory codes in the CAPABILITY entity itself. Additional information can be held in the subtypes illustrated in Figure 11.

2.4.12.2 The entity CAPABILITY is linked to OBJECT-ITEMs and OBJECT-TYPEs in three ways:

a. Specifying the expected or normal capability for OBJECT-TYPEs.

b. Estimating or recording the actual capability of OBJECT-ITEMs.

c. Stating (through ACTION-REQUIRED-CAPABILITY) the *required capability* of OBJECT-ITEMs or OBJECT-TYPEs when they are needed as resources for carrying out ACTIONs.

The links to OBJECT-ITEM and OBJECT-TYPE are described below. The link to ACTION is discussed in a subsequent section.

2.4.12.3 Expected/Normal Capability. The entity OBJECT-TYPE-CAPABILITY-NORM is defined as the standard value of a specific CAPABILITY of an OBJECT-TYPE. Since the entity relates to types rather than items, the data it contains will tend to be static. The entity represents staff planning data concerning the capabilities of different OBJECT-TYPEs. The data can be used to:

a. Provide a broad threat analysis in terms of enemy or potentially hostile OBJECT-TYPEs.

b. Assist in the selection of friendly OBJECT-TYPEs for the tasks to be done.

c. Aid an application program in classifying OBJECT-TYPEs in accordance with operational user's preferences.

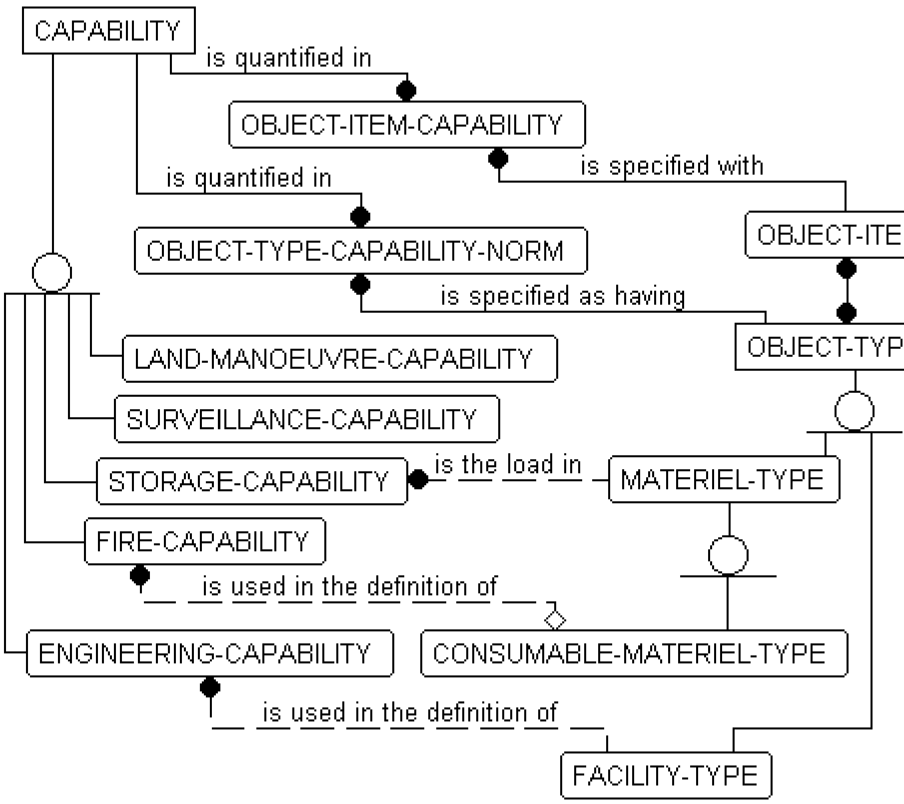


Figure 11. Specifying the Capabilities of Battlespace Objects

2.4.12.4 Actual Capability. The capabilities of individual OBJECT-ITEMs may differ from the norm due to attrition. OBJECT-ITEM-CAPABILITY holds the perceived value of a specific CAPABILITY of an OBJECT-ITEM where it differs from the norm or where there is no norm. As well as recording detail of friendly troops, OBJECT-ITEM-CAPABILITY could hold a threat analysis for individual enemy OBJECT-ITEMs, e.g., an enemy tank regiment may have demonstrated a capability to move at a faster rate than its OBJECT-TYPE-CAPABILITY-NORM.

2.4.12.5 Required Capability. It is necessary to be able to specify a required CAPABILITY in order to complete an ACTION. This enables optimal resource usage for planning as well as for managing resources during the life of an ACTION. ACTION-REQUIRED-CAPABILITY is defined as the specific CAPABILITYs needed to execute a given task (i.e. an assigned ACTION). This subject is elaborated in paragraph 2.4.17.

2.4.13 Positioning of and Geometry for OBJECT-ITEMs

2.4.13.1 The entity LOCATION permits the recording of point locations, as well as various open/closed multi-dimensional boundaries, such as areas of responsibility for units, axes of advance, or three dimensional air corridors. To achieve this, the LOCATION entity captures two distinct but related concepts of interest to planners and operators in the battlespace, namely the specification of the:

a. ***Position/location*** of items in the battlespace

b. ***Geometry*** of battlespace features.

2.4.13.2 The specification of position and geometry is provided by LOCATION and its subtypes POINT, LINE, SURFACE, and GEOMETRIC-VOLUME, as shown in Figure 12. The figure includes only part of the structure under LOCATION.

2.4.13.3 The linkage to battlespace objects is shown by many-to-many relationships because there may be multiple roles (a current relation, a planned relation, or a proposed relation) or because multiple location reports may be collected for each individual OBJECT-ITEM.

2.4.13.4 The specification of geometry and location can be either absolute with respect to Earth co-ordinates or relative with respect to an arbitrary point.

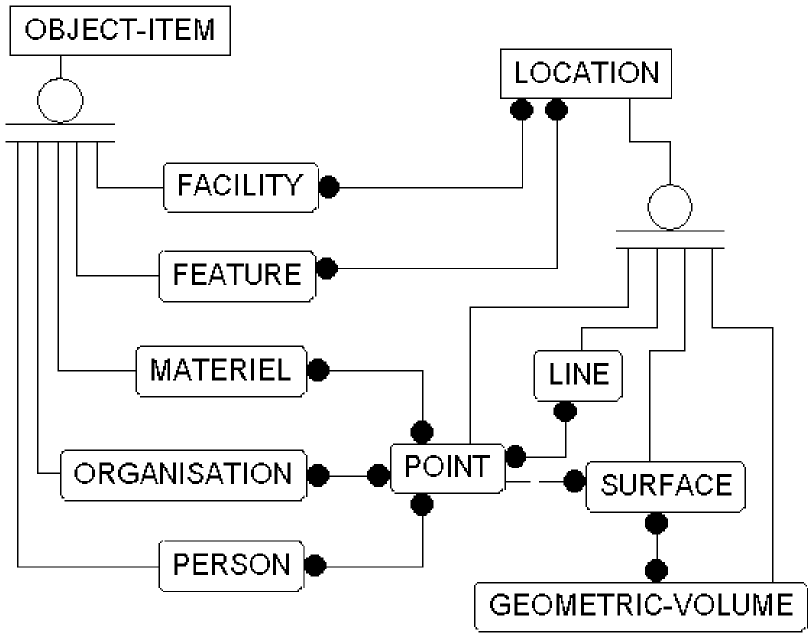


Figure 12. Specifying Position and Geometry for OBJECT-ITEMs

2.4.13.5 The FACILITY and FEATURE subtypes of OBJECT-ITEM are related directly to LOCATION, and therefore FACILITYs and FEATUREs can be mapped to POINTs, LINEs, SURFACEs, and GEOMETRIC-VOLUMEs. Examples of features include rendezvous points, supply routes, restricted fire areas, and air corridor). For each instance of FEATURE, a meaning is given to the geometry by specifying the type for the FEATURE. In case of FACILITY, the geometry refers only to the physical characteristics of a FACILITY, such as height, width, length, and horizontal outline.

2.4.13.6 The three other subtypes of OBJECT-ITEM (MATERIEL, ORGANISATION, and PERSON) are related only to the POINT subtype of LOCATION. For example, the location of an enemy military UNIT with respect to its centre of mass would be specified as a point co-ordinate and may also include a bearing and speed vector to express movement.

2.4.13.5 If location by POINT only is not adequate, geometry can be specified by associating a specific FEATURE with the battlespace object. As an example, if the assembly area of an armoured division (an ORGANISATION) must be recorded, then a suitable CONTROL-FEATURE can be defined and a SURFACE specified for it. A similar extension applies to FACILITY if any other geometry besides its intrinsic shape needs to be specified.

2.4.14 Amplifying Information about Estimates

2.4.14.1 Introduction

The entities discussed so far directly address the information about battlespace objects and their types. Two additional entities—REPORTING-DATA and CONTEXT—enable the specification of amplifying information and offer a mechanism for combining such information to make use of the underlying data in more complex ways.

2.4.14.2 Amplifying Information about Reported Data

A considerable amount of the information about the battlespace situation consists of perceptions or interpretations by persons or organisations. These generally relate to dynamic parts of information—those having to do with OBJECT-ITEM locations, status, holdings, associations, and classification. The REPORTING-DATA entity provides a mechanism for recording amplifying data for such records and includes attributes for the responsible reporting ORGANISATION, the effective date and time for the estimate, the duration for which the estimate is valid, the reporting date and time of the estimate, and the degree of validity of the estimate. In addition, external information can be cited by using the entity REFERENCE in connection with REPORTING-DATA.

2.4.14.3 Combining Information

2.4.14.3.1 The REPORTING-DATA and CONTEXT structure is shown in Figure 13. It permits any number of REPORTING-DATAs to be linked together to form a new REPORTING-DATA. Thus, an intelligence analyst may create an intelligence appreciation about the location of an enemy unit by basing it on a number of different observations that place nominally different units at approximately the same place and the same time. The analyst then creates an entry in ORGANISATION-POINT with an associated entry in REPORTING-DATA that points through CONTEXT to all the data being used. For example, an analyst's Reporting Data 4 may be associated with previous Reporting Data 1, Reporting Data 2, and Reporting Data 3.

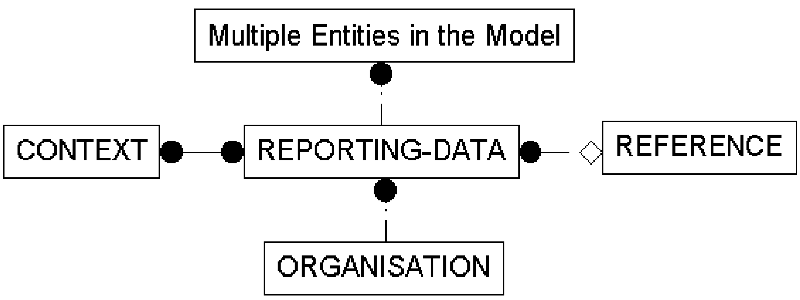


Figure 13. Specifying Amplifying Information and Combining Such Information

2.4.14.3.2 The new information that is created by linking existing information is itself an estimate that needs to be described by a suitable REPORTING-DATA. This is done through CONTEXT-REPORTING-DATA-ASSOCIATION which relates a specific CONTEXT as a subject with another REPORTING-DATA as an object. The relationship is characterised by the following values: Implies, Is confirmed by, Is corrected by, Is defined to be, Is negated by, Is superseded by.

2.4.15 Actions: Planning and Conducting Battlespace Operations

2.4.15.1 Introduction

The entity ACTION, together with its related entities, is capable of specifying and describing all activities and events that occur in the battlespace. An ACTION is viewed as a simple statement in which something carries out an activity to affect something else at some time. The "something" is described by OBJECT-TYPEs and OBJECT-ITEMs. Thus, OBJECT-TYPEs and OBJECT-ITEMs are related to ACTION in two distinct ways: as resources and as objectives.[7] ACTIONs can be characterised by the following statement:

RESOURCEs carry out and are utilised in **ACTION**s,
which are focused against **OBJECTIVE**s.

For example, the 11th (NL) Air Mobile Brigade may use 4 Chinook helicopters (an ACTION-RESOURCE) to transport 100 troops to a landing zone (ACTION-OBJECTIVEs). Complex statements, such as operations orders, can be constructed by relating simple statements.

2.4.15.2 The Basic ACTION Model

The basic model structure for ACTION is shown in Figure 14; its features are described in the following sections.

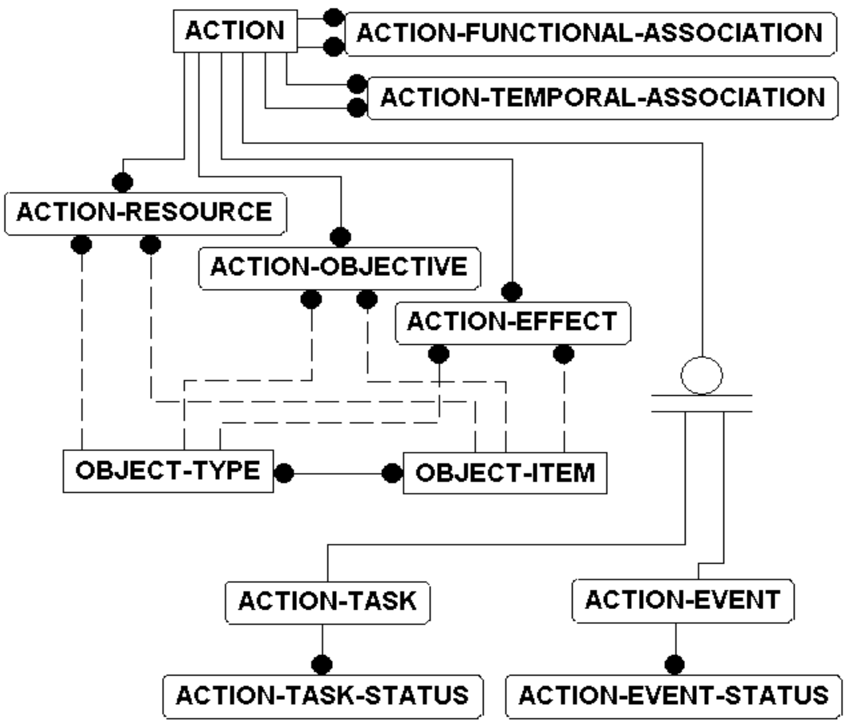


Figure 14. The Primary Model Structure for ACTION

2.4.15.3 Subtypes of ACTION

2.5.15.3.1 To cater to two different data requirements, ACTION has two subtypes:

---

7 A third relationship between ACTION and OBJECT-TYPEs/OBJECT-ITEMs is used to characterise the effects of ACTIONs, whether intended or not. A subsequent section covers this topic.

a. ***ACTION-TASK*** caters for activities that are planned or foreseen.

b. ***ACTION-EVENT*** caters for activities that occur, are of military interest, and must be noted.

2.4.15.3.2 The entity ACTION-TASK is defined as an ACTION that is being or has been planned. It concerns those ACTIONs over which control can be exercised or which are predicted (such as friendly operations, and those enemy activities that have been predicted as a result of intelligence assessment). It can represent actions that are typically found in plans, orders, and requests.

2.4.15.3.3 An ACTION-EVENT is defined as an ACTION that is an incident, phenomenon, or occasion of military significance which has occurred or is occurring but for which planning is not known. This entity is intended to capture ACTIONs that simply occur and need to be noted. An ACTION-EVENT may trigger a new ACTION-TASK. For example, the encounter of a scattered minefield near the landing zone will result in an evasive manoeuvre. An observer in the battlespace may also use ACTION-EVENT to report his sightings that result from a recorded ACTION-TASK of which he has no knowledge.

2.4.15.4 The Role of Objects as Resources and Objectives

2.4.15.4.1 To establish a tasking there is a need to establish an aim and allocate a resource to execute it. Therefore the entities ACTION-RESOURCE and ACTION-OBJECTIVE have been introduced in order to be able to relate OBJECT-ITEMs and OBJECT-TYPEs to ACTION as assets or aims.

2.4.15.4.2 The entity ACTION-RESOURCE is defined as an OBJECT-ITEM or an OBJECT-TYPE that is required, requested, allocated, or otherwise used or planned to be used in conducting a specific ACTION. ACTION-RESOURCEs are those OBJECT-ITEMs and OBJECT-TYPEs that have been specified as the things executing, things being used in or allocated to, or things whose use is qualified in some way, in carrying out a specific ACTION.

2.4.15.4.3 The entity ACTION-OBJECTIVE is defined as the focus, in terms of an OBJECT-ITEM or OBJECT-TYPE, in conducting a specific ACTION. ACTION-OBJECTIVEs are those OBJECT-TYPEs or OBJECT-ITEMs that are specified to be (or excluded from) the focus of an ACTION.

2.4.15.5 Specification of ACTION-EFFECT

2.4.15.5.1 Requirement. There is a need to monitor the effectiveness of ACTIONs that are executed in the battlespace as well as to estimate the potential effects of planned or pending ACTIONs.

2.4.15.5.2 ACTION-EFFECT. ACTION-EFFECT is defined as a perceived effectiveness of a specific ACTION against a specific battlespace item or its type. For example, the enemy force has been diminished by at least 50 percent and the enemy position was captured.

2.4.15.5.3 Measuring Effects and Collateral Damage. The ACTION-EFFECT estimate specifies a quantity if the objective is an OBJECT-TYPE, or a fraction if the objective is an OBJECT-ITEM. Battlespace performance could be evaluated by comparing ACTION-EFFECTs to stated ACTION-OBJECTIVEs. It should be noted that ACTION-EFFECT permits the capture of information about effects of ACTIONs on objects that are not necessarily the objectives of the ACTION. This is referred to as ***collateral damage***.

2.4.15.6 ACTIONs in Relation to Other ACTIONs

2.4.15.6.1 General. The promulgation and understanding of an operations order is dependent upon the complex linkage of a series of assigned actions (tasks). These tasks are ***linked functionally*** (e.g. The Corps Barrier Zone Completion is decomposed into several Divisional Barrier Zone tasks which is then further decomposed into Brigade Barrier Zone tasks and so on). There is also a ***temporal*** dimension that indicates that Action A cannot start before Action B is completed (e.g., A unit cannot achieve Phase Line 2 until it has achieved Phase Line 1. The Generic Hub provides two associative entities that specify the dependencies between ACTIONs and allow for the creation of hierarchies:

a. ACTION-FUNCTIONAL-ASSOCIATION caters to functional relationships; and

b. ACTION-TEMPORAL-ASSOCIATION caters to time-specific dependencies between ACTIONs.

2.4.15.6.2 ACTION-FUNCTIONAL-ASSOCIATION. The entity ACTION-FUNCTIONAL-ASSOCIATION records the relationship of a specific ACTION as being dependent on, supporting, or derived from another specific ACTION. The categories of association are described by the following phrases: Has as a sub-ACTION, In order that, In response to/depending on, Is a modification of, Is a template for, Is an alternative to, Uses as a reference. The simplest relationship is where an ACTION includes a number of other subordinate ACTIONs. This is represented in Figure 15, where Action 2 is the major action that is supported by Action 1. Action 1 consists of four ACTIONs (Action 3 to Action 6); three of the actions are subordinated to Action 1 directly (Action 3 to Action 5), while the fourth action (Action 6) is subordinated to Action 5. In this example, the relationship hierarchy can be represented by the phrases as "Is a sub-Action of" in case of connecting lines and "In order that" for the support.

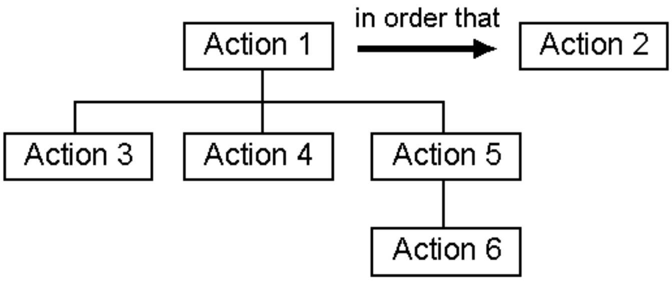


Figure 15. ACTION Hierarchy

2.4.15.6.3 ACTION-TEMPORAL-ASSOCIATION. The timings of sub-actions that are part of a complex action will frequently be interdependent. The entity ACTION-TEMPORAL-ASSOCIATION is designed to handle the data requirements associated with temporal dependencies between ACTIONs. ACTION-TEMPORAL-ASSOCIATION is the assignment of an ACTION (i.e., ACTION-TASK) to be time-dependent for its execution on another ACTION (e.g., ACTION-EVENT or ACTION-TASK).

2.4.15.6.4 Absolute Temporal Dependence. There are several ways to establish temporal dependence. The simplest method and one that does not require the entity ACTION-TEMPORAL-ASSOCIATION is through the use of absolute time when such specification is appropriate. In this method, the absolute start and end times are specified using the attributes in ACTION-TASK so that the sub-tasks are carried out in the correct sequence.

2.4.15.6.5 Relative Temporal Dependence. In many cases, the required start time of the overall action is not known, or perhaps the unit tasking the ACTION is flexible with regard to the exact time the sub-actions are to start or end provided they start or end at some time relative to another action. In order to specify temporal dependence the concept of temporal relationships has been employed. These are characterised by phrases such as “Starts at the end of,” “Starts during and ends after,” and “Starts at the same time and ends after.” These temporal relationships permits specification of the relative order in which ACTIONs are to occur without stating any actual times.

2.4.15.6.6 Offset Temporal Dependence. The temporal association also provides the flexibility of specifying fixed offset intervals, wherein a subject ACTION is to start at some specified time interval before or after a particular reference point in the object task. For example, the transportation of troops may be part of a larger mission to attack a position held by the enemy, requiring that the movement to the landing zone be executed 30 minutes before the attack starts.

2.4.15.6.7 ACTIONs can be related together in very complex ways using the concepts of absolute time, temporal relationships, and temporal relationships with offset intervals. It is possible to formulate plans without specifying a particular start time (or H-hour) while still being able to specify the interrelated time dependencies between its constituent sub-actions. In order to fix a start time for such a plan, it is merely necessary to introduce a new ACTION, with a specified planned start time, and relate it to the ACTIONs to be initiated, e.g., H-hour will be 0900.

2.4.15.7 Progress Status of ACTIONs

2.4.15.7.1 There is a need to monitor the effectiveness and progress of both tasks and events.as follows:

a. ACTION-TASK-STATUS captures the ***perceived appraisal of the planning and execution progress of a particular ACTION-TASK*** in fractional terms or through the reporting of actual starting and ending dates and times.

b. ACTION-EVENT-STATUS reports the ***perceived appraisal of the actual progress of an ACTION-EVENT***. The progress is estimated fractionally at a given date and time; therefore, fraction 0 would coincide with a starting date and time and fraction 1 with the end.

2.4.15.7.2 Using Effectiveness and ACTION-TASKS. ACTION-TASK-STATUS specifies the progress of the ACTION-TASK towards completion without referring to the effectiveness of the ACTION-TASK vis a vis specified objectives. This can be used to monitor the progress of occurring ACTION-TASKs, as well as to provide an estimate of future progress of planned, expected, or ordered ACTION-TASKs.

2.4.16 Concepts That Broaden the Functionality of ACTION

2.4.16.1 Introduction

Five additional concepts add to the scope of data that can be captured to enrich a specification of ACTION. The five concepts include:

a. *CAPABILITYs* that are required for an ACTION

b. A *role* that an ORGANISATION may have with respect to an ACTION-TASK

c. *Constraints or guidance* on the use of an ACTION-RESOURCE

d. Conditions imposed by *rules of engagement*

c. CONTEXTs as a mechanism for specifying or capturing *starting, intermediate, or ending conditions* for an ACTION

d. *Candidate target lists* as an aid in operational planning.

The relationship of these concepts to ACTION is illustrated in Figure 16.

2.4.16.2 Capabilities Required for an ACTION

2.4.16.2.1 The ability to specify a required CAPABILITY in order to complete an ACTION is necessary for planning optimal employment of resources and for managing resources during the life of an ACTION. ACTION-REQUIRED-CAPABILITY is defined as the specific CAPABILITYs required to satisfy an agreed operational need (an ACTION).

2.4.16.2.2 Use of this construct permits the matching of the available capabilities of battlespace objects or their types to the required capabilities in the selection of the most appropriate resources. Also, if the ACTION-REQUIRED-CAPABILITY is known, and, if a resource that was selected to match a CAPABILITY was suddenly not available or was no longer able to provide the requisite CAPABILITY, it alerts the planner that he should re-allocate replacement assets.

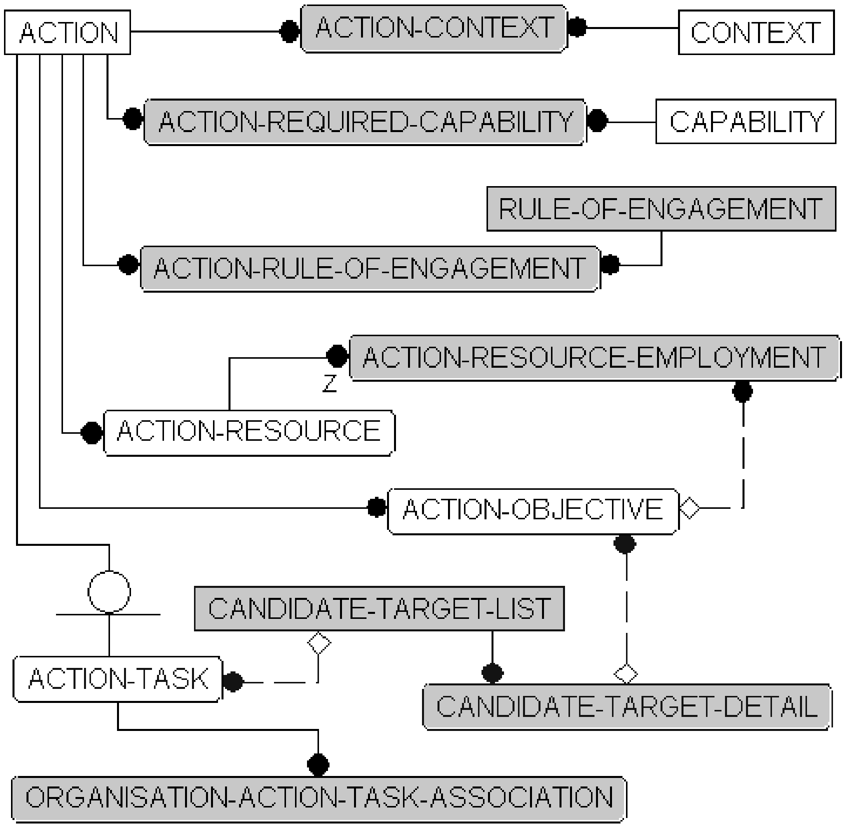


Figure 16. Data Structures for Enhancing the Functionality of ACTION

2.4.16.3 Role of an ORGANISATION with Respect to an ACTION-TASK

2.4.16.3.1 Specification Additional Roles. The addition of an associative entity between ACTION-TASK and ORGANISATION (ORGANISATION-ACTION-TASK-ASSOCIATION) permits the explicit specification of any role or roles that an ORGANISATION may have in relation to an ACTION-TASK over and above those covered by ACTION-OBJECTIVE or ACTION-

RESOURCE. The roles could include initiation, co-ordination, planning, authorisation, oversight, distribution of orders and so on.

2.4.16.3.2 Specification Commander's Intent/Concept of Operations. The second, important function of the entity ORGANISATION-ACTION-TASK-ASSOCIATION is to enable the specification of commander’s intent or concept of operations for an ACTION-TASK. Generally, this would be the top-level or mission task statement for a unit.

2.4.16.4 Use of Resource in an ACTION

ACTION-RESOURCE-EMPLOYMENT is the procedure to be used for utilising a specific OBJECT-TYPE or OBJECT-ITEM against an objective. The structure is currently used to specify some restrictions on aircraft employment that are intended to avoid harm to friendly troops and that also may be useful for deconflicting fires.

2.4.16.5 Rules of Engagement

The RULE-OF-ENGAGEMENT lists a set of approved constraints which may be invoked as appropriate to govern the way a given activity is to be executed. A rule is attached to an ACTION through ACTION-RULE-OF-ENGAGEMENT.

2.4.16.6 Context for an ACTION

2.4.16.6.1 The entity ACTION-CONTEXT, through its linkage to REPORTING-DATA via CONTEXT, helps to set the whole situation, background, or environment relevant to a particular ACTION. It can specify conditions that must precede an ACTION or those that should result from the execution of an ACTION. It can record constraints on ACTIONs.

2.4.16.6.2 In general, the CONTEXT structure enables the specification of related data of the type that is referred to as an operational overlay. The planner can use the CONTEXT information to judge the merits of a plan or an order, and to assess a need for changes.

2.4.16.7 Candidate Target Lists

2.4.16.7.1 Target Lists. The model provides a mechanism for identifying OBJECT-ITEMs and OBJECT-TYPEs as candidate targets for use during operational planning. CANDIDATE-TARGET-LIST is a list of battlespace items and types that have potential value for destruction or exploitation and is nominated by competent authority for consideration in planning battlespace activities. Note that the specification of types allows for the identification of a class of targets that can be engaged as required, rather than as discrete battlespace items. The specific item or type nominations are contained in CANDIDATE-TARGET-DETAIL. Lists can be linked to ACTION-TASKS and details can be identified with ACTION-OBJECTIVES.

2.4.16.7.2 Structuring of Target Lists. The CANDIDATE-TARGET-LIST structure can be used to create prioritised lists of inidvidually identified target candidates. For example, Division A could nominate a specific enemy brigade for attack, a specific radar site for intercept activity, and a specific area in which friendly fire is to be avoided because a long-range reconnaissance patrol may be occupying it. The same structure can also be used to create targeting objectives by classes that may reflect the commander’s intent: for example—in order of priority—command-and-control centres, armoured fighting vehicles, POL supplies, and fire-control radars in that order. Target lists can also be nested.

2.4.16.7.3 Target List Format. The Target List can accommodate various identification schemes including ABCA, BE, FIBE, Organisational and direct site number assignment.

2.4.17 Intelligence and Combat Information

2.4.17.1 Requests for intelligence need to be linked to the products of surveillance and reconnaissance. A REQUEST is a special instance of ACTION-TASK that can use all the functionality of the ACTION structure to specify a requirement to collect information. The execution planning in response to the request would be done within the same structure as any other ACTION. Once the collection is complete, one or more REQUEST-ANSWERs can be created. The structure for REQUEST-ANSWER is illustrated in Figure 17.

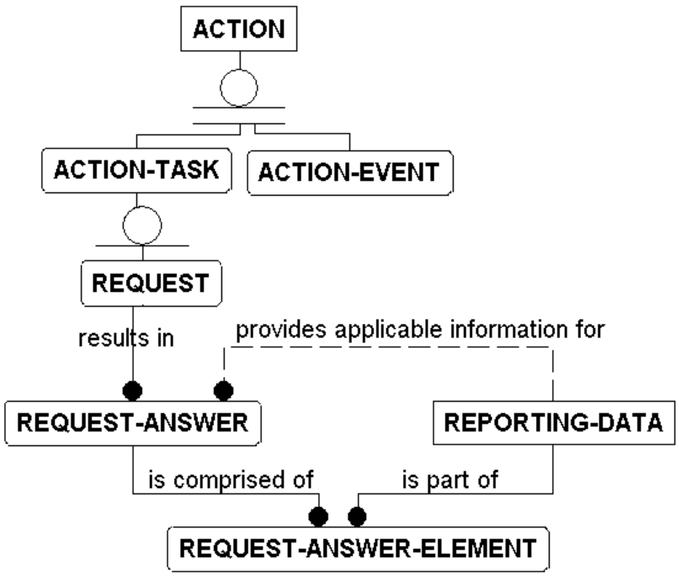


Figure 17. A Mechanism for Handling Intelligence and Combat Information

2.4.17.2 An affirmative REQUEST-ANSWER indicates that additional information may be recorded elsewhere in the model. The pointer to such information is implemented through the entity REQUEST-ANSWER-ELEMENT. For example, a hostile unit may have been located at a given co-ordinate as a result of a search for enemy units in a prescribed region. This information would be recorded in an entity called ORGANISATION-POINT that is linked to REPORTING-DATA. The REQUEST-ANSWER-ELEMENT would then be able to indicate the correct REPORTING-DATA that is part of the REQUEST-ANSWER.

2.4.17.3 A negative entry in REQUEST-ANSWER is actually a genuine piece of information that cannot be recorded elsewhere. If the search for hostile units results in none being found, then that finding is recorded in REQUEST-ANSWER. Since the data recorded in REQUEST-ANSWER is itself an estimate, REQUEST-ANSWER is linked to REPORTING-DATA through a second relationship which permits the REQUEST-ANSWER to be used as data together with other estimates.

2.4.18 Specifying Time in the Model

2.4.18.1 The Need

There is a need to specify time[8] points and time periods having a specific military significance; for example, the starting time of an action, the reporting time of a situation report, and the period of time covered by a weather forecast. There is also a need to be able to specify time in two ways:

a. Fixed (*absolute*) with respect to the standard calendar (e.g., 120700Z Sep69)

b. *Relative* with respect to an arbitrary origin that may be unspecified (e.g., D+3).

2.4.18.2 The Design

2.4.18.2.1 The Generic Hub provides some specifications of time in the entities where they are needed as absolute time. However, time specifications for most of the dynamic data are made through REPORTING-DATA as the effective time for the data that REPORTING-DATA references. There are two exceptions where relative time may be used. One is in the ACTION structure as discussed in Section 2.4.16.5; the other is functionality provided through the REPORTING-DATA structure as illustrated in Figure 18.

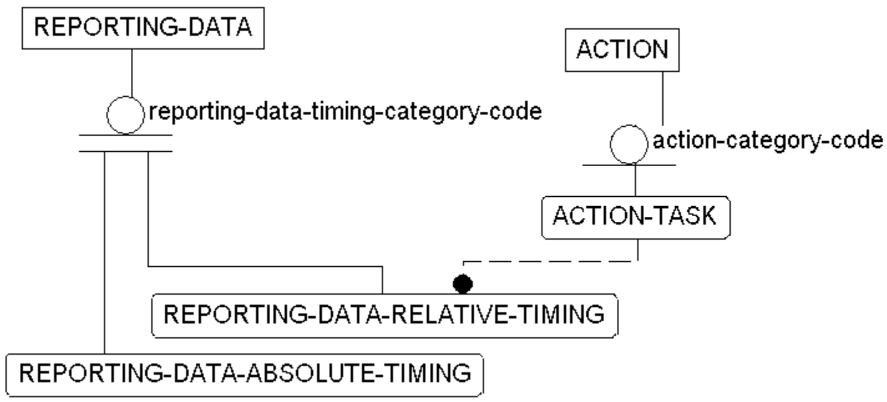


Figure 18. Timing through REPORTING-DATA

2.4.18.2.2 A chronological point with respect to the standard calendar is reported through the subtype REPORTING-DATA-ABSOLUTE-TIMING. It specifies a chronological point as a date and a 24-hour clock time. The date is defined with respect to a chosen origin in the Julian calendar and the clock time is defined with respect to Universal Time.

2.4.18.2.3 If the effective time is to be relative, then it is reported through another subtype of REPORTING-DATA: REPORTING-DATA-RELATIVE-TIMING. The chronological point is an offset with respect to some defining ACTION-TASK that serves as the zero reference for the time scale. The logic is that relative time has meaning only in relation to planning activity.

---

[8] The word "time" when used in the context of natural language refers to the general notion of time that encompasses collectively the specific meanings of the class words "date" and "time."

2.4.19 Summary of the Generic Hub 3 Data Model

2.4.19.1 An overview of the Generic Hub data model is presented in Figure 19. The nine main entities are shaded in grey. The grouping of entities is instructive in itself. The bottom part of the diagram centred about OBJECT-TYPE, OBJECT-ITEM, and LOCATION portrays the contents of the battlespace: what is out there, what does it have, what is it supposed to have, where is it, what is its status, what are its relationships with other objects in the battlespace. Most of the static reference data is to be found among these entities, such as OBJECT-TYPE and Establishment, and to a lesser degree OBJECT-ITEM and its Associations.

2.4.19.2 The upper part is focused on ACTION with CAPABILITY, CONTEXT, and RULE-OF-ENGAGEMENT being oriented primarily to ACTION. Much of this data tends to be dynamic in nature: what are the objects capable of and how are they to be used, how are they being used, and what are they achieving.

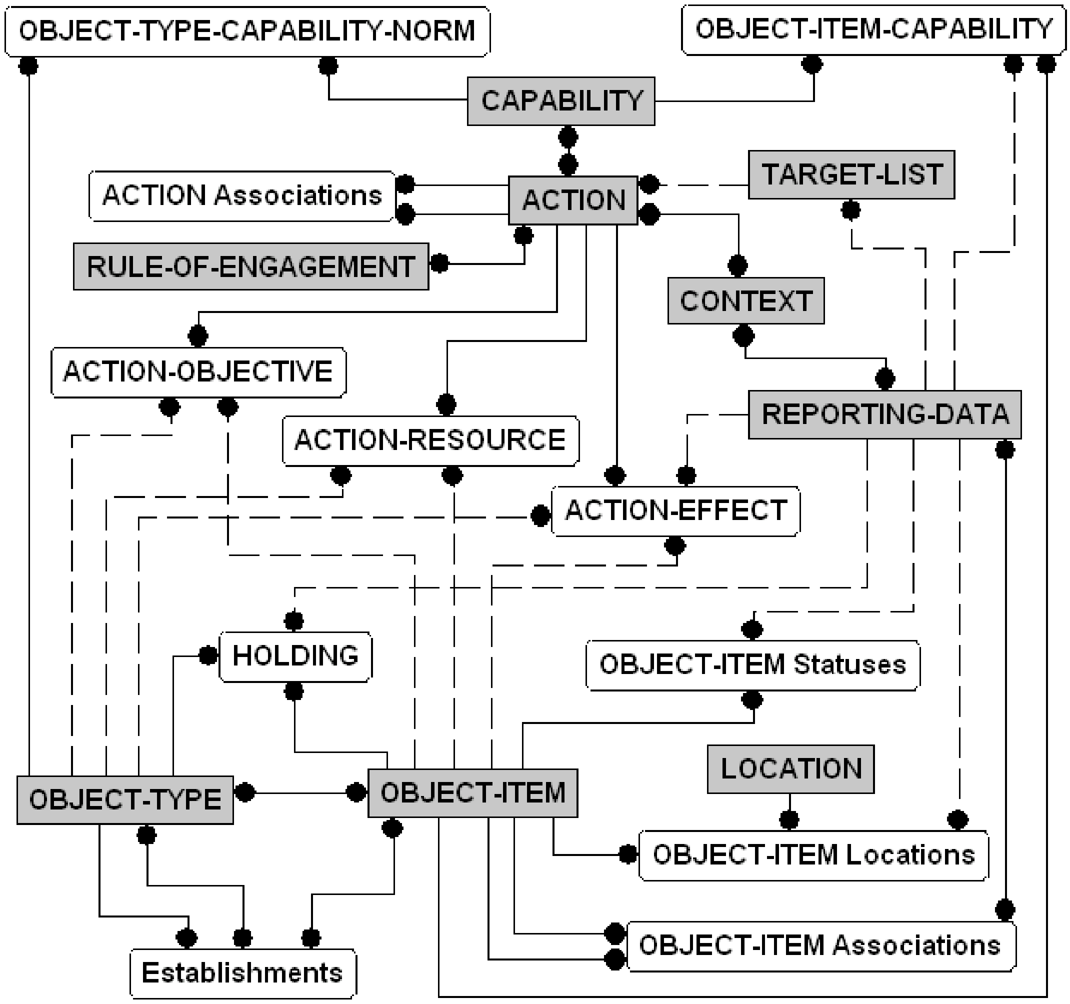


Figure 19. High-Level View of the Generic Hub Data Model

2.4.19.3 The entity REPORTING-DATA plays a special role in the model. It records reporting data about much of the information held in the lower part of the model. It also serves as the means for that information to be used in multiple ways in developing courses of action, allocating resources, preparing plans, and executing operations orders, all of which are in the province of the upper part of the model.

2.4.19.4 The upper and the lower parts are connected through a number of associative entities that are used for linking plans, orders, and requests through objectives, resources, and effects to OBJECT-TYPEs and OBJECT-ITEMs.

2.4.19.5 This paper concludes with an example to illustrate the use of the data structures.

2.5 An Example: Data for an ORGANISATION

2.5.1 Introduction

2.5.1.1 This section illustrates selected features of the model as they may be of interest to a military unit engaged in operations..

2.5.1.1 Figure 20 below shows how an ORGANISATION is related to other key entities that are subtypes of either OBJECT-TYPE or OBJECT-ITEM. On the left side, its direct connection to OBJECT-TYPE represent the holdings that it may have in MATERIEL-TYPE, ORGANISATION-TYPE, and PERSON-TYPE. An establishment that may be assigned to an ORGANISATION is represented by a link to ORGANISATION-TYPE-ESTABLISHMENT, which may have as its components the types in MATERIEL-TYPE, ORGANISATION-TYPE, and PERSON-TYPE. On the right side, the connections to the subtypes of OBJECT-ITEM are the various associations that ORGANISATION may have, including one to itself.

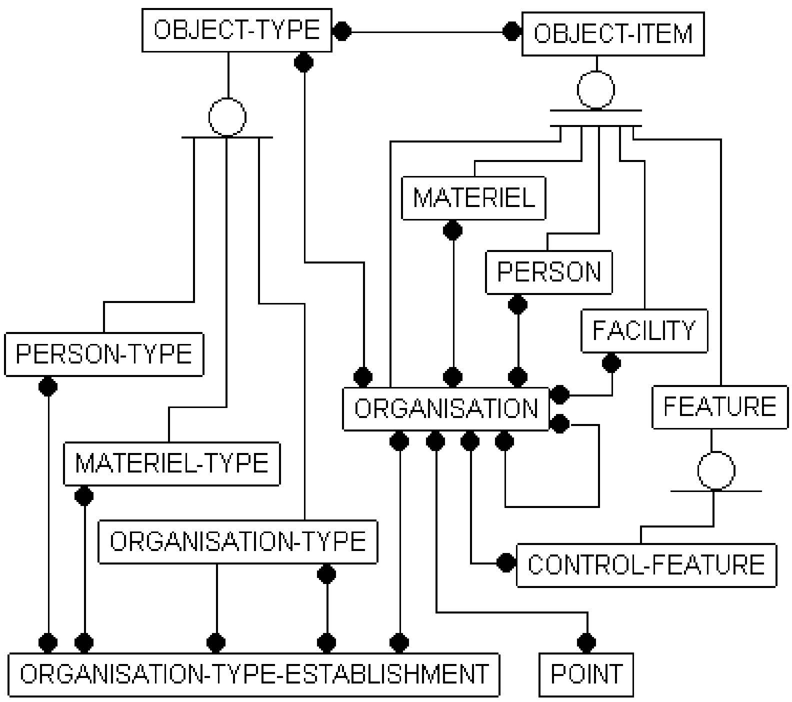


Figure 20. ORGANISATION in Relation to Other Entities

2.5.1.2 An ORGANISATION also has a relationship with the subtype POINT of LOCATION to specify its position.

2.5.2 Producing Plans

The model supports the planning process by capturing information at each stage, and permitting a variety of planning options to be examined. The steps in planning may include the following:

a. Create a new ACTION-TASK or specify new parameters for an existing ACTION in order to take the initiative or to respond to an ACTION-EVENT.

b. Add detail to the ACTION-TASK by using the functional and temporal associations. This permits the subdivision of the plan into sub-activities with differing functional and temporal relationships to the high-level plan.

c. Identify the ACTION-OBJECTIVEs in terms of OBJECT-TYPEs and/or OBJECT-ITEMs. This is the mechanism for identifying key objectives in terms of enemy units, facilities, and materiel (e.g., destroy a bridge in enemy held territory).

d. Search for the required CAPABILITYs to perform the ACTION. This is the process of matching the appropriate ACTION-RESOURCE to meet the requirements of a specific ACTION. For example, crossing of an obstacle requires the employment of an engineer UNIT-TYPE with the appropriate CAPABILITY, and the movement of personnel requires vehicles or aircraft with the appropriate payloads.

e. Allocate OBJECT-TYPE as an ACTION-RESOURCE to a ACTION-TASK based on its CAPABILITY-NORM. Having identified the requirement for troop-carrying vehicles, this step requires the allocation of, for example, 12 Blackhawk helicopters.

f. In order to determine what resources are available for this ACTION, search for OBJECT-ITEMs whose OBJECT-ITEM-CAPABILITY matches the CAPABILITY-NORM for their type. For example, the 3rd US Aviation Brigade may have 24 Blackhawk helicopters and the 1st US Marine Expeditionary Force may have 12.

g. Allocate individual OBJECT-ITEMs as ACTION-RESOURCEs to an ACTION-TASK. Twelve Blackhawk helicopters from the 3rd US Aviation Brigade are designated to perform the task.

h. Define CONTROL-FEATUREs to support the ACTION. Such features may be air corridors, low-level transit routes, or target areas.

2.5.3 Generating Orders

Once the planning process is complete, an order can be generated by simply converting the status of a particular plan, or a series of plans, from “plan” to “order.”

2.5.4 Reporting of Status

Status reporting deals with a wide range of objects, from an individual soldier to a complete situation report. The entities used to generate such reports encompass most of the data model. The following is a sample of possible applications:

a. The OBJECT-ITEM-STATUS entity can be used to record information about individual OBJECT-ITEMs (e.g., Sgt. T. Hanks is wounded in action; 15 (GE) Panzer Division is fully operational).

b. ACTION-TASK-STATUS may be used to provide updates on the dynamics of the battlespace (e.g., minefield laying 70 percent complete, estimated time of completion + 2 hours).

c. ACTION-EVENT-STATUS provides a means of reporting unplanned activity (e.g., flooding started at 1626 on 18 July 2000).

d. OBJECT-ITEM associations can be used to specify a friendly/enemy order of battle (in particular, ORGANISATION-ORGANISATION-ASSOCIATION).

e. Establishments and HOLDING can be used to indicate surpluses or deficiencies (e.g., 1 (DA) Mechanised Brigade has a holding of 50 Leopard I main battle tanks whereas it is established to have 56).

2.6 Detailed Documentation of the Generic Hub Specification

The details of the model are described in the balance of this paper in segments that are functionally related views of the model. These segments usually cluster around the independent entities. In this way, the basic parts, or building blocks, of the Generic Hub are characterised, together with examples of their functionality.

(This page intentionally left blank)

3. OBJECT CLASSES AND IDENTIFIABLE OBJECTS

3.1 Introduction

3.1.1 Requirements

3.1.1.1 There is a requirement to identify objects of military significance. In this context, "objects" refer to physical things including units, equipment, stores, personnel, facilities, geographic features, and also to non-physical concepts such as co-ordination points, lines, and areas. Such objects may already exist and be known; they may also be newly identified or expected in the future.

3.1.1.2 There is a requirement to distinguish between individual objects and classes of objects in describing things of military interest. Many objects in the battlespace are of interest primarily in terms of their class or category rather than as an individual object; for example, tanks, armoured brigades, or infantrymen.

3.1.1.3 There is a requirement to define those characteristics of objects and their types that are necessary for performing command and control tasks. For example, it must be possible to describe the size of a unit, the name of a commanding officer, or the military load classification of a bridge. Such information tends to be dynamic in nature; as new information becomes available other information becomes outdated or nullified.

3.1.1.4 There is an explicit requirement to include those characteristics of objects and their types to permit a suitable display of objects on battlespace situation maps.[9]

3.1.1.5 There is a requirement to retain information about certain characteristics of objects as a function of time. For example, it should be possible to keep a historical log of the location of a unit for purposes of tracking and to specify predicted future locations of a unit for purposes of planning. Such a time record is also needed for other dynamic characteristics of objects, such as their operational or personnel status and their holdings in terms of other objects (e.g., the number of troops and/or equipment in a particular unit).

3.1.2 Overview

3.1.2.1 Objects, Object Types, and Their Relationships

3.1.2.1.1 Objects and their types are modelled as OBJECT-ITEMs and OBJECT-TYPEs, respectively. An OBJECT-ITEM represents an individual object of military significance, e.g., the unit "1 DIV" or a truck with a specific license plate. An OBJECT-TYPE represents a class of objects, e.g., an armoured division or a specific type of vehicle (such as "Truck").

3.1.2.1.2 The structure which is provided by the model to satisfy the requirements comprises three parts: (1) OBJECT-ITEM and its subtyping hierarchy; (2) OBJECT-TYPE and its subtyping hierarchy; and (3) OBJECT-ITEM-TYPE which links OBJECT-ITEM to OBJECT-TYPE. The three basic entities and their relationships are displayed in Figure 21.

---

9 The governing document for NATO display symbology is APP-6A October 1998.

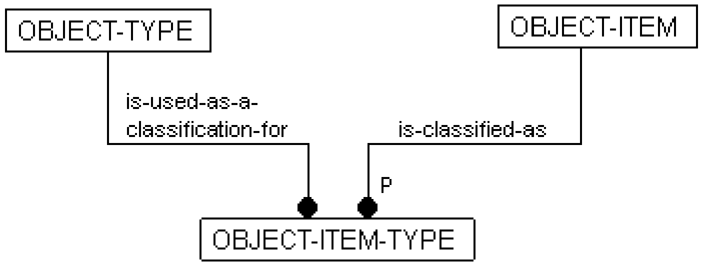


Figure 21. Objects, Types, and Their Relationships

3.1.2.1.3 Each instance of OBJECT-ITEM and each instance of OBJECT-TYPE is assigned a unique identity in the model. However, multiple instances of OBJECT-ITEM may refer to the same real-world object. For example, multiple observers who observe the same enemy unit may create different instances of OBJECT-ITEM, each with its own identity. The task of combining and correlating raw intelligence data such as this in order to build a recognised ground picture falls outside the model; however, it could potentially result in the creation of another instance of OBJECT-ITEM that is the product of the correlation.

3.1.2.1.4 The distinction between OBJECT-TYPEs and OBJECT-ITEMs is paramount in the model to enable the characteristics of objects to be specified at the correct level of generality. If a characteristic is about a class, e.g., Leopard-2, it is an attribute of OBJECT-TYPE; therefore, calibre of main gun, track width, and load class would be characteristics of OBJECT-TYPE as they apply to all instances of Leopard-2. If a characteristic is unique to a specific instance, it is an attribute of OBJECT-ITEM; therefore, the identifying number of a specific Leopard-2 is a characteristic of OBJECT-ITEM. Attributes of OBJECT-TYPEs tend to be more static (i.e., less subject to changes over time) than attributes of OBJECT-ITEMs, as the former must hold for all objects of a particular class while the latter information is restricted to a single object.

3.1.2.1.5 The link between an object and its class is specified using OBJECT-ITEM-TYPE, which is an associative entity used to classify a particular OBJECT-ITEM as being of a particular OBJECT-TYPE. This allows each instance of OBJECT-ITEM to “inherit” information that is stored about its corresponding class. The entity OBJECT-ITEM-TYPE and its uses are discussed in Chapter 4; whereas the present chapter is dedicated to describing OBJECT-ITEM and OBJECT-TYPE data structures.

3.1.2.2 The Subtyping Hierarchies

3.1.2.2.1 The first way in which information concerning objects is structured within the model is by distinguishing between objects and object classes, as described above. This means that characteristics are assigned to either OBJECT-ITEM or OBJECT-TYPE depending on whether they convey instance-specific information or class-specific information.

3.1.2.2.2 The second way in which information is structured in the model is through the use of subtypes. Subtyping is based on the fact that a characteristic which is applicable to one (class of) object(s) does not need to be applicable to all (classes of) objects. For example, a bridge has a military load classification while a unit does not; a person has a gender while a facility does not. Based on this idea, the subtypings of OBJECT-ITEM and OBJECT-TYPE are developed by first identifying the object characteristics relevant to command and control and then attributing those characteristics at the appropriate level of generality. The resulting first-level subtyping hierarchies are displayed in Figure 22.

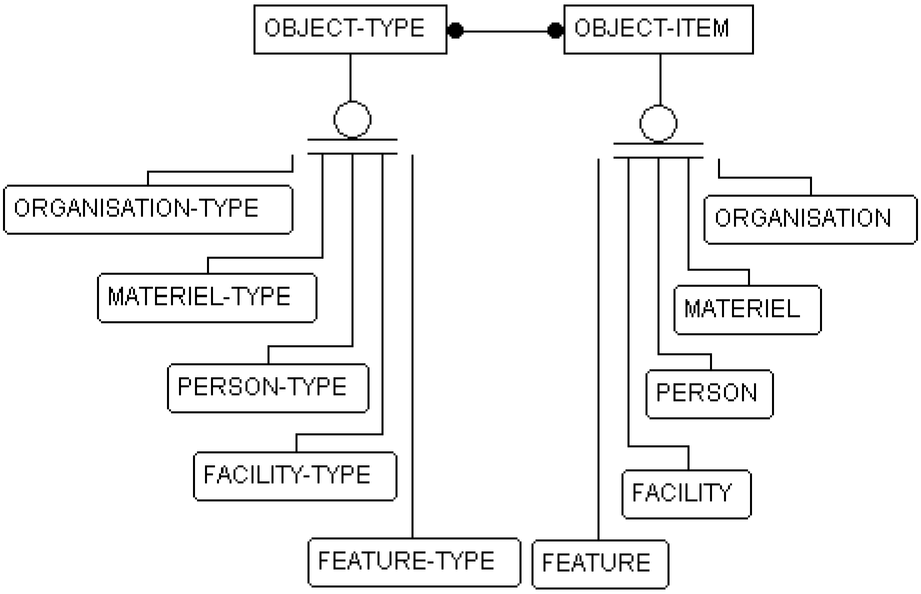


Figure 22. Subtypes of OBJECT-TYPE and OBJECT-ITEM

3.1.2.2.3 The basic subtyping structures under OBJECT-ITEM and OBJECT-TYPE are very similar. Both incorporate an immediate subtyping of OBJECT-ITEM (-TYPE) into ORGANISATION(-TYPE), PERSON(-TYPE), MATERIEL(-TYPE), FACILITY(-TYPE) and FEATURE(-TYPE); this is in fact a complete subtyping, which implies that everything of interest in the battlespace can be classified as being one of these five types. Some of the subtypes may entail an additional level of subtyping when one part of an object category (or subtype) has characteristics that are not shared by another part of the same category. The complete subtyping structures for type and item are presented in the subsequent sections of this chapter.

3.1.2.2.4 The type and item subtyping structures can also differ since the information characteristics that are needed on the type side may not apply to the other side, and vice versa. For example, the subtyping of ORGANISATION-TYPE is different from subtyping of ORGANISATION; FACILITY-TYPE does not have subtypes while FACILITY does; and MATERIEL-TYPE is subtyped but MATERIEL is not.

3.2 OBJECT-TYPE Hierarchy

3.2.1 First-Level Structure

3.2.1.1 Many objects in the battlespace are of interest primarily in terms of a class or category rather than as individually identified items, for example, a tank, a helicopter, a howitzer, a rifle, an armoured brigade, an infantryman. A considerable amount of information can be conveyed about an object through its membership in a class. In order to capture this information, the data model contains the independent entity OBJECT-TYPE and its subtype hierarchy. The data structure for OBJECT-TYPE and the first level of subtyping is illustrated in Figure 23.

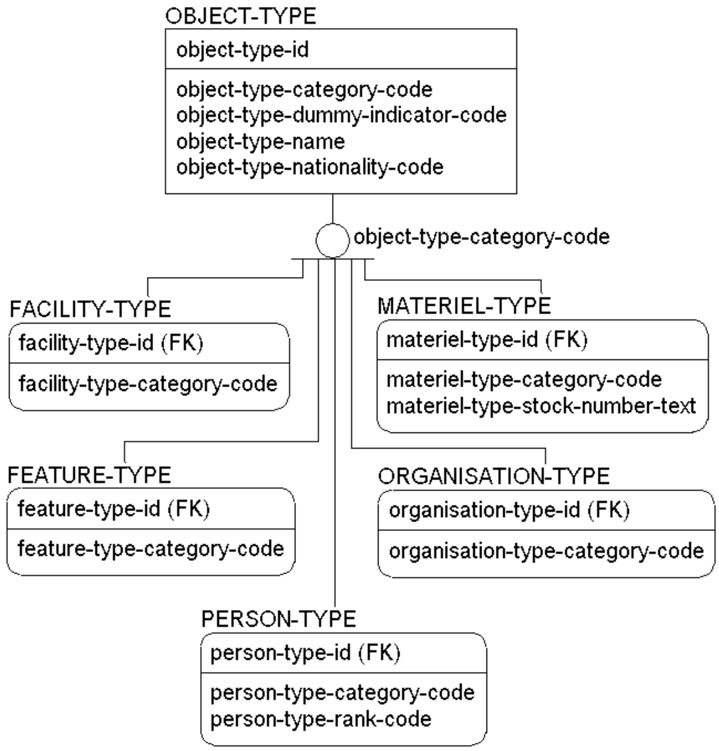


Figure 23. The First Level of the OBJECT-TYPE Subtyping Hierarchy

3.2.1.2 An OBJECT-TYPE is defined as an individually identified class of objects that has military significance. It is a generalisation of five other object classes that are treated in the data model as subtypes of OBJECT-TYPE. The attributes are:

a. object-type-id—The unique value, or set of characters, assigned to represent a specific OBJECT-TYPE and to distinguish it from all other OBJECT-TYPEs. This does not change over time and therefore there will be a requirement to generate a unique identifier for each type of object for which the command and control system needs to retain or specify information.

b. object-type-category-code—The specific value that represents or denotes the class of OBJECT-TYPE. It serves as a discriminator that partitions OBJECT-TYPE into subtypes. The domain values are: FACILITY-TYPE, FEATURE-TYPE, MATERIEL-TYPE, ORGANISATION-TYPE, and PERSON-TYPE.[10]

c. object-type-dummy-indicator-code—The specific value that denotes whether a specific OBJECT-TYPE represents an actual or simulated object class. The domain values are: No, Yes.

d. object-type-name—A designation, expressed in a word or phrase, of a specific OBJECT-TYPE.

[10] Attributes with class word *code* have a set of domain values associated with them. The complete lists and their definitions are contained in Annex E. Only example domain values are provided in the main body.

e. object-type-nationality-code—The specific value that represents or denotes the identification of the independent first-level geographic-political area and its dependencies, areas of quasi-independence, and areas with special unrecognised sovereignty, including outlying and disputed areas and which characterises a specific OBJECT-TYPE. Example domain values are: Canada (CA), Denmark (DA), France (FR), Germany (GE), Italy (IT), The Netherlands (NL), Norway (NO), Portugal (PO), Spain (SP), United Kingdom (UK), United States (US).

3.2.1.3 An example instance[11] table[12] for OBJECT-TYPE is given in Table 6.

Table 6. OBJECT-TYPE Example Instances

OBJECT-TYPE

object-type-id	object-type-category-code	object-type-dummy-indicator-code	object-type-name	object-type-nationality-code
1234	ORGANISATION-TYPE	No	Tank Regiment	UK
721	MATERIEL-TYPE	No	Anti-tank missile	SP
391	ORGANISATION-TYPE	No	Div HQ Bn	US
141	FEATURE-TYPE	No	Line of contact	DA
72	ORGANISATION-TYPE	No	Parachute Bn	UK
41	ORGANISATION-TYPE	Yes	Fd Artillery Bde	US
42	ORGANISATION-TYPE	No	Fd Artillery Rgt	GE
43	ORGANISATION-TYPE	No	Construction Bn	FR
57	ORGANISATION-TYPE	No	Armour Division	UK
44	ORGANISATION-TYPE	No	Transport Company	DA

3.2.1.4 The first-level subtypes of OBJECT-TYPE are defined below and are specified in detail in subsequent sections:

a. ORGANISATION-TYPE—An OBJECT-TYPE that represents administrative or functional structures. It is constituted to accomplish an aim, purpose, or mission. The domain values are: Convoy-type, POST-TYPE, UNIT-TYPE, Not otherwise specified.

b. MATERIEL-TYPE—An OBJECT-TYPE that represents equipment, apparatus or supplies of military interest without distinction to its application for administrative or combat purposes. The domain values are: CONSUMABLE-MATERIEL-TYPE, EQUIPMENT-TYPE, Not otherwise specified.

c. FEATURE-TYPE—An OBJECT-TYPE that encompasses meteorological; geographic, and control features of military significance. These are naturally occurring phenomena or administratively specified characteristics. The domain values are: CONTROL-FEATURE-TYPE, GEOGRAPHIC-FEATURE-TYPE, Not otherwise specified.

d. FACILITY-TYPE—An OBJECT-TYPE that is intended to be built, installed or established to serve some particular purpose and is identified by the service it is

---

[11] In IDEF1X, occurrences of an entity are termed instances, whereas occurrences of an attribute are termed values.

[12] The columns in an instance table correspond to attributes of the entity whose name is given at the top left of the table, and the rows are example attribute values for instances of the entity. A double line is used to separate those columns corresponding to key attributes (on the left) from non-key attributes (on the right). The values in the instance tables are for illustration only and are not intended for use in implementation databases.

intended to provide rather than by its content. Example domain values are: Airfield/airport/airstrip, Barracks, Medical facility, POL point, Wire obstacle, double fence.

e. PERSON-TYPE—An OBJECT-TYPE that represents human beings about whom information is to be held. Example domain values are: Allied military, Civilian, Paramilitary, Prisoner of war, Refugee.

3.2.2 Overview of the Complete OBJECT-TYPE Subtyping Hierarchy

3.2.2.1 There is a requirement to further categorise OBJECT-TYPEs beyond the first level. An overview of the entire OBJECT-TYPE subtype data structure is shown in Figure 24 at the entity level.

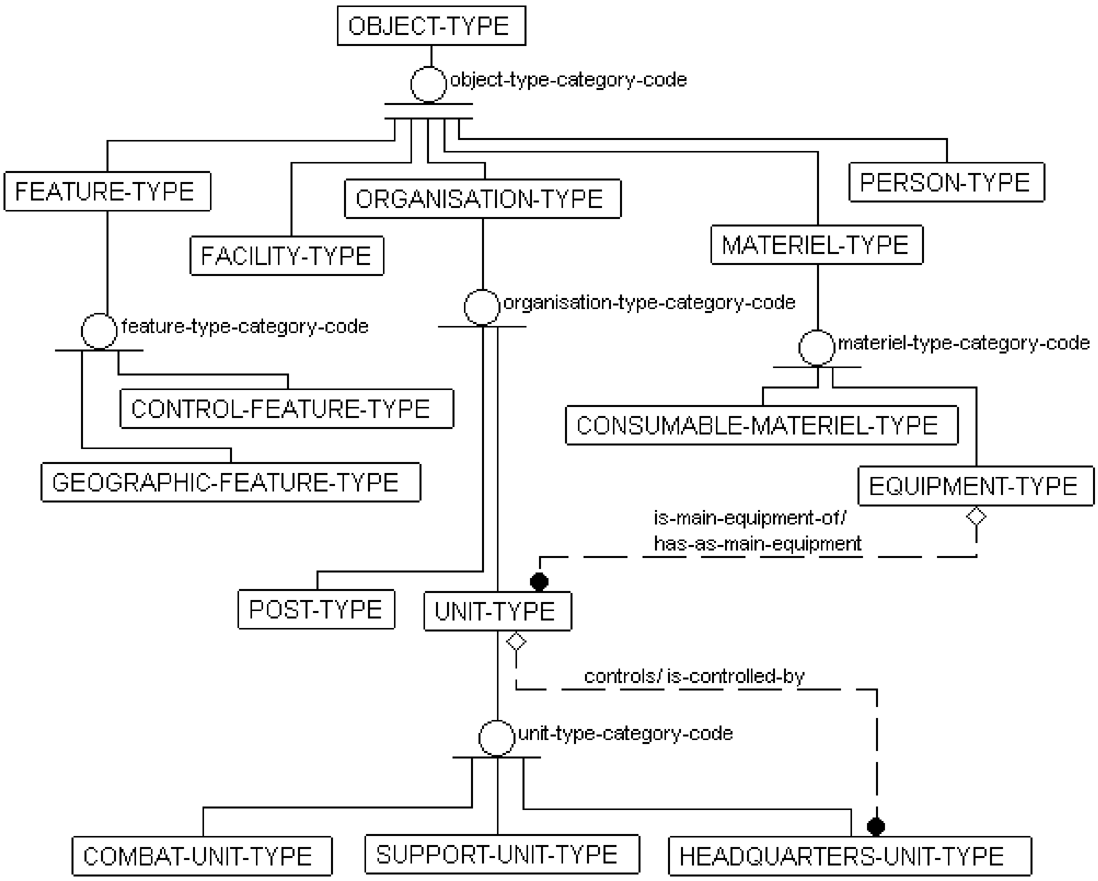


Figure 24. OBJECT-TYPE Subtype Hierarchy

3.2.2.2 Three of the OBJECT-TYPE subtypes are further subtyped. The subtypes of FEATURE-TYPE are CONTROL-FEATURE-TYPE and GEOGRAPHIC-FEATURE-TYPE. The subtypes of MATERIEL-TYPE are CONSUMABLE-MATERIEL-TYPE and EQUIPMENT-TYPE. The subtypes of ORGANISATION-TYPE are POST-TYPE and UNIT-TYPE. UNIT-TYPE is further subtyped as COMBAT-UNIT-TYPE, HEADQUARTERS-UNIT-TYPE, and SUPPORT-UNIT-TYPE. Detailed specifications are presented in subsequent sections.

3.2.3 ORGANISATION-TYPE

3.2.3.1 Specification of ORGANISATION-TYPE

3.2.3.1.1 The model view of ORGANISATION-TYPE in depicted in Figure 25.

3.2.3.1.2 ORGANISATION-TYPE has the following attributes:

a. organisation-type-id—The object-type-id of a specific ORGANISATION-TYPE. This is the role name of the object-type-id carried by the category relationship between OBJECT-TYPE and ORGANISATION-TYPE.

b. organisation-type-category-code—The specific value that represents or denotes the class of ORGANISATION-TYPE. It serves as a discriminator that partitions ORGANISATION-TYPE into subtypes. The domain values are: Convoy-type, POST-TYPE; UNIT-TYPE, Not otherwise specified .

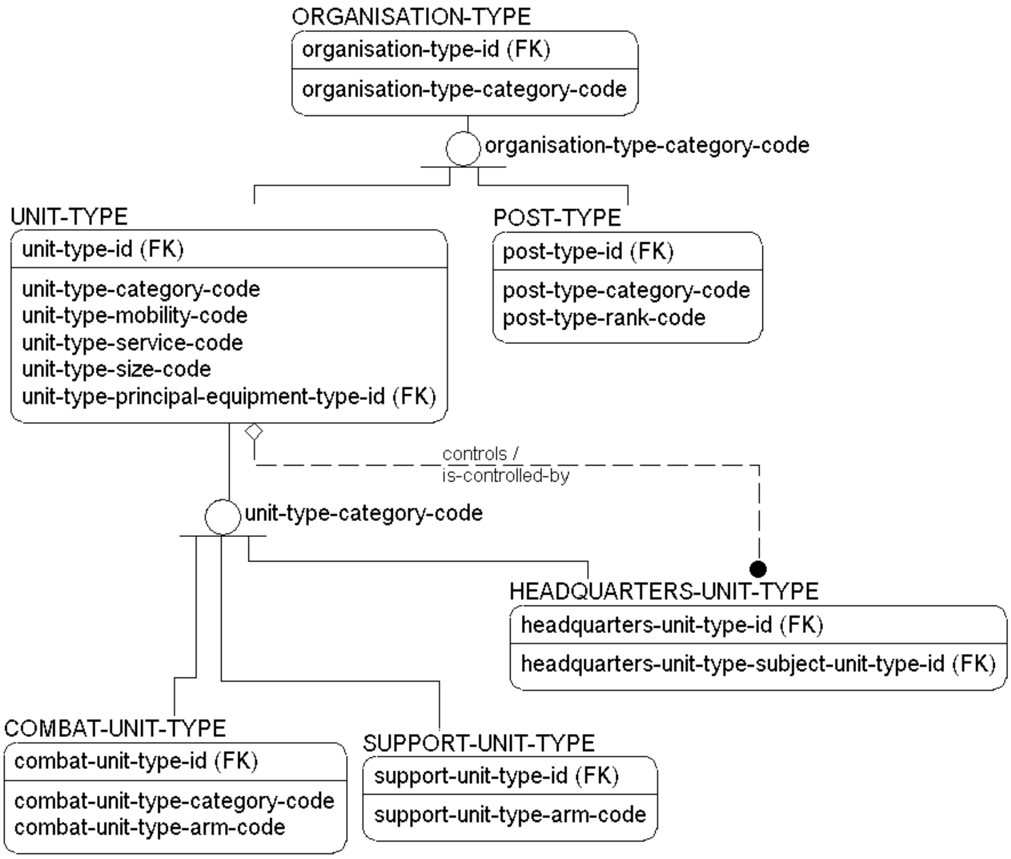


Figure 25. ORGANISATION-TYPE Subtype Hierarchy

3.2.3.2 UNIT-TYPE as a Subtype of ORGANISATION-TYPE

3.2.3.2.1 UNIT-TYPE is defined as a military ORGANISATION-TYPE whose structure is prescribed by a competent authority. One aim of UNIT-TYPE subtype is to permit unique specification of tables of equipment and organisation (referred to in this model as establishment, as discussed in a subsequent section) for any unit of interest within the scope of the model. A second aim is to provide information that is necessary for generating unit symbology for situation displays. The attributes are:

a. unit-type-id—The organisation-type-id of a specific UNIT-TYPE. This is the role name of the object-type-id carried by the category relationship between ORGANISATION-TYPE and UNIT-TYPE.

b. unit-type-category-code—The specific value that represents or denotes the class of UNIT-TYPE. It serves as a discriminator that partitions UNIT-TYPE into subtypes. The domain values are: COMBAT-UNIT-TYPE, HEADQUARTERS-UNIT-TYPE, SUPPORT-UNIT-TYPE, Not known.

c. unit-type-mobility-code—The specific value that represents or denotes mobility by air, land or sea of a particular UNIT-TYPE.

d. unit-type-principal-equipment-type-id—The equipment-type-id of the EQUIPMENT-TYPE that is predominantly associated with a specific UNIT-TYPE for the purpose of identification. This is a role name for object-type-id. For example an armoured unit can have as its principal equipment "Vehicle, tank" and specifically "Battle-tank, heavy." This distinction is important in the calculation of unit effectiveness where the primary consideration is percentage of principal equipment operational rather than the precentage of all equipment.

e. unit-type-service-code—The specific value that represents or denotes a military, paramilitary, or irregular force or group capable of functioning as an offensive or defensive combat or support organisation. Example domain values are: Air Force, Army, Border guard, Combined, Joint, Local defence force, Local militia, Marines, Navy, Not otherwise specified, Not known.

f. unit-type-size-code—The specific value that represents or denotes the lowest structural level or point at which organisational control or authority of a specific UNIT-TYPE is concentrated. Example domain values are: Army, Army group, Battalion, Battalion group, Brigade, Company, Company group, Corps, Division, Platoon, Regiment,[13] Section, Squad, Team/fire team/crew, Not otherwise specified, Not known.

3.2.3.2.2 Table 7 below illustrates the use of ORGANISATION-TYPE and its subtype in characterising unit types of interest.

Table 7. ORGANISATION-TYPE and UNIT-TYPE Example Instances

(a) ORGANISATION-TYPE

organisation-type-id	organisation-type-category-code
57	UNIT-TYPE
1234	UNIT-TYPE
72	UNIT-TYPE
391	UNIT-TYPE
41	UNIT-TYPE
42	UNIT-TYPE
43	UNIT-TYPE
44	UNIT-TYPE
201	UNIT-TYPE

[13] Note: UK and FR regiments, being comprised of three or four manoeuvre units, are represented as the “Battalion” unit-type-size-code, based on the comparative table of NATO formations and units, as prescribed in STANAG 2356.

(b) UNIT-TYPE

unit-type-id	unit-type-service-code	unit-type-size-code	unit-type-mobility-code	unit-type-category-code	unit-type-principal-equipment-type-id
57	Army	Div	Tracked	COMBAT-UNIT-TYPE	—[14]
1234	Army	Bn	Tracked	COMBAT-UNIT-TYPE	68763 [Challenger MBT][15]
72	Army	Bn	Wheeled/ tracked	COMBAT-UNIT-TYPE	86978 [SA80 Assault Rifle]
391	Army	Coy	Air mobile	HEADQUARTERS-UNIT-TYPE	—
41	Army	Bde	Tracked	COMBAT-UNIT-TYPE	88023 [155-mm Field Artillery]
42	Army	Rgt	Wheeled	COMBAT-UNIT-TYPE	88024 [105-mm Field Artillery]
43	Army	Bn	Wheeled	SUPPORT-UNIT-TYPE	—
44	Army	Coy	Wheeled	SUPPORT-UNIT-TYPE	—
201	Army	Plt	Wheeled/ tracked	HEADQUARTERS-UNIT-TYPE	—

3.2.3.2.3 When a unit-type-size-code is specified for a HEADQUARTERS-UNIT-TYPE, the value chosen should be for the size of the headquarters unit itself rather than the size of the unit that the headquarters serves. As an example, the headquarters unit serving a division may be a company or a battalion, and in all cases will be smaller than the parent unit.

3.2.3.2.4 Not all combinations of domain values for UNIT-TYPE attributes that specify category code, mobility code, service code, and size code are meaningful. A number of constraints have been placed on the choice of domain values to limit the combinations to those that are operationally sensible. The resulting set of valid combinations is documented in Annex F, Table F-1.

3.2.3.3 COMBAT-UNIT-TYPE as a Subtype of UNIT-TYPE

3.2.3.3.1 One subtype of UNIT-TYPE is a COMBAT-UNIT-TYPE is defined as a UNIT-TYPE whose primary mission is the destruction of enemy forces and/or installations. The attributes are the following:

a. combat-unit-type-id—The unit-type-id of a specific COMBAT-UNIT-TYPE. This is the role name of the object-type-id carried by the category relationship between UNIT-TYPE and COMBAT-UNIT-TYPE.

b. combat-unit-type-category-code—The specific value that represents or denotes the class of COMBAT-UNIT. The domain values are: Air-defence unit type, Fire-support unit type, Manoeuvre unit type, Not known.

c. combat-unit-type-arm-code—The specific value that represents or denotes the arm designation of a particular COMBAT-UNIT-TYPE. This attribute is intended to capture the principal role for which a COMBAT-UNIT-TYPE is established. Example domain values are: Anti-tank, Armour, Armoured infantry, Armoured reconnaissance, Army aviation, Attack helicopter, Cavalry.

---

14 A dash (—) denotes a null value.

15 The use of brackets ("[" and "]") is to provide the meaning of the object being referenced by the identifier value.

3.2.3.3.2 Table 8 below illustrates the use of COMBAT-UNIT-TYPE in providing additional detail that enables a more detailed characterisation to be made.

Table 8. Example Instances for COMBAT-UNIT-TYPE

COMBAT-UNIT-TYPE

combat-unit-type-id	combat-unit-type-category-code	combat-unit-type-arm-code
57	Manoeuvre unit type	Infantry
1234	Manoeuvre unit type	Armour
72	Manoeuvre unit type	Airborne/parachute
41	Fire-support unit type	Field artillery
42	Fire-support unit type	Field artillery

3.2.3.3.3 Not all combinations of domain values for COMBAT-UNIT-TYPE attributes that specify category code and arm code are meaningful. A number of constraints have been placed on the choice of domain values to limit the combinations to those that are operationally sensible. The resulting set of valid combinations is documented in Annex F, Table F-2.

3.2.3.4 SUPPORT-UNIT-TYPE as a Subtype of UNIT-TYPE

3.2.3.4.1 A second subtype of UNIT-TYPE is a SUPPORT-UNIT-TYPE that is defined as a UNIT-TYPE that aids, protects, complements, or sustains any other force (adapted from NATO definition of Support). The attributes are:

a. support-unit-type-id—The unit-type-id of a specific SUPPORT-UNIT-TYPE. This is the role name of the object-type-id carried by the category relationship between UNIT-TYPE and SUPPORT-UNIT-TYPE.

b. support-unit-type-arm-code—The specific value that represents or denotes the arm designation of a particular SUPPORT-UNIT-TYPE. Example domain values are: Bridge laying; Construction; Electronic warfare; Explosive ordnance disposal; Engineer, armoured; Headquarters support; Intelligence; Labour resources; Maintenance; Medical.

3.2.3.4.2 An example instance table for SUPPORT-UNIT-TYPE is provided in Table 9.

Table 9. Example Instance for SUPPORT-UNIT-TYPE

SUPPORT-UNIT-TYPE

support-unit-type-id	support-unit-type-arm-code
43	Engineer, not otherwise specified
44	Intelligence

3.2.3.5 HEADQUARTERS-UNIT-TYPE as a Subtype of UNIT-TYPE

3.2.3.5.1 A third subtype of UNIT-TYPE is a HEADQUARTERS-UNIT-TYPE, defined as a UNIT-TYPE that has an administrative and/or command function.[16] Unit types serving a headquarters function should not be classified as support. Subtyping of UNIT-TYPEs separates them into mutually exclusive categories; the rule enforced by the model is that a SUPPORT-UNIT-

[16] Staff cells for headquarters are not explicitly distinguished in the subtype hierarchy of UNIT-TYPE.

TYPE cannot be a headquarters and a HEADQUARTERS-UNIT-TYPE—for the purposes of the model—is not considered support.[17] The attributes are:

a. headquarters-unit-type-id—The unit-type-id of a specific HEADQUARTERS-UNIT-TYPE (a role name for object-type-id).

b. headquarters-unit-type-subject-unit-type-id—The unit-type-id of a specific UNIT-TYPE that exercises oversight over a specific HEADQUARTERS-UNIT-TYPE (a role name for object-type-id). The use of this attribute permits explicit association of a headquarters type with a particular type of parent unit.

3.2.3.5.2 Example instances for HEADQUARTERS-UNIT-TYPE are provided in Table 10. In the first example, Unit Type 391 is a company-size formation intended to be the headquarters for a division type (identifier 57). In the second example, Unit Type 201 is a platoon that serves as a headquarters for an airborne battalion.

Table 10. HEADQUARTERS-UNIT-TYPE Example Instances

HEADQUARTERS-UNIT-TYPE

headquarters-unit-type-id	headquarters-unit-type-subject-unit-type-id
391	57
201	72

3.2.3.6 POST-TYPE as a Subtype of ORGANISATION-TYPE

3.2.3.6.1 POST-TYPE is an ORGANISATION-TYPE with a set of duties that can be fulfilled by one person. The attributes are:

a. post-type-id—The organisation-type-id of a specific POST-TYPE (a role name for object-type-id).

b. post-type-category-code—The specific value that represents or denotes the type classification of a POST-TYPE. Example domain values are: Maintenance technician; Operations officer; Intelligence officer .

c. post-type-rank-code—The specific value that represents or denotes a designation for a military, naval, or civil grade that establishes the relative position or status of a specific POST-TYPE. Example domain values are: OF-1, OF-2, OF-3.

3.2.3.6.2 Example instances for POST-TYPE are provided in Table 11.

Table 11. POST-TYPE Example Instances

POST-TYPE

post-type-id	post-type-category-code	post-type-rank-code
12345678	Operations officer	OF-3
13248765	Intelligence officer	OF-2

3.2.4 MATERIEL-TYPE and Its Subtypes

3.2.4.1 Specification of MATERIEL-TYPE

3.2.4.1.1 Figure 26 displays the data structure for MATERIEL-TYPE and its two subtypes: EQUIPMENT-TYPE and CONSUMABLE-MATERIEL-TYPE. The attributes are:

[17] The model classifications for data purposes need not be the same as those used by applications at the presentation level.

a. materiel-type-id—The object-type-id of a specific MATERIEL-TYPE (a role name for object-type-id).

b. materiel-type-category-code—The specific value that represents or denotes the class of MATERIEL-TYPE. It serves as a discriminator that partitions MATERIEL-TYPE into subtypes. The domain values are: CONSUMABLE-MATERIEL-TYPE, EQUIPMENT-TYPE, Not otherwise specified.

c. materiel-type-stock-number-text—The unformatted character string that represents a specific MATERIEL-TYPE. This attribute is intended for the NATO Stock Number, which is a 13-digit number of which four digits designate a class, two digits designate a nation, and seven digits designate a national code number. The attribute “materiel-type-stock-number-text” is marked with the symbol “IE1.1” in Figure 26. This indicates that the attribute is considered to be a candidate for use as an inversion entry, which is an attribute or a group of attributes that may be used to access instances in an entity without assurance that only a single (unique) instance will be found. The designation of inversion entries (or alternate keys when uniqueness can be guaranteed) may be important in linking real-world keys that are in use today and which are recognised by large groups of military users with the surrogate keys that identify OBJECT-TYPEs (and consequently MATERIEL-TYPEs) in the data model. This would facilitate a cross-reference between the various keys currently in use and the systematic specification of keys.

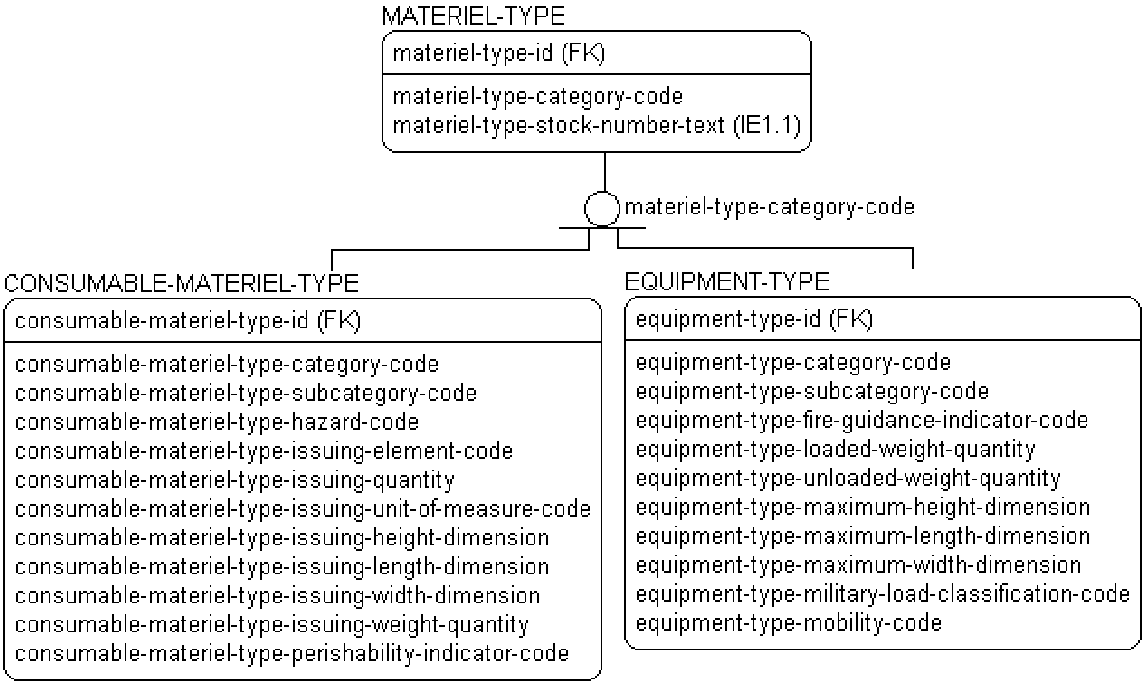


Figure 26. MATERIEL-TYPE and Its Subtypes

3.2.4.1.2 Example instances for MATERIEL-TYPE are provided in Table 12. The examples include instances that are considered to be durable and not intended for consumption (EQUIPMENT-TYPE) as well as those that are meant to be used up in the normal conduct of operations other than through attrition (CONSUMABLE-MATERIEL-TYPE).

Table 12. MATERIEL-TYPE Example Instances[18]

MATERIEL-TYPE

materiel-type-id	[object-type-name][19]	materiel-type-category-code
68763	Challenger MBT	EQUIPMENT-TYPE
9576	Scorpion[20]	EQUIPMENT-TYPE
49662	Abrams MBT	EQUIPMENT-TYPE
179	LARS, Multiple Rocket Launcher	EQUIPMENT-TYPE
813	Attack Helicopter, AH-64	EQUIPMENT-TYPE
86978	SA 80 Assault Rifle[21]	EQUIPMENT-TYPE
8440	L1A1 120-mm tank gun	EQUIPMENT-TYPE
574	UK Armoured Regiment Standard Ammunition Pack	CONSUMABLE-MATERIEL-TYPE
11	Warrior Armoured Fighting Vehicle	EQUIPMENT-TYPE
25472	L1A2 120-mm APFSDS[22]	CONSUMABLE-MATERIEL-TYPE
1869	L1A2 120-mm HESH[23]	CONSUMABLE-MATERIEL-TYPE
6687	Bradley AFV	EQUIPMENT-TYPE
1870	Diesel Fuel 200-litre Drum	CONSUMABLE-MATERIEL-TYPE
1871	Bulk Diesel Fuel, 5,000-litre Tank	CONSUMABLE-MATERIEL-TYPE

3.2.4.2 EQUIPMENT-TYPE as a Subtype of MATERIEL-TYPE

3.2.4.2.1 An EQUIPMENT-TYPE is defined as a MATERIEL-TYPE that is not intended for consumption. Expressed in another way, EQUIPMENT-TYPE is a class of durable goods. The attributes are:

a. equipment-type-id—The materiel-type-id of a specific EQUIPMENT-TYPE (a role name for object-type-id).

b. equipment-type-category-code—The specific value that represents or denotes the class of EQUIPMENT-TYPE. Example domain values are: Aircraft, fixed wing; Aircraft, rotary wing; Electronics, communications; Electronics, electronic warfare; Electronics, radar; Vehicle, armoured; Vehicle, not otherwise specified; Weapon, air-defence; Weapon, field artillery.

c. equipment-type-subcategory-code—The specific value that represents or denotes the detailed class of a particular EQUIPMENT-TYPE. Example domain values are: Air-traffic control radar, Air-defence missile launcher, Ambulance, Amphibious warfare vessel, Anti-aircraft machine gun, Anti-ship surface missile launcher, Attack aircraft.

d. equipment-type-fire-guidance-indicator-code—The specific value that indicates whether a specific EQUIPMENT-TYPE provides fire guidance. The domain values are: No, Yes.

---

18 The dashed line at the right side of the instance table indicates that columns for one or more (non-key) attributes have been omitted.

19 This column belongs to an attribute in OBJECT-TYPE. It is included here to indicate the meaning of the objects referenced by *materiel-type-id*.

20 Scorpion is a UK Light Tank/Reconnaissance Vehicle manufactured by ALVIS.

21 The SA 80 Assault Rifle is the standard issue small arm for the British Army manufactured by Royal Ordnance.

22 APFSDS—Armour-Piercing Fin-Stabilised Discarding Sabot (a type of tank gun ammunition).

23 HESH—High Explosive Squash Head (a type of tank gun ammunition).

e. equipment-type-loaded-weight-quantity—The non-monetary numeric value that represents the weight of a specific EQUIPMENT-TYPE including the normal maximum payload, crew, and personal/organisation equipment as well as the basic issue items. The unit is kilogram.

f. equipment-type-unloaded-weight-quantity—The non-monetary numeric value that represents the weight of a specific EQUIPMENT-TYPE including on-equipment materiel that is an integral part of the equipment when issued. The unit is kilogram. Note: For vehicles, it includes basic issue items and a fuel tank three-fourths full but does not include payload, crew or personal and organisation equipment not an integral part of the vehicle. For aircraft, it includes installed equipment and full fuel load (flyaway configuration) or no fuel load (reducible configuration). For other end items, the weight is based on an end item configuration (without crates or boxing).

g. equipment-type-maximum-height-dimension—The one-dimensional linear measurement that represents the extreme vertical distance measured from the lowest to the highest reference point of a specific EQUIPMENT-TYPE. The unit is metre.

h. equipment-type-maximum-length-dimension—The one-dimensional linear measurement that represents the extreme horizontal distance measured from end to end and parallel to the central axis of a specific EQUIPMENT-TYPE. The unit is metre.

i. equipment-type-maximum-width-dimension—The one-dimensional linear measurement that represents the extreme horizontal distance measured from side to side and perpendicular to the central axis of a specific EQUIPMENT-TYPE. The unit is metre.

j. equipment-type-military-load-classification-code—The specific value that represents the “tactical” weight of a vehicle—equivalent to the load that a bridge, ferry or raft can carry.

k. equipment-type-mobility-code—The specific value that represents or denotes the mobility of a particular EQUIPMENT-TYPE. Example domain values are: Air, fixed wing; Air, rotary wing; Land, over snow; Land, towed; Land, tracked; Land, wheeled; Land, wheeled cross country; Not known.

3.2.4.2.2 Example instances for EQUIPMENT-TYPE are provided in Table 13.

Table 13. EQUIPMENT-TYPE Example Instances

(a) MATERIEL-TYPE

materiel-type-id	[object-type-name]	materiel-type-category-code
301101	Tractor Whl Ind Ded—830M	EQUIPMENT-TYPE
301102	Truck Tank Water	EQUIPMENT-TYPE

(b) EQUIPMENT-TYPE

equip-ment-type-id	equipment-type-category-code	eqpmt-type-max-height-dim	eqpmt-type-max-length-dim	eqpmt-type-max-width-dim	eqpmt-type-loaded-weight-quantity	equipment-type-unloaded-weight-quantity
301101	Vehicle not otherwise specified	3.780 (metre)	7.620 (metre)	3.454 (metre)	(null)	25,045 (kilogram)
301102	Vehicle not otherwise specified	2.294 (metre)	6.629 (metre)	2.703 (metre)	8,636 (kilogram)	3,932 (kilogram)

3.2.4.2.3 Not all combinations of domain values for EQUIPMENT-TYPE attributes that specify category code, subcategory code, and mobility code are meaningful. A number of constraints have been placed on the choice of domain values to limit the combinations to those that are operationally sensible. The resulting set of valid combinations is documented in Annex F, Table F-3.

3.2.4.3 CONSUMABLE-MATERIEL-TYPE as a Subtype of MATERIEL-TYPE

3.2.4.3.1 A CONSUMABLE-MATERIEL-TYPE is defined to be a MATERIEL-TYPE that is intended to be expended. Consumables can generally be issued in different standard quantities, each having its own packaging. CONSUMABLE-MATERIEL-TYPE provides various attributes that describe the packaging in question. The attributes are:

a. consumable-materiel-type-id—The materiel-type-id of a specific CONSUMABLE-MATERIEL-TYPE (a role name for object-type-id).

b. consumable-materiel-type-category-code—The specific value that represents or denotes the class of CONSUMABLE-MATERIEL-TYPE. The domain values are: Ammunition; Clothing; Construction stores; Food; Medical; POL; Water; Not known.

c. consumable-materiel-type-subcategory-code—The specific value that represents or denotes the detailed class of a specific CONSUMABLE-MATERIEL-TYPE. Example domain values are: Air-to-air missile; Air-to-surface missile; Anti-tank mine; Blood; Bomb; Hand grenade; Lubricant; Matting; Medicine; NBC kit; Oil; Petrol; Rocket; Small arms ammunition; Surface-to-air missile; Uniform; Wire.

d. consumable-materiel-type-hazard-code—The specific value that represents or denotes a CONSUMABLE-MATERIEL-TYPE that requires special handling because of environmental or safety reasons. The domain values are: Chemical, Corrosive, Explosive, Inflammable, Radiation, Toxic.[24]

e. consumable-materiel-type-issuing-element-code—The specific value that represents or denotes a standard unit in which a specific CONSUMABLE-MATERIEL-TYPE is made available (e.g., *drum* in 200-litre drum). The domain values are: Bulk, Drum, Pack, Pallet, Unit.

f. consumable-materiel-type-issuing-quantity—The non-monetary numeric value representing the aggregated units in which a specific CONSUMABLE-MATERIEL-TYPE is made available (e.g., *200* to represent a 200-litre drum).

g. consumable-materiel-type-issuing-unit-of-measure-code—The specific value that represents or denotes the unit of measure of which a standard quantity (unit) of a specific CONSUMABLE-MATERIEL-TYPE is made available (e.g., *litre* in 200-litre drum). The domain values are: Cubic metre, Each, Kilogram, Kilometre, Litre, Metre, Metric ton, Square metre.

h. consumable-materiel-type-issuing-height-dimension—The one-dimensional linear measurement that represents the extreme vertical distance measured from the lowest to the highest reference point for specific CONSUMABLE-MATERIEL-TYPE that is packaged for shipment. The unit is metre.

---

[24] The normal markings consist of UN followed by a 4 digit numeric code. The codes with explicit meanings are illustrated by the following: UN1263 = paint; UN 1170 = ethanol; UN 2910 = Radiac; UN 1.4 = small arms ammunition.

i. consumable-materiel-type-issuing-length-dimension—The one-dimensional linear measurement that represents the extreme horizontal distance measured from end to end and parallel to the central axis of specific CONSUMABLE-MATERIEL-TYPE that is packaged for shipment. The unit is metre.

j. consumable-materiel-type-issuing-width-dimension—The one-dimensional linear measurement that represents the extreme horizontal distance measured from side to side and perpendicular to the central axis of a specific CONSUMABLE-MATERIEL-TYPE that is packaged for shipment. The unit is metre.

k. consumable-materiel-type-issuing-weight-quantity—The non-monetary numeric value representing the gravitational force exerted on an amount of a standard unit of issue for a specific CONSUMABLE-MATERIEL-TYPE when it is prepared for delivery. The unit is kilogram.

l. consumable-materiel-type-perishability-indicator-code—The specific value that represents or denotes whether a particular CONSUMABLE-MATERIEL-TYPE is liable to decay or spoil. The domain values are: No; Yes.

3.2.4.3.2 Example instances for CONSUMABLE-MATERIEL-TYPE are provided in Table 14.

Table 14. CONSUMABLE-MATERIEL-TYPE Example Instances

CONSUMABLE-MATERIEL-TYPE

consumable-materiel-type-id	consumable-materiel-type-category-code	consumable-materiel-type-issuing-element-code	consumable-materiel-type-issuing-quantity	consumable-materiel-type-issuing-unit-of measure-code	consumable-materiel-type-issuing-weight-quantity
574	Ammunition	Pack	50	Each	100
25472	Ammunition	Pallet	200	Each	2,000
1869	Ammunition	Pallet	500	Each	4,000
1870	POL	Drum	200	Litre	220
1871	POL	Bulk	5,000	Litre	7,000

3.2.4.3.3 Not all combinations of domain values for CONSUMABLE-MATERIEL-TYPE attributes that specify category code and subcategory code are meaningful. A number of constraints have been placed on the choice of domain values to limit the combinations to those that are operationally sensible. The resulting set of valid combinations is documented in Annex F, Table F-4.

3.2.5 FEATURE-TYPE and Its Subtypes

3.2.5.1 Introduction to the Concept of FEATURE-TYPE

The concept of FEATURE-TYPE is used to describe a class of battlespace elements that can be either natural features that may influence operations in the battlespace or artificial features representing administrative, political, or tactical constraints to be taken into account. An individual feature can be a real-world occurrence of a structure, a phenomenon, or some other entity which is described by a set of characteristics and which is associated with a specific geographic location. A class of features defines an instance of the entity FEATURE-TYPE. Since the definition of FEATURE-TYPE embraces a wide range of elements in the battlespace, a hierarchical subdivision into two different categories—CONTROL-FEATURE-TYPE and GEOGRAPHIC-FEATURE-TYPE—has been specified. The structure of FEATURE-TYPE is depicted in Figure 27.

3.2.5.2 Specification of FEATURE-TYPE

3.2.5.2.1 The attributes are:

a. feature-type-id—The object-type-id of a specific FEATURE-TYPE (a role name for object-type-id).

b. feature-type-category-code—The specific value that represents or denotes the class of FEATURE-TYPE. It serves as a discriminator that partitions FEATURE-TYPE into subtypes. The domain values are: CONTROL-FEATURE-TYPE, GEOGRAPHIC-FEATURE-TYPE, Not otherwise specified.

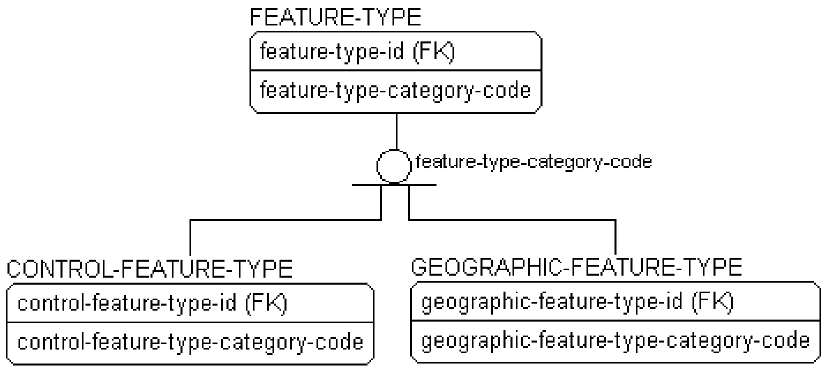


Figure 27. FEATURE-TYPE First-Level Subtype Hierarchy

3.2.5.2.2 Table 15 provides example instances for FEATURE-TYPE. The relationship of FEATURE-TYPE as a subtype of OBJECT-TYPE was depicted previously in Figure 23.

Table 15. Example Instances for FEATURE-TYPE

FEATURE-TYPE

feature-type-id	[object-type-name]	feature-type-category-code
4321	Major freshwater river	GEOGRAPHIC FEATURE TYPE
4322	Marsh/swamp	GEOGRAPHIC FEATURE TYPE
4323	Ridge line	GEOGRAPHIC FEATURE TYPE
4324	Dense forest	GEOGRAPHIC FEATURE TYPE
4311	Phase line	CONTROL FEATURE TYPE
4312	Air-defence corridor	CONTROL FEATURE TYPE
4313	Objective area	CONTROL FEATURE TYPE
4314	Area of responsibility	CONTROL FEATURE TYPE

3.2.5.3 CONTROL-FEATURE-TYPE as a Subtype of FEATURE-TYPE

3.2.5.3.1 A CONTROL-FEATURE-TYPE is defined as a nontangible FEATURE-TYPE of military interest that may be represented as a geometric figure and is associated with the conduct of military operations. In particular, CONTROL-FEATURE-TYPE is used to express the idea of abstract objects created or assigned by military authorities for the purposes of planning and coordination, especially in operational areas. The attributes are:

a. control-feature-type-id—The feature-type-id of a specific CONTROL-FEATURE-TYPE (a role name for object-type-id).

b. control-feature-type-category-code—The specific value that represents or denotes the class of CONTROL-FEATURE-TYPE. Example domain values are: Airspace coordination area, air corridor; Area of interest; Area of responsibility; Artillery area; Check point; Crossing site; Decision point; Drop zone; Fire support coordination line; Forward line of troops; Landing zone; Route; Strong point; Supply area.

3.2.5.3.2 Table 16 provides example instances for FEATURE-TYPE.

Table 16. Example Instances for CONTROL-FEATURE-TYPE

CONTROL-FEATURE-TYPE

control-feature-type-id	control-feature-type-category-code
4311	Forward line own troops
4342	Forward edge of the battle area
4343	Boundary, organisation
4344	Release point

3.2.5.4 GEOGRAPHIC-FEATURE-TYPE as a Subtype of FEATURE-TYPE

3.2.5.4.1 A GEOGRAPHIC-FEATURE-TYPE is defined as a FEATURE-TYPE that describes terrain characteristics to which military significance is attached. This category includes only natural objects, such as types of rivers, hills, valleys, etc. Usually these kinds of objects are captured by means of cartography and can be displayed on maps. The attributes are:

a. geographic-feature-type-id—The feature-type-id of a specific GEOGRAPHIC-FEATURE-TYPE (a role name for object-type-id).

b. geographic-feature-type-category-code—The specific value that represents or denotes the class of GEOGRAPHIC-FEATURE-TYPE.[25] Example domain values are: Beach; Cliff/escarpment; Contour line (land); Depression; Ditch; Forest; Grassland; Gully (gorge); Hill; Island; Lake/pond; Marsh/swamp; Mountain; Ridge line; River/stream; Rock strata/rock formation; Sand dune/sand hills; Scrub/brush; Spot elevation; Valley bottom line; Water (except inland); Not otherwise specified.

3.2.5.4.2 Table 17 provides example instances for GEOGRAPHIC-FEATURE-TYPE.

Table 17. Example Instances for GEOGRAPHIC-FEATURE-TYPE

GEOGRAPHIC-FEATURE-TYPE

geographic-feature-type-id	geographic-feature-type-category-code
4321	River/Stream
4322	Lake/pond
4323	Spot elevation
4324	Forest

3.2.6 PERSON-TYPE

3.2.6.1 PERSON-TYPE has the following attributes:

a. person-type-id—The object-type-id of a specific PERSON-TYPE (a role name for object-type-id).

b. person-type-category-code—The specific value that represents or denotes the class of PERSON-TYPE. The domain values are: Allied military, Civilian, Military, Paramilitary, Prisoner of war, Refugee, Not known.

---

[25] The Feature and Attribute Coding Catalog (FACC), Volume 4 of the DIGEST standard, provides a specification of GEOGRAPHIC-FEATURE-TYPEs [Ref. DIGEST 1994].

c. person-type-rank-code—The specific value that represents or denotes a designation for a military, naval, or civil grade that establishes the relative position or status of a specific PERSON-TYPE in an organisation. The code values correspond to grades in STANAG 2116.

3.2.6.2 Table 18 provides example instances for PERSON-TYPE.

Table 18. Example Instances for PERSON-TYPE

PERSON-TYPE

person-type-id	person-type-category-code	person-type-rank-code
5311	Military	[Captain]
5312	Paramilitary	—
5313	Prisoner of war	[Sergeant]
5314	Refugee	—

3.2.7 FACILITY-TYPE

3.2.7.1 The attributes are:

a. facility-type-id—The object-type-id of a specific FACILITY-TYPE (a role name for object-type-id).

b. facility-type-category-code—The specific value that represents or denotes the class of FACILITY-TYPE. Example domain values are: Cemetery/graveyard/burial ground; Decontamination facility; Fuel handling point; Harbour/port, Hospital, field; Observation post; POL point; Rail facilities; Rearming and refuelling point, forward area; Relay facility; Site, power; Site, radar; Site, logistic; Transloading facility; Not otherwise specified.

3.2.7.2 Table 19 provides an example instance table for FACILITY-TYPE.

Table 19. Example Instances for FACILITY-TYPE

FACILITY-TYPE

facility-type-id	facility-type-category-code
6311	Airfield/airport/airstrip
6312	Depot, not otherwise specified
6313	Maintenance facility
6314	Supply dump

3.2.8 Comment Regarding OBJECT-TYPE Data Concepts

3.2.8.1 Each nation has a different way of classifying its own units. The model supports the representation of as many UNIT-TYPEs as possible (within the constraints of common sense). It should be recognised that the manner of classifying units within the data structure may not correspond to national classification policy. However, national implementations of external displays for operational users can (and should) be built to support the national doctrine and naming conventions. The internal classification within the database of a C2 application (based on the model) can be entirely invisible to the user of that application.

3.2.8.2 The concepts of geographic feature and control feature types have a potential for overlap. The following comments attempt to clarify the distinction.

3.2.8.3 A control feature is specified by military organisations to serve operational purposes. It is a non-permanent point (e.g., start point for a road move, or a reserved demolition), line (e.g., a Main supply route or No fire line), area (e.g., a Slow-go area), or volume (e.g., an air corridor) that may be overlaid on a map. A control feature would normally be drawn on a map overlay, traced, or superimposed onto digitised map data and assigned a descriptive title, symbol, or name (e.g., Line of departure, Corps boundary). The establishment of control features (and consequently their classification as instances of CONTROL-FEATURE-TYPE) is under the control of battlespace commanders.

3.2.8.4 A geographic feature for the most part describes permanent or durable natural features. In addition, the concept includes non-physical boundaries, such as national or regional borders, that are commonly drawn on maps. The boundaries are established by authorities or organisations other than those operating in the battlespace. In other words, such features are outside the influence of operational battlespace authorities. This approach permits all external boundaries–such as those found in an atlas–to be treated in a consistent way as GEOGRAPHIC-FEATURE-TYPEs.

3.2.9 Business Rule

The category codes in the OBJECT-TYPE hierarchy are not permitted to be changed. New instances of OBJECT-TYPE must be created with the appropriate category codes within the OBJECT-TYPE hierarchy.

3.3 OBJECT-ITEM Hierarchy

3.3.1 Specification of OBJECT-ITEM

3.3.1.1 Generally, a thing of interest in the battlespace cannot be described solely by identifying the class to which it belongs. Each instance of a specific class is different from all other instances of that class. For instance, two M1A1 Abrams tanks may be for all purposes identical, but each will have its own location and as such be unique. In order to identify individual instances of objects, and in order to record information concerning individual characteristics that are not typical of the class, the data model provides the independent entity OBJECT-ITEM.

3.3.1.2 OBJECT-ITEM is defined as an individually identified object that has military significance. This can range from a unit to a single person, an entire tank to a single bolt, and a mountain to a pile of dirt. OBJECT-ITEM can represent not only physical objects, but can also represent intangible objects such as rendezvous points, phase lines, and boundaries.

3.3.1.3 OBJECT-ITEM is broken down into a hierarchy of subtypes. An overview of the entire tree structure at entity level is illustrated in Figure 28. The details are presented in subsequent sections.

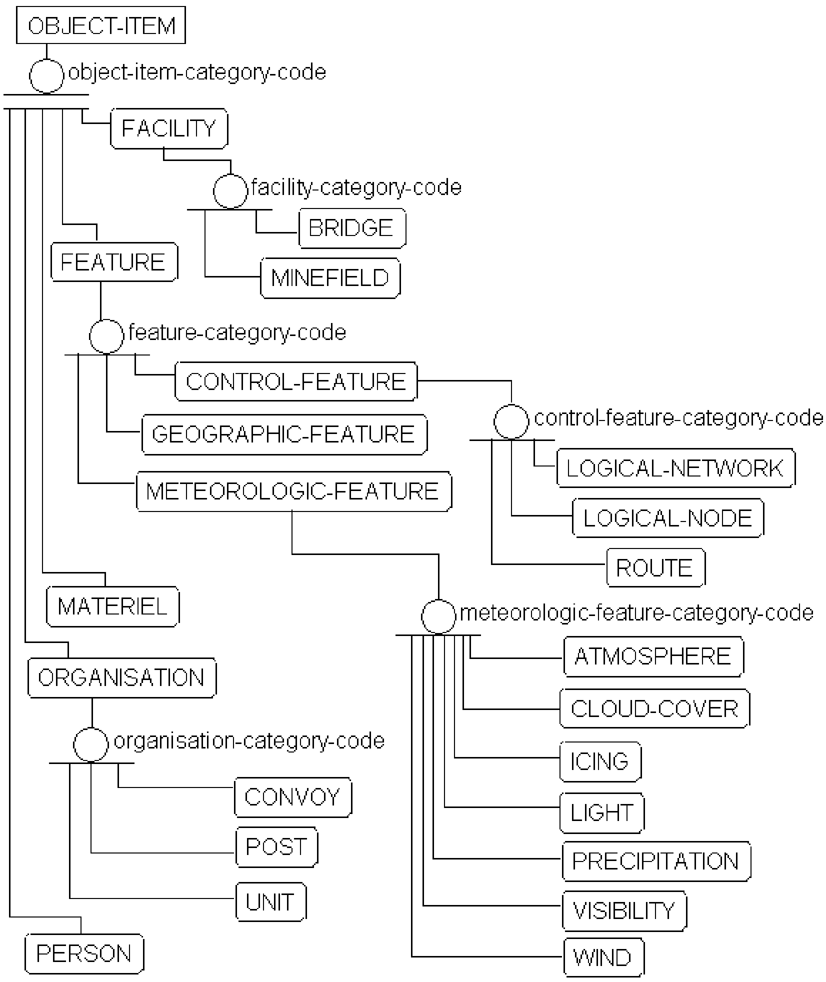


Figure 28. The OBJECT-ITEM Subtype Tree

3.3.1.4 The first level of OBJECT-ITEM categorisation results in five subtypes. The five subtypes are FACILITY, FEATURE, MATERIEL, ORGANISATION, and PERSON. The first-level subtyping of OBJECT-ITEM mirrors the subtyping of OBJECT-TYPE for purposes of classification. The attribute-level representation of this structure is depicted in Figure 29. The detailed specification of the five subtypes and their subtypes is presented in subsequent sections.

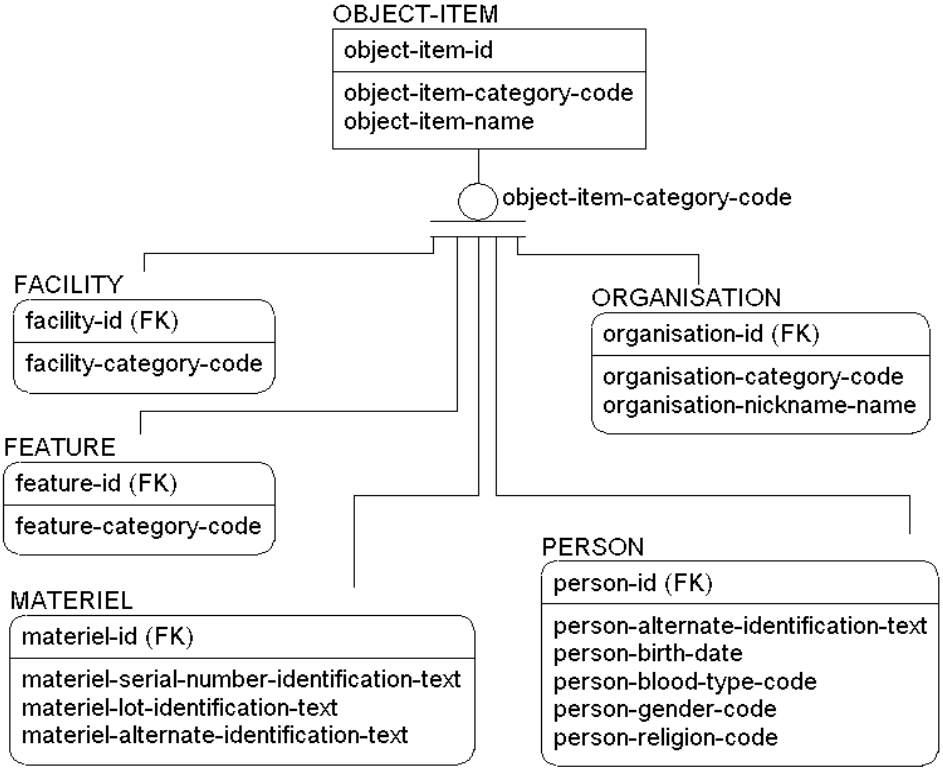


Figure 29. First-Level Subtypes of OBJECT-ITEM

3.3.1.5 OBJECT-ITEM has the following attributes:

a. object-item-id—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEMs. For example, a particular unit (e.g., 1 Bn 2 (US) Inf Bde) will be labelled by a unique identifier which can be used to access information relating to that unit.

b. object-item-category-code—The specific value that represents or denotes the class of OBJECT-ITEM. It serves as a discriminator that partitions OBJECT-ITEM into subtypes. Domain values are: FACILITY, FEATURE, MATERIEL, ORGANISATION, and PERSON.

c. object-item-name—A designation, expressed in a word or phrase, of a specific OBJECT-ITEM.

3.3.1.6 Table 20 provides example instances for OBJECT-ITEM.

Table 20. OBJECT-ITEM Examples

OBJECT-ITEM

object-item-id	object-item-category code	object-item-name
78128	ORGANISATION	1 Bn 2 (US) Inf Bde
3051	ORGANISATION	— [Null: Enemy unit has been observed but not identified]
57	FEATURE	Rhone River
66499	PERSON	General Smith

3.3.2 ORGANISATION as a Subtype of OBJECT-ITEM

3.3.2.1 Specification of ORGANISATION

3.3.2.1.1 ORGANISATION is defined as an OBJECT-ITEM that is an administrative or functional structure. Three forms of military organisation are represented by explicit subtypes, namely, UNIT, CONVOY, and POST. The structure of ORGANISATION hierarchy is depicted in Figure 30.

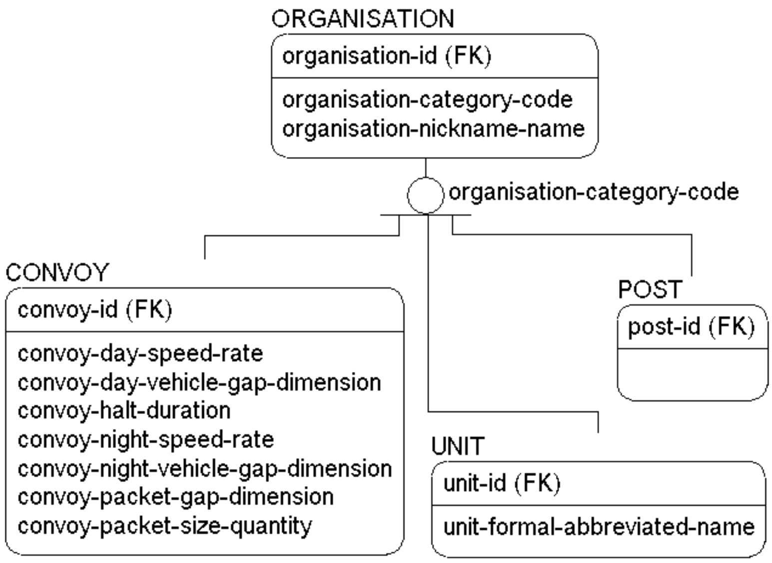


Figure 30. ORGANISATION and Its Subtypes

3.3.2.1.2 The attributes are:

a. organisation-id—The object-item-id for a specific ORGANISATION (a role name for object-item-id).

b. organisation-category-code—The specific value that represents or denotes the class of ORGANISATION. It serves as a discriminator that partitions ORGANISATION into subtypes. The domain values are: CONVOY, POST, UNIT, Not known, Not otherwise specified.

c. organisation-nickname-name—A designation, expressed in a word or phrase, of the common informal reference given to a specific ORGANISATION (e.g., "Big Red One," also known as 1(US) Mechanized Division).

3.3.2.1.3 The following comment applies to object-item-name when it used for an organisation. The name may be the designator (but not a call sign) for an observer, forward air controller, lasing team, or a specific flight of aircraft. (Ref. ADatP-3, FFIRN 01028, "Unit

Identifier"—The identification of a military, paramilitary, or government agency unit as used in official communications within military establishments.)

3.3.2.2 UNIT as a Subtype of ORGANISATION

3.3.2.2.1 UNIT is defined as a military ORGANISATION whose structure is prescribed by competent authority, e.g., in the form of a table of organisation and equipment; specifically, part of an organisation. A formation is specified as a UNIT. The attributes are:

a. unit-id—The organisation-id of a specific UNIT (a role name for object-item-id).

b. unit-formal-abbreviated-name—A designation, expressed in a word or phrase, of the common formal abbreviation used to designate a specific UNIT.

3.3.2.2.2 An example of how the entities OBJECT-ITEM, ORGANISATION and UNIT are used together to specify instances of real-world units is shown in Table 21.

Table 21. ORGANISATION and UNIT Examples

(a) OBJECT-ITEM ORGANISATION

object-item-name	organisation-id	organisation-category-code	organisation-nickname-name
101st Airborne Division	4597	UNIT	The Screaming Eagles
3rd Cavalry Bn	4598	UNIT	(null)
1/33 Field Artillery Bn	4599	UNIT	The Rockasans
9112 Prov Coy	4600	UNIT	(null)

(b) UNIT

unit-id	unit-formal-abbreviated-name
4597	101 Div
4598	3 CAV
4599	1/33 FA Bn
4600	9112 Pro Coy

3.3.2.3 POST as Subtype of ORGANISATION

POST (also known as “posting” or “position”) is defined as an ORGANISATION with a set of duties that can be fulfilled by one person. POST has only a single attribute:

post-id—The organisation-id of a specific POST (a role name for object-item-id).

3.3.2.4 CONVOY as a Subtype of ORGANISATION

CONVOY is defined as an ORGANISATION that is a group of vehicles organised for the purpose of control and orderly movement with or without escort protection. The attributes are:

a. convoy-id—The organisation-id of a specific CONVOY (a role name for organisation-id).

b. convoy-day-speed-rate—The value that represents the maximum distance per unit time that a specific CONVOY is to maintain during daylight operations, measured in units of kilometres per hour.

c. convoy-day-vehicle-gap-dimension—The one-dimensional linear measurement that represents the distance between vehicles in a particular CONVOY during daylight operations.

d. convoy-halt-duration—The non-monetary numeric value representing the aggregated units of time that a specific CONVOY may remain stationary during operations.

e. convoy-night-speed-rate—The value that represents the maximum distance per unit time that a specific CONVOY is to maintain during operations in darkness, measured in units of kilometres per hour.

f. convoy-night-vehicle-gap-dimension—The one-dimensional linear measurement that represents the distance between vehicles in a particular CONVOY during operations in darkness.

g. convoy-packet-gap-dimension—The one-dimensional linear measurement that represents the distance between packets in a particular CONVOY.

h. convoy-packet-size-quantity—The non-monetary numeric value that represents the number of vehicles per packet in a particular CONVOY.

3.3.3 MATERIEL as a Subtype of OBJECT-ITEM

3.3.3.1 MATERIEL is defined as an OBJECT-ITEM that is equipment, apparatus or supplies of military interest without distinction as to its application for administrative or combat purposes. The attributes are:

a. materiel-id—The object-item-id of a specific MATERIEL (a role name for object-item-id).

b. materiel-serial-number-identification-text—The unformatted character string assigned to represent a specific MATERIEL. Comment: The serial number, frequently found stamped on a battlespace object, may be unique only for a MATERIEL-TYPE with a specific model number.

c. materiel-lot-identification-text—The unformatted character string assigned to represent a specific production of a specific MATERIEL. For example, it might be used to specify the production lot of propellant or other munition.

d. materiel-alternate-identification-text—The unformatted character string assigned to alternatively represent a specific MATERIEL (e.g., weapon “bumper number” or aircraft “tail number”). This attribute is used in fire support to provide a common reference for a specific item of materiel that can be recognised in voice mode as well as in information systems.

3.3.3.2 Table 22 provides example instances for MATERIEL

Table 22. Examples of MATERIEL

MATERIEL

materiel-id	materiel-serial-number-identification-text	materiel-lot-identification-text	materiel-alternate-identification-text
5467	3-0004-66772-09	null	Radar Alpha
5468	5-9803-89932-11	null	Howitzer 3
12950	7-1945-34487-21	12-92-883	White Bag

3.3.4 PERSON as a Subtype of OBJECT-ITEM

3.3.4.1 PERSON is a necessary entity for exchange of command and control information at the international level, since there is a requirement to track the identity and location of commanders and key staff at many echelons. There may also be a need to identify hostages and victims of national disasters or acts of terrorism.

3.3.4.2 A PERSON is defined as an OBJECT-ITEM that is a human being to whom military significance is attached. The attributes are:

a. person-id—The object-item-id of a specific PERSON (a role name for object-item-id).

b. person-alternate-identification-text—The unformatted character string assigned to alternatively represent a specific PERSON. An example is a personal identification card number, such as a social security number or passport number.

c. person-birth-date—The date when a specific PERSON was born.

d. person-blood-type-code—A code which represents the specific blood type of a PERSON. The domain values are: A Rh Pos, A Rh Neg, B Rh Pos, B Rh Neg, O Rh Pos, O Rh Neg, AB Rh Pos; AB Rh Neg; Not known.

e. person-gender-code—The code that represents the classification of a PERSON based on reproductive physiological traits. The domain values are: Male; Female; Not known.

f. person-religion-code—A code that represents the religion of a PERSON. The domain values are: Atheist; Buddhist; Greek Orthodox; Hindu; Jew; Muslim; None; Protestant; Roman Catholic, Russian Orthodox, Not known.

3.3.4.3 Table 23 provides instances for PERSON with the object-item-name in the first column.

Table 23. Example Instances for PERSON

OBJECT-ITEM		PERSON			
object-item-name		**person-id**	**person-alternate-identification-text**	**person-blood-type-code**	**person-gender-code**
William A. Smith		4532	008-32-7612	B RH Pos	Male
Jessica L. Williams		7539	123-45-6789	O Rh Neg	Female
Audrey H. Muhler		7540	046-67-8923	AB Rh Neg	Female
Ferdinand Seville		7546	111-33-2222	Not known	Male

3.3.4.4 PERSON-SKILL has been added to the model as a child entity of PERSON. PERSON-SKILL is defined as a proficiency, ability, or dexterity of a specific PERSON. It allows the identification of specific skills that a particular PERSON may have. The current specification includes only linguistic skills. The structure is illustrated in Figure 31.

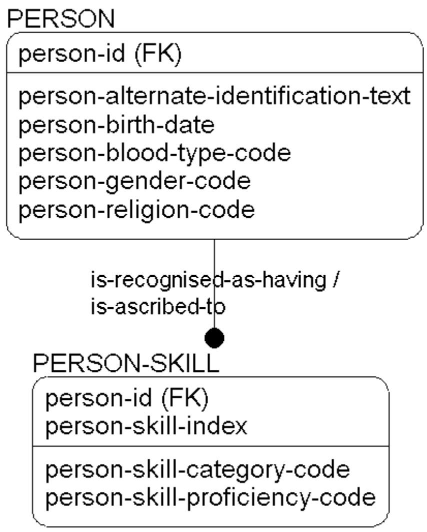


Figure 31. PERSON-SKILL as a Child of PERSON

3.3.4.5 The attributes are:

a. person-id—The object-item-id of a specific PERSON (a role name for object-item-id).

b. person-skill-index—The unique value, or set of characters, assigned to represent a specific PERSON-SKILL for a specific PERSON and to distinguish it from all other PERSON-SKILLs for that PERSON.

c. person-skill-category-code—The specific value that represents or denotes the class of PERSON-SKILL. Example domain values are: Language, Danish; Language, Norwegian, Language, Portuguese.

d. person-skill-proficiency-code—The specific value that represents or denotes the level of proficiency of a specific PERSON in a specific skill. The domain values are: Extremely proficient, Moderately proficient, Slightly proficient, Very proficient, Not known.

3.3.4.6 A simple example in Table 24 illustrates the use of the PERSON-SKILL structure for linguistic abilities. The current set of domain values for person-skill-proficiency-code refers only to language skills; however, the set can be easily extended to include any other skills of military interest.

Table 24. Use of PERSON-SKILL

(a) PERSON

person-id	person-alternate-identification-text
1	John
2	Jack

(b) PERSON-SKILL

person-id	person-skill-index	person-skill-category-code	person-skill-proficiency-code
1	1	Language, German	Slightly proficient
1	2	Language, Dutch	Very proficient
2	1	Language, Portuguese	Extremely proficient
2	2	Language, Spanish	Very proficient
2	3	Language, French	Moderately proficient

3.3.4.7 The model provides minimal specification for PERSON. Specification of relationships among PERSONs (e.g., spouse, next of kin, power of attorney, dependent) is not part of the current data model. Relationships of specific PERSONs to ORGANISATIONs (e.g., who has been assigned to a UNIT) is specified using an OBJECT-ITEM association, while that for PERSONs and MATERIEL (what rifle is assigned to a person by serial number) is not and is therefore left as a matter for national implementation.

3.3.5 FACILITY as a Subtype of OBJECT-ITEM

3.3.5.1 Specification of FACILITY

3.3.5.1.1 A FACILITY is defined as an OBJECT-ITEM that is built, installed or established to serve some particular purpose and is identified by the service it provides rather than by its content. In effect, this means that virtually anything man-made is defined as a FACILITY; natural objects are represented as GEOGRAPHIC-FEATUREs.

3.3.5.1.2 FACILITY has an incomplete subtyping into two subtypes. BRIDGE and MINEFIELD capture essential information concerning two classes of tactically important battlespace objects. The data structure for FACILITY and its subtypes is illustrated in Figure 32.

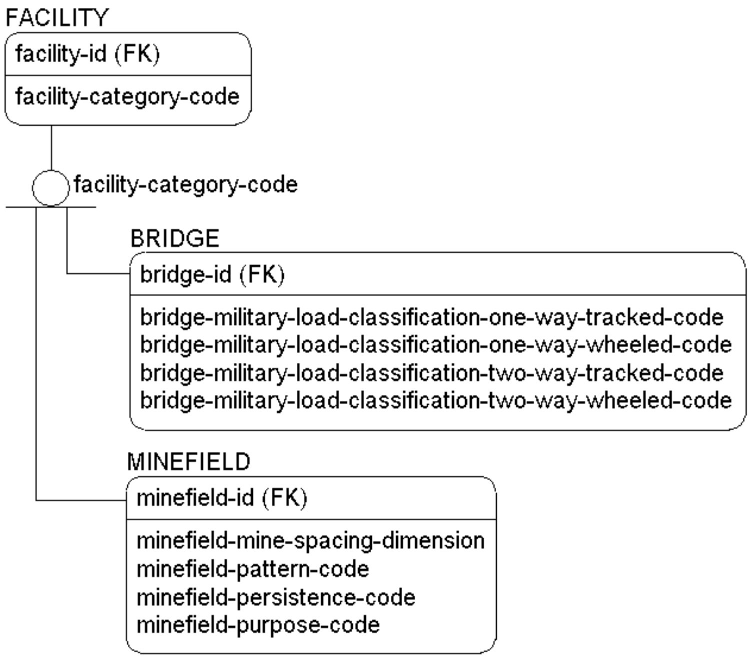


Figure 32. FACILITY and Its Subtypes

3.3.5.1.3 The attributes are:

a. facility-id—The object-item-id of a specific FACILITY (a role name for object-item-id).

b. facility-category-code—The specific value that represents or denotes the class of FACILITY. It serves as a discriminator that partitions FACILITY into subtypes. The domain values are: BRIDGE; MINEFIELD; Not otherwise specified.

3.3.5.1.4 Example instances for FACILITY are illustrated in Table 25.

Table 25. Examples of FACILITY

OBJECT-ITEM	FACILITY	
object-item-name	**facility-id**	**facility-category-code**
1 (UK) Amd Division Dressing Station	398	Not otherwise specified
Blackbush Airfield	4311	Not otherwise specified
Golden Gate Bridge	7436	BRIDGE

3.3.5.1.5 A precise definition of the concept of FACILITY is required to allow clear distinctions to be drawn between FACILITY, ORGANISATION, and GEOGRAPHIC-FEATURE. Observations for the concept of FACILITY include the following:

a. The operational user of a C2IS system will be interested in a FACILITY with respect to the service it provides rather than its content. Information about the detailed ESTABLISHMENT of a FACILITY will be held with respect to the organisation(s) which are associated with a particular FACILITY. Thus, airfields, field hospitals, rearming and refuelling points are all FACILITYs (many instances of which will have ORGANISATIONs associated with them).

b. Permanent structures, such as bridges and roads, are considered FACILITYs.

3.3.5.2 MINEFIELD as a Subtype of FACILITY

3.3.5.2.1 MINEFIELD is defined as a FACILITY that is an area of land or water containing mines laid with or without a pattern (adapted from two definitions of Minefield in JCS Pub 1-02). Note (NATO): In land mine warfare, a mine is an explosive or other material, normally encased, designed to destroy or damage ground vehicles, boats, or aircraft, or designed to wound, kill, or otherwise incapacitate personnel. In naval mine warfare, a mine is an explosive device laid in the water with the intention of damaging or sinking ships or of deterring shipping from entering an area. The attributes are:

a. minefield-id—The facility-id of a specific MINEFIELD (a role name for object-item-id).

b. minefield-mine-spacing-dimension—The one-dimensional linear measurement that represents the distance between the mines emplaced in a specific MINEFIELD.

c. minefield-pattern-code—The specific value that represents or denotes the pattern of a specific MINEFIELD. The domain values are: All scattered; Not scattered; Thickened with scattered mines; Not known.

d. minefield-persistence-code—The specific value that represents or denotes the option for terminating the effectiveness of a specific MINEFIELD. The domain values are: Permanent; Remote activated destruction; Timed automatic destruction; Not known.

e. minefield-purpose-code—The specific value that represents or denotes the intended function of a specific MINEFIELD. The domain values are: Heavy tactical; Light tactical; Medium tactical; Nuisance; Phoney; Protective; Not known.

3.3.5.2.2 Example instances for MINEFIELD are provided in Table 26.

Table 26. MINEFIELD Example Instances

MINEFIELD

minefield-id	minefield-pattern-code	minefield-persistence-code	minefield-purpose-code	minefield-mine-spacing-dimension
384753	Thickened with scattered mines	Remote activated destruction	Nuisance	10 (m)
435262	All scattered	Not known	Phoney	25 (m)
897433	Not scattered	Permanent	Protective	3 (m)

3.3.5.3 BRIDGE as subtype of FACILITY

3.3.5.3.1 BRIDGE is defined as a FACILITY that is a structure spanning and providing passage over a waterway, railway, or other obstacle. BRIDGE has the following attributes:

a. bridge-id—The facility-id of a specific BRIDGE (a role name for object-item-id).

b. bridge-military-load-classification-one-way-tracked-code—The specific value that represents the calculated classification of the load of tracked vehicles that a specific BRIDGE can carry in one direction. Example domain values are: 4, 8, 12, 20, 40, 80, 150.

c. bridge-military-load-classification-one-way-wheeled-code—The specific value that represents the calculated classification of the load of wheeled vehicles that a specific BRIDGE can carry in one direction. Example domain values are: 4, 8, 12, 20, 40, 80, 150.

d. bridge-military-load-classification-two-way-tracked-code—The specific value that represents the calculated classification of the load of tracked vehicles that a specific BRIDGE can carry simultaneously in two directions. Example domain values are: 4, 8, 12, 20, 40, 80, 150.

e. bridge-military-load-classification-two-way-wheeled-code—The specific value that represents the calculated classification of the load of wheeled vehicles that a specific BRIDGE can carry simultaneously in two directions. Example domain values are: 4, 8, 12, 20, 40, 80, 150.

3.3.5.3.2 Bridge military load classification codes are assigned through a standard system for classifying the load capabilities of bridges. Calculations are described in STANAG 2021.

3.3.6 FEATURE as Subtype of OBJECT-ITEM

3.3.6.1 Specification of FEATURE

3.3.6.1.1 FEATURE is defined as an OBJECT-ITEM that encompasses meteorological, geographic, and control features of military significance. In other words, FEATUREs are used to describe characteristics, phenomena, or other similar objects that are associated with a geographic location. These entities are of interest in the battlespace, and may be administratively defined or occur naturally.

3.3.6.1.2 Because the specification encompasses a broad range of elements in the battlespace, FEATURE has been subtyped into three categories: CONTROL-FEATURE, GEOGRAPHIC-FEATURE, and METEOROLOGIC-FEATURE, as displayed in Figure 33.

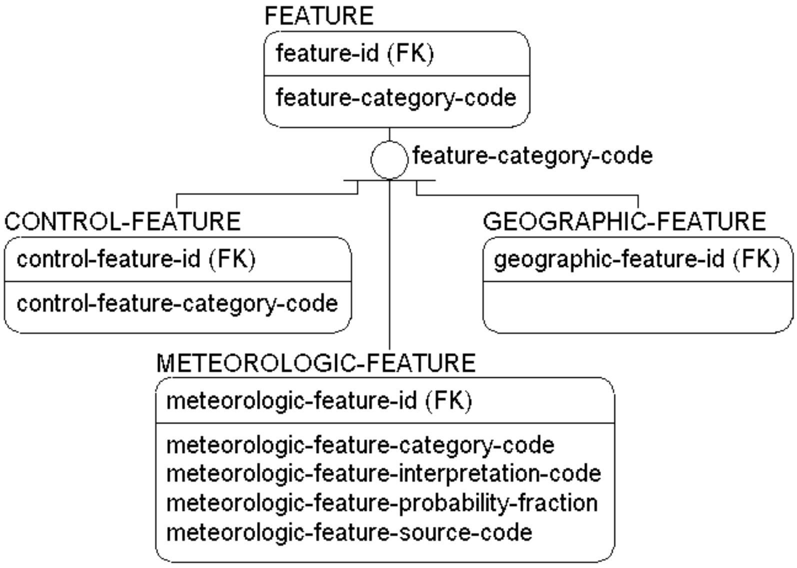


Figure 33. FEATURE and Its First-Level Subtypes

3.3.6.1.3 The attributes are:

a. feature-id—The object-id of a specific FEATURE (a role name for object-item-id).

b. feature-category-code—The specific value that represents or denotes the class of FEATURE. It serves as a discriminator that partitions FEATURE into subtypes. The domain values are: CONTROL-FEATURE; GEOGRAPHIC-FEATURE; METEOROLGIC-FEATURE; Not otherwise specified.

3.3.6.1.4 Table 27 provides example instances for FEATURE.

Table 27. Example Instances for FEATURE

OBJECT-ITEM	FEATURE	
object-item-name	**feature-id**	**feature-category-code**
Phase Line Tango	11245	CONTROL-FEATURE
Rhone River	674	GEOGRAPHIC-FEATURE
El niño	679	METEOROLOGIC-FEATURE

3.3.6.2 CONTROL-FEATURE as a Subtype of FEATURE

3.3.6.2.1 CONTROL-FEATURE is defined as a nontangible FEATURE of military interest that is administratively specified, may be represented by a geometric figure, and is associated with the conduct of military operations. This expresses the idea of administratively defined objects created by military authorities and controlling or affecting the activities of military formations. CONTROL-FEATURE describes objects which are of interest but which do not physically exist (e.g., boundary line, landing zone). Three such features that have their own unique properties are routes, logical communications networks and logical communications nodes. Consequently, CONTROL-FEATURE is incompletely subtyped into ROUTE, LOGICAL-NETWORK, and LOGICAL-NODE. The data structure for CONTROL-FEATURE is illustrated in Figure 34.

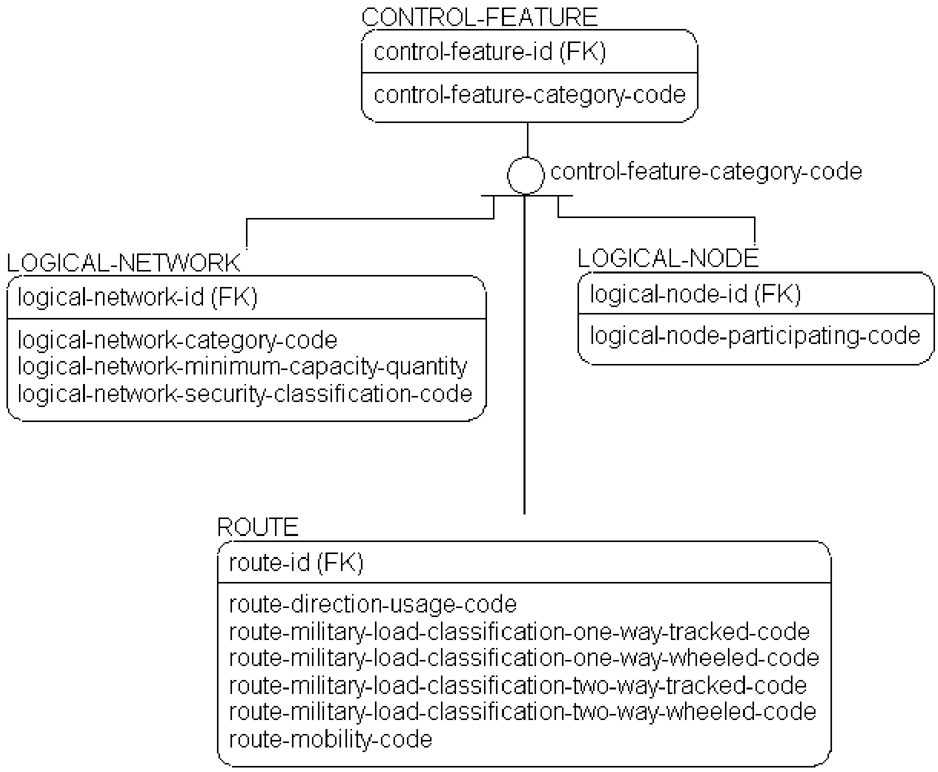


Figure 34. The Data Structure for CONTROL-FEATURE

3.3.6.2.2 The attributes are:

a. control-feature-id—The feature-id of a specific CONTROL-FEATURE (a role name for object-item-id).

b. control-feature-category-code—The specific value that represents or denotes the class of CONTROL-FEATURE. It serves as a discriminator that partitions CONTROL-FEATURE into subtypes. The domain values are: ROUTE; LOGICAL-NODE; LOGICAL-NETWORK; Not otherwise specified.

3.3.6.2.3 Table 28 provides example instances for CONTROL-FEATURE.

Table 28. Example Instances for CONTROL-FEATURE

CONTROL-FEATURE

control-feature-id	control-feature-category-code
64689	ROUTE
56894	Not otherwise specified
53777	LOGICAL-NODE
53787	LOGICAL-NODE

3.3.6.3 ROUTE as a Subtype of CONTROL-FEATURE

3.3.6.3.1 ROUTE is defined as a CONTROL-FEATURE that is the prescribed course to be travelled from a specific point of origin to a specific destination. The attributes are:

a. route-id—The control-feature-id of a specific ROUTE (a role name for object-item-id).

b. route-direction-usage-code—The specific value that represents or denotes the assigned direction for the traffic on the route. The domain values are: Alternating, One-way, Two-way.

c. route-military-load-classification-one-way-tracked-code—The specific value that represents the calculated classification of the load of tracked vehicles that a specific ROUTE can carry in one direction. Example domain values are: 4, 8, 12, 20, 40, 80, 150.

d. route-military-load-classification-one-way-wheeled-code—The specific value that represents the calculated classification of the load of wheeled vehicles that a specific ROUTE can carry in one direction. Example domain values are: 4, 8, 12, 20, 40, 80, 150.

e. route-military-load-classification-two-way-tracked-code—The specific value that represents the calculated classification of the load of tracked vehicles that a specific ROUTE can carry simultaneously in two directions. Example domain values are: 4, 8, 12, 20, 40, 80, 150.

f. route-military-load-classification-two-way-wheeled-code—The specific value that represents the calculated classification of the load of wheeled vehicles that a specific ROUTE can carry simultaneously in two directions. Example domain values are: 4, 8, 12, 20, 40, 80, 150.

g. route-mobility-code—The specific value that indicates the suitability of a specific ROUTE for movement. The domain values are: By foot only; Tracked; Wheeled; Wheeled and tracked; Not known.

3.3.6.3.2 Example instances for ROUTE are provided in Table 29. The table specifies that a route identified by the route-id 45932 is capable of carrying wheeled or tracked vehicles with equipment-type-military-load-classification-code of 60 or less. The second route identified by route-id 83576 is suitable only for foot traffic, although its load classification of 4 exceeds by a considerable margin the load that would be represented by a human. This is an instance where the route characteristics might preclude vehicular traffic due to obstacles or insufficient width.

Table 29. ROUTE Example Instances

ROUTE

route-id	route-military-load-classification-one-way- tracked-code	route-mobility-code
45932	60	Wheeled and tracked
83576	4	By foot only

3.3.6.4 LOGICAL-NETWORK as a Subtype of CONTROL-FEATURE[26]

LOGICAL-NETWORK is defined as a CONTROL-FEATURE that is a chain of interconnecting communications elements logically designed to function in a specified manner. The attributes are:

a. logical-network-id—The control-feature-id of a specific LOGICAL-NETWORK (a role name for object-item-id).

[26] Chapter 16 contains an extensive discussion and examples of networks and nodes.

b. logical-network-category-code—The specific value that represents or denotes the class LOGICAL-NETWORK. The domain values are: Common user network; Compound network; Sole-user-network.

c. logical-network-minimum-capacity-quantity—The non-monetary numeric value representing the minimum number of baud that a specific LOGICAL-NETWORK can process.

d. logical-network-security-classification-code—The specific value that represents the security classification of a specific LOGICAL-NETWORK. The domain values are: NATO UNCLASSIFIED, NATO RESTRICTED, NATO CONFIDENTIAL, NATO SECRET, COSMIC TOP SECRET. The codes are defined in NATO document C-M(55)15 FINAL.

3.3.6.5 LOGICAL-NODE as a Subtype of CONTROL-FEATURE

LOGICAL-NODE is defined as a CONTROL-FEATURE that participates as a logical element in a communications network. A LOGICAL-NODE may be a role for an ORGANISATION specified through ORGANISATION-CONTROL-FEATURE-ASSOCIATION, an entity discussed in a subsequent chapter. The attributes are:

a. logical-node-id—The control-feature-id of a specific LOGICAL-NODE (a role name for object-item-id).

b. logical-node-participating-code—The specific value which reflects the method of operation of a specific LOGICAL-NODE. The domain values are: Transmitting; Receiving; Transmitting/receiving.

3.3.6.6 Specification of GEOGRAPHIC-FEATURE

3.3.6.6.1 GEOGRAPHIC-FEATURE is defined as a FEATURE describing terrain characteristics to which military significance is attached. In general, this represents any natural object or configuration of ground or water represented on a map or chart. GEOGRAPHIC-FEATURE has only one attribute:

geographic-feature-id—The feature-id of a specific GEOGRAPHIC-FEATURE (a role name for object-item-id).

3.3.6.6.2 The specifications of FACILITY and FEATURE has been constructed using Digital Geographic Exchange Standard (DIGEST) [DIGEST 1992].[27] DIGEST is a multinational effort by NATO nations to reach agreement on standards for geographic products. Volume 4 of DIGEST (*Feature Attribute Coding Catalog*) provides a list of feature types, attributes, and agreed domain values. It should be noted that the DIGEST standard has features and attributes for structures that are defined in the model as being FACILITYs rather than GEOGRAPHIC-FEATUREs.

3.3.6.7 METEOROLOGIC-FEATURE as Subtype of FEATURE

3.3.6.7.1 Specification of METEOROLOGIC-FEATURE

3.3.6.7.1.1 METEOROLOGIC-FEATURE is defined as a FEATURE that describes reported or forecast weather and light conditions. Several types of meteorological (MET) information are used in tactical operations and provided for various periods of use (e.g., 12 hours, 24 hours).

---

[27] Now referred to as AGeoP-3 [Ref. DIGEST 1994].

3.3.6.7.1.2 A METEOROLOGIC-FEATURE describes a meteorological condition at a specific location. This location (e.g., a specific area or point) is identified using FEATURE-LOCATION. Several conditions which are described using METEOROLOGIC-FEATURE can depend on altitude; in such cases, a set of METEOROLOGIC-FEATURE instances is used and associated with FEATURE-LOCATION representing the correct altitude (using a POINT or SURFACE specification) or using a range of altitudes specified by a GEOMETRIC-VOLUME (using the volume-upper-level-elevation-dimension and volume-lower-level-elevation-dimension).

3.3.6.7.1.3 A METEOROLOGIC-FEATURE also describes a meteorological condition at a specific time, either a past time for observations or a future time for weather predictions. This time is specified in the REPORTING-DATA that links it to the FEATURE-LOCATION. A prediction can be made for an entire period of time by also specifying duration of that prediction in reporting-data-absolute-timing-duration. To support the creation of predictions, METEOROLOGIC-FEATURE provides an attribute that specifies the probability of the condition occurring at the specified location within the specified timeframe.

3.3.6.7.1.4 Each METEOROLOGIC-FEATURE describes only a single meteorological condition. However, it is possible to construct a composite weather image by defining multiple METEOROLOGIC-FEATUREs with different FEATURE-LOCATIONs, but which all refer to the same REPORTING-DATA.

3.3.6.7.1.5 METEOROLOGIC-FEATURE has an incomplete subtyping comprising six subtypes: ATMOSPHERE, CLOUD-COVER, ICING, LIGHT, PRECIPITATION, VISIBILITY, and WIND. Each instance of METEOROLOGIC-FEATURE (and one of its subtypes) describes a single meteorological condition in more detail. The subtype structure of METEOROLOGIC-FEATURE is illustrated in Figure 35.

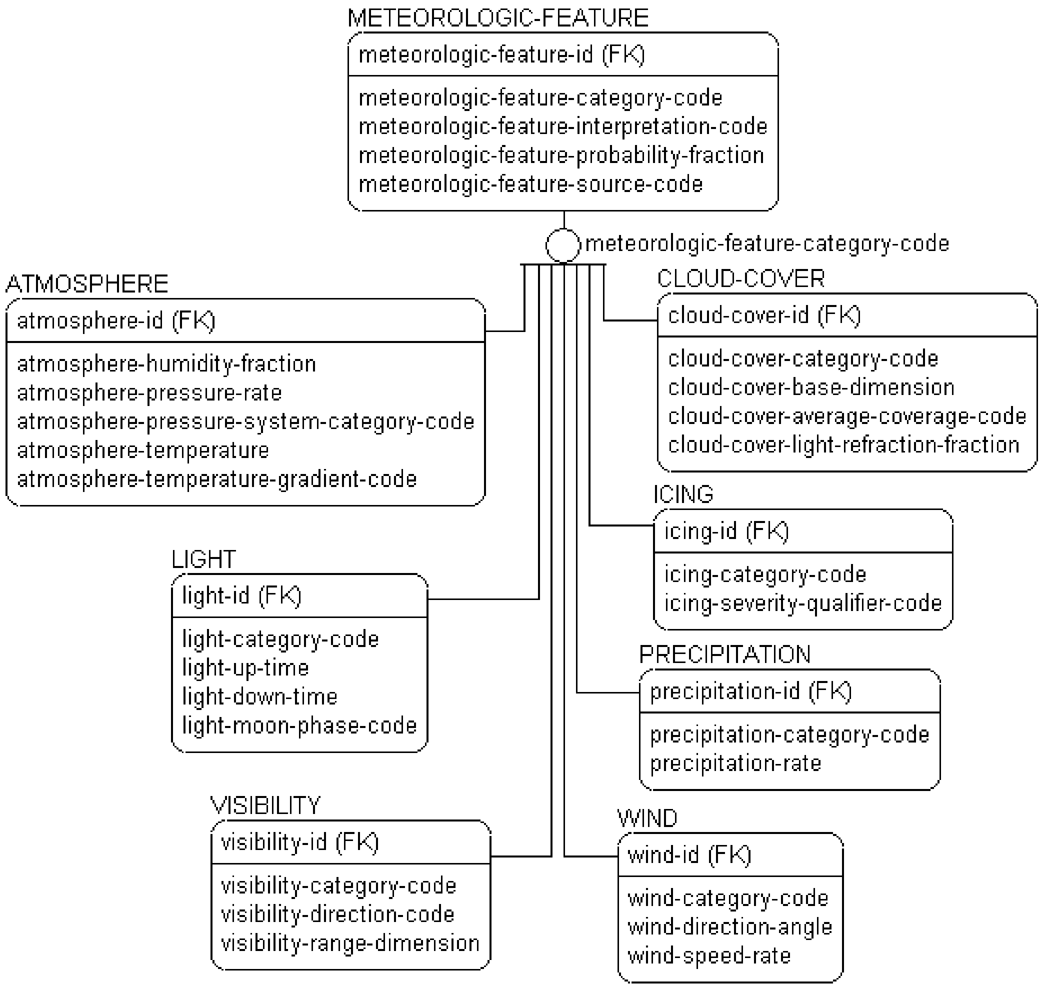


Figure 35. The Subtypes of METEOROLOGIC-FEATURE

3.3.6.7.1.6 The attributes of METEOROLOGIC-FEATURE are:

a. meteorologic-feature-id—The feature-id of a specific METEOROLOGIC-FEATURE (a role name of object-item-id).

b. meteorologic-feature-category-code—The specific value that denotes the class of METEOROLOGIC-FEATURE. It serves as a discriminator that partitions METEOROLOGIC-FEATURE into subtypes. Example domain values are: ATMOSPHERE, CLOUD-COVER, Cyclone, Hurricane, ICING, LIGHT, PRECIPITATION, Storm, Thunderstorm, Tornado, Tropical storm, Typhoon, VISIBILITY, Whirlwind, WIND, Not otherwise specified.

c. meteorologic-feature-interpretation-code—The specific value that denotes the statistical meaning of a specified METEOROLOGIC-FEATURE. The domain values are: Absolute maximum; Absolute minimum; Average maximum; Average minimum; Nominal.

d. meteorologic-feature-probability-fraction—The specific value that defines the likelihood that a specific condition will occur for a specific METEOROLOGIC-FEATURE. Domain is non-negative real number not exceeding 1.0.

e. meteorologic-feature-source-code—The specific value that denotes the basis for the estimate of a condition for a specific METEOROLOGIC-FEATURE. The domain values are: Forecast; Measured, Observed.

3.3.6.7.1.7 Note that an instance of METEOROLOGIC-FEATURE should have only one corresponding LOCATION, as the probability attribute in METEOROLOGIC-FEATURE is only intended for a single location over a specific period of time.

3.3.6.7.2 ATMOSPHERE as a Subtype of METEOROLOGIC-FEATURE

ATMOSPHERE is defined as a METEOROLOGIC-FEATURE that specifies humidity, pressure, and temperature characteristics of Earth's atmosphere. ATMOSPHERE has the following attributes:

a. atmosphere-id—The meteorologic-feature-id of a specific ATMOSPHERE (a role name for object-item-id).

b. atmosphere-humidity-fraction—The value that represents the ratio of water present in the air to the maximum amount of water (saturation point) possible at a given temperature and pressure. The domain values are non-negative real numbers not exceeding 1.0.

c. atmosphere-pressure-rate—The value that represents the ambient air in terms of force per unit area, expressed in units of newtons per square metre.

d. atmosphere-pressure-system-category-code—The specific value that represents or denotes the class of a pressure system in a particular ATMOSPHERE. Example domain values are; Cold front, High pressure center, Ridge line.

e. atmosphere-temperature—The number representing the heat of the ambient air at a point. The domain is a real number exceeding -274, expressed in degrees Celsius.

f. atmosphere-temperature-gradient-code—The specific value that represents or denotes heat change with respect to elevation in a certain area. The domain values are: Inversion, Lapse, Normal, Not known.

3.3.6.7.3 CLOUD-COVER as a Subtype of METEOROLOGIC-FEATURE

CLOUD-COVER is defined as a METEOROLOGIC-FEATURE that specifies the characteristics of clouds above Earth's surface. CLOUD-COVER has the following attributes:

a. cloud-cover-id—The meteorologic-feature-id of a specific CLOUD-COVER (a role name for object-item-id).

b. cloud-cover-category-code—The specific value that represents or denotes the prevailing class of a specific CLOUD-COVER. The domain values are: Clouds; Radioactive cloud.

c. cloud-cover-base-dimension—The one-dimensional linear measurement that represents the elevation of the lowest cloud base for a specific CLOUD-COVER.

d. cloud-cover-average-coverage-code—The specific value that represents or denotes the average density of a specific CLOUD-COVER as fractional coverage. The domain values are: 0/8; 1/8; 2/8; 3/8; 4/8; 5/8; 6/8; 7/8; 7-8/8, 8/8.

e. cloud-cover-light-refraction-fraction—The value that represents the velocity of light in a specified CLOUD-COVER as a fraction of the velocity of light in a vacuum, based on cloud height and used for radar sensing.

3.3.6.7.4 ICING as a Subtype of METEOROLOGIC-FEATURE

ICING is defined as a METEOROLOGIC-FEATURE that specifies the accumulation of frozen water on stationary or moving surfaces.

a. icing-id—The meteorologic-feature-id of a specific ICING (a role name for object-item-id).

b. icing-category-code—The specific value that represents or denotes the class of a particular ICING. The domain values are; Clear icing, Mixed icing, Rime icing.

c. iccing-severity-qualifier-code—The specific value that represents or denotes the severity of a particular ICING. The domain values are; Light, Moderate, Severe.

3.3.6.7.5 LIGHT as a Subtype of METEOROLOGIC-FEATURE

LIGHT is defined as a METEOROLOGIC-FEATURE that specifies the availability of natural illumination by type and time. LIGHT has the following attributes:

a. light-id—The meteorologic-feature-id of a specific LIGHT (a role name for object-item-id).

b. light-category-code—The specific value that represents or denotes the class of LIGHT. The domain values are: Civil twilight; Darkness, Daylight; Moonlight; Nautical twilight.

c. light-up-time—The 24-hour clock-time that marks the beginning of the period of effectiveness of the specified type of LIGHT.

d. light-down-time—The 24-hour clock-time that marks the end of the period of effectiveness of the specified type of LIGHT.

e. light-moon-phase-code—The specific value that represents or denotes the phase of the moon for a specific LIGHT. The domain values are: Full moon; New moon; Waning moon; Waxing moon.

3.3.6.7.6 PRECIPITATION as a Subtype of METEOROLOGIC-FEATURE

PRECIPITATION is defined as a METEOROLOGIC-FEATURE that specifies the type of particulate matter in the Earth's atmosphere and the rate of its descent onto the Earth’s surface. PRECIPITATION has the following attributes:

a. precipitation-id—the meteorologic-feature-id of a specific PRECIPITATION (a role name for object-item-id).

b. precipitation-category-code—The specific value that represents or denotes the prevailing class of a specific PRECIPITATION. Example domain values are: Hail, No precipitation, Rain; Sleet; Snow.

c. precipitation-rate—The relationship that represents the amount of PRECIPITATION deposited per unit time, expressed in units of millimetres per hour.

3.3.6.7.7 VISIBILITY as a Subtype of METEOROLOGIC-FEATURE

VISIBILITY is defined as a METEOROLOGIC-FEATURE that specifies the distance at which an object illuminated by light in the visual spectrum can be detected. VISIBILITY has the following attributes:

a. visibility-id—The meteorologic-feature-id of a specific VISIBILITY (a role name for object-item-id).

b. visibility-category-code—The specific value that represents or denotes the class of obscurant that governs a particular VISIBILITY. Example domain values are; Blowing snow, Fog, Sandstorm, Smoke.

c. visibility-direction-code—The specific value that represents or denotes the direction for which a specific visibility is valid. The domain values are: All directions; Down; East; East Northeast; East Southeast; North; North Northeast; North Northwest; Northeast; Northwest; South; South Southeast; South Southwest; Southeast; Southwest; Up; West; West Northwest; West Southwest.

d. visibility-range-dimension—The one-dimensional linear measure that represents the distance which can be surveyed using visual observation for a specific VISIBILITY. Domain is a non-negative real number, expressed in metres.[28]

3.3.6.7.8 WIND as a Subtype of METEOROLOGIC-FEATURE

WIND is defined as a METEOROLOGIC-FEATURE that specifies the velocity and directional characteristics of atmospheric movement. WIND has the following attributes:

a. wind-id—The meteorologic-feature-id of a specific WIND (a role name for object-item-id).

b. wind-category-code—The specific value that represents or denotes the class of WIND. Example domain values are: Constant; Gusting; Not known; Squalls; Variable.

c. wind-direction-angle—The rotational measurement clockwise between the line of true North and the direction of a specific WIND.

d. wind-speed-rate—The value that represents the distance per unit time of a specific WIND, expressed in units of kilometres per hour.

3.3.7 Comments and Amplifications

3.3.7.1 It is important to note that while different objects are always modelled as different OBJECT-ITEMs, different OBJECT-ITEMs may refer to the same battlespace object. As an example, consider a situation in which two reporting organisations have sighted the same enemy unit but neither can give a positive identification. Because they have no way of knowing that they are referring to the same object, they must create their own unique OBJECT-ITEM identifiers when reporting their sighting.

3.3.7.2 There may be a difference in the way certain objects are viewed by outside observers and the way they are modelled. A unit may set up a field hospital, a maintenance station or a command post. In military terms, these may be considered to be units. In the model, however, field hospitals, maintenance stations, and command posts are consistently modelled as facilities. Each facility can be linked to a unit as needed using the entity ORGANISATION-FACILITY-ASSOCIATION (discussed in Chapter 7).

---

[28] Note (US Army AR 310-25): In US weather observing practice, the greatest distance in a given direction at which it is just possible to see and identify with the unaided eye (a) in the daytime, a prominent dark object against the sky at the horizon, and (b) at night, a known, preferably unfocused, moderately intense light source. After the visibility has been determined through the entire horizon circle, they are resolved into a single value of prevailing visibility for reporting purposes.

(This page intentionally left blank)

4. CLASSIFICATION OF OBJECT-ITEMs BY TYPE

4.1 Introduction

4.1.1 There is a requirement to represent more than one classification of any specific OBJECT-ITEM. This permits the recording of differing interpretations by several organisations of what the type of an item may be. This also enables the historical registry of classifications as a means for understanding the decisions that were made at the time a classification was considered valid.

4.1.2 The ability to classify OBJECT-ITEMs as OBJECT-TYPE makes any information that is stored as type data applicable to the item. Thus, any characteristic of an item that can be described as a type property does not need to be repeated for each item.

4.2 Relationship between OBJECT-TYPE and OBJECT-ITEM

4.2.1 The many-to-many relationship between OBJECT-TYPE and OBJECT-ITEM is resolved by an associative entity called OBJECT-ITEM-TYPE. It is defined as a record of the perceived classification of a specific OBJECT-ITEM as a specific OBJECT-TYPE. The structure is illustrated in Figure 36. The relationship from OBJECT-TYPE to OBJECT-ITEM-TYPE is an identifying relationship "is used as a classification for" that carries the object-type-id identifying the type of the OBJECT-TYPE that an OBJECT-ITEM is going to be classified as. The second relationship, from OBJECT-ITEM to OBJECT-ITEM-TYPE, is an identifying relationship "is classified as" that carries the object-item-id identifying the specific OBJECT-ITEM that is going to be classified as that particular type.

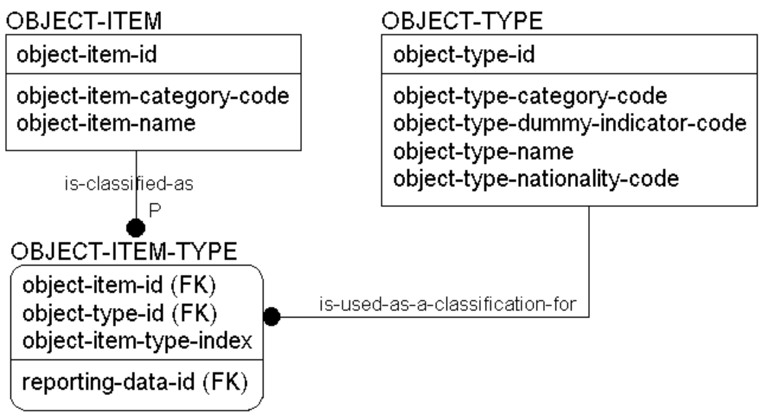


Figure 36. The Relationships from OBJECT-TYPE to OBJECT-ITEM

4.2.2 OBJECT-ITEM-TYPE has only one native attribute:

> object-item-type-index—The unique value, or set of characters, assigned to represent a specific OBJECT-TYPE for a specific OBJECT-ITEM and to distinguish it from all other OBJECT-TYPEs for that OBJECT-ITEM.

4.2.3 The presence of the index enables different classifications to be recorded over a period of time. For example, as noted earlier (Section 2.5.6.2), Unit A may classify an unknown object first as a vehicle, then successively (as better information becomes available) as an armoured vehicle, a tank, a main battle tank, and a T72. Unit B may have a somewhat different perspective of the same object and classify it successively as a vehicle, an APC, and a main battle tank.

4.2.4 The use of this data structure is illustrated in Table 30. In this example, an allied unit (1 RHA) is classified as UK field artillery regiment. In the second example, an opposing force unit is the 6 Guards Tank Division but whose real identity is assumed to be initially unknown. It is only identified by its object-item-id. Thus, the first classification that is made considers it to be an armoured regiment. As more information becomes available, the unit identified as 14486 is re-classified as an armoured division.

Table 30. Use of *object-type-id* in OBJECT-ITEM-TYPE

OBJECT-ITEM-TYPE

object-item-id	object-type-id	object-item-type-index	reporting-data-id
1793	75 [UK Fd Arty Rgt]	1	1001
14486	644 [OR Armd Rgt]	1	1002
14486	610 [OR Armd Div]	1	1003

4.3 Business Rules for OBJECT-ITEM Classification

4.3.1 The IDEF1X diagrammatic specification is not capable of ensuring that the values of discriminators (a role played by category codes) in the hierarchy for an OBJECT-ITEM match the values of discriminators in the hierarchy for the OBJECT-TYPE to which it is related. Rules to ensure this consistency need to be defined outside the diagram as part of a complete IDEF1X specification. Table 31 provides a statement of these rules that are applicable at the time original classification is made.

4.3.2 Further investigation needs to be conducted to determine whether these rules should be extended to subsequent reclassification of an instance of an OBJECT-TYPE. In order to maintain consistency of data records, it may be necessary to prohibit any changes in category codes if the change involves moving a classification category between different branches of a subtyping hierarchy. A reclassification could be permissible if it involves a change of category code within a single subtype. Thus, for example, an item may be re-classified from a vehicle to a truck to a tank within the EQUIPMENT-TYPE subtype of MATERIEL-TYPE, but not be allowed to be reclassified from EQUIPMENT-TYPE to CONSUMABLE-MATERIEL-TYPE within MATERIEL-TYPE.

Table 31. Business Rules to Enforce Consistency of Object Subtyping

If an OBJECT-ITEM is:	Then its OBJECT-TYPE must be:	And the values of the category codes in these two entities must be equivalent:	
FACILITY	FACILITY-TYPE	OBJECT-ITEM	OBJECT-TYPE
FEATURE	FEATURE-TYPE	OBJECT-ITEM	OBJECT-TYPE
MATERIEL	MATERIEL-TYPE	OBJECT-ITEM	OBJECT-TYPE
ORGANISATION	ORGANISATION-TYPE	OBJECT-ITEM	OBJECT-TYPE
PERSON	PERSON-TYPE	OBJECT-ITEM	OBJECT-TYPE
UNIT	UNIT-TYPE	ORGANISATION	ORGANISATION-TYPE
CONTROL-FEATURE	CONTROL-FEATURE-TYPE	FEATURE	FEATURE-TYPE
GEOGRAPHIC-FEATURE	GEOGRAPHIC-FEATURE-TYPE	FEATURE	FEATURE-TYPE
BRIDGE	FACILITY-TYPE	FACILITY	FACILITY-TYPE
MINEFIELD	FACILITY-TYPE	FACILITY	FACILITY-TYPE

(This page intentionally left blank)

5. LOCATION

5.1 Introduction

5.1.1 Concept for LOCATION

5.1.1.1 The data structure under the independent entity LOCATION captures two distinct but related concepts of interest to planners and operators in the battlespace:

(a) The specification of geometry associated with battlespace features;

(b) The specification of location of battlespace objects with respect to the Earth's surface.

The ability to specify geometry permits the recording of various open or closed boundaries, such as areas of responsibility for units, as well as other geometric elements, such as the security fence surrounding an ammunition dump. The positioning of battlespace objects with respect to the Earth's surface is achieved by associating the entities representing battlespace objects with either the LOCATION entity itself or with one of its subtypes, such as POINT.

5.1.2 LOCATION and Its Subtypes

5.1.2.1 LOCATION is defined as a specification of position and geometry with respect to a specified frame of reference. LOCATION has four geometric subtypes: a zero dimensional POINT, a one dimensional LINE that can be a *polygonal path*, a two-dimensional SURFACE, and a three-dimensional GEOMETRIC-VOLUME. *Thus, LOCATION specifies geometry as well as position in space.* The overall structure for specifying location and geometry is shown in Figure 37 at the entity level.

5.1.2.2 The notion of LOCATION and its subtypes is discussed and illustrated in the following sections. The relationship of LOCATION to OBJECT-ITEMs is covered in a subsequent section.

5.2 Specification of LOCATION

5.2.1 LOCATION is an independent entity that has only two attributes: its identifier and a discriminator that points to one of its four subtypes. The attributes are:

a. location-id—The unique value, or set of characters, assigned to represent a specific LOCATION and to distinguish it from all other LOCATIONs.

b. location-category-code—The specific value that represents or denotes a class of LOCATION. It serves as a discriminator that partitions LOCATION into subtypes. The domain values are: POINT, LINE, SURFACE, GEOMETRIC-VOLUME.

5.2.2 The four subtypes of LOCATION, their substructures, and the relationships among them are described in detail in the sections below.

5.3 POINT

5.3.1 POINT is defined as a zero dimensional LOCATION; it has two subtypes—ABSOLUTE-POINT and RELATIVE-POINT. The model structure for POINT is illustrated in Figure 38. ABSOLUTE-POINT is the only entity in the data model with “co-ordinate” attributes, in this case latitude and longitude. All locations are defined in terms of the POINT structure and its relationships to other LOCATIONs. RELATIVE-POINT permits a specification of geometry without placing the geometry at any particular spot on the surface of the Earth. It is particularly useful for specifying doctrinal deployment of military formations.

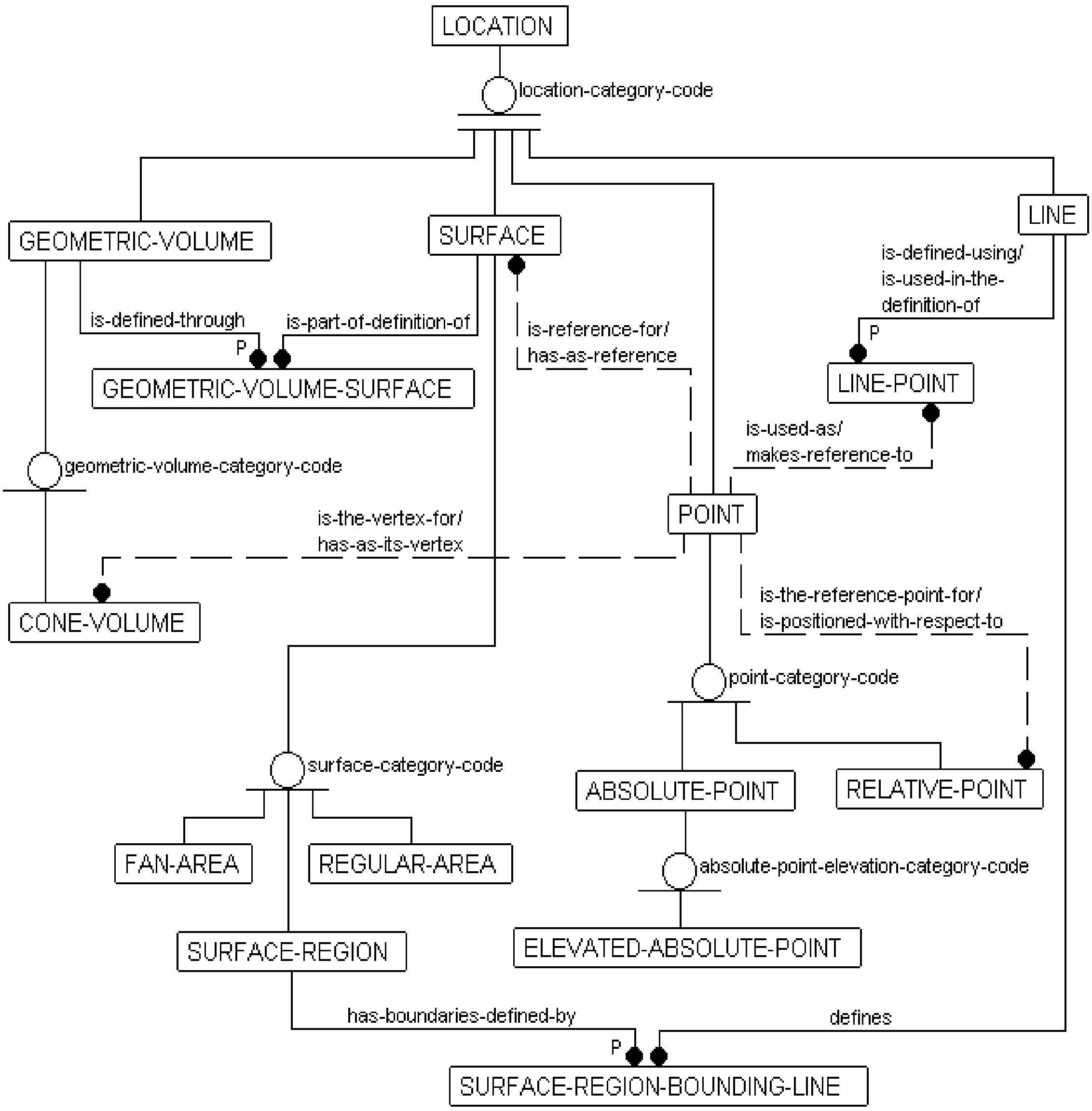


Figure 37. Entity-Level View of the LOCATION Structure

5.3.2 The attributes are:

a. point-id—The location-id of a specific POINT (a role name for location-id).

b. point-category-code—The specific value that represents or denotes the class of POINT. It serves as a discriminator that partitions POINT into subtypes. The domain values are ABSOLUTE-POINT, RELATIVE-POINT, Undefined, Not otherwise specified.

c. point-horizontal-precision-code—The specific value denoting the precision for specifying the coordinates of a POINT in the horizontal plane. The domain values are: 1m, 10m, 100m, 1km, 10km.

d. point-vertical-precision-code—The specific value denoting the precision for specifying the elevation of a POINT along a normal to the horizontal plane.[29] The domain values are: 1m, 10m, 100m, 1km, 10km.

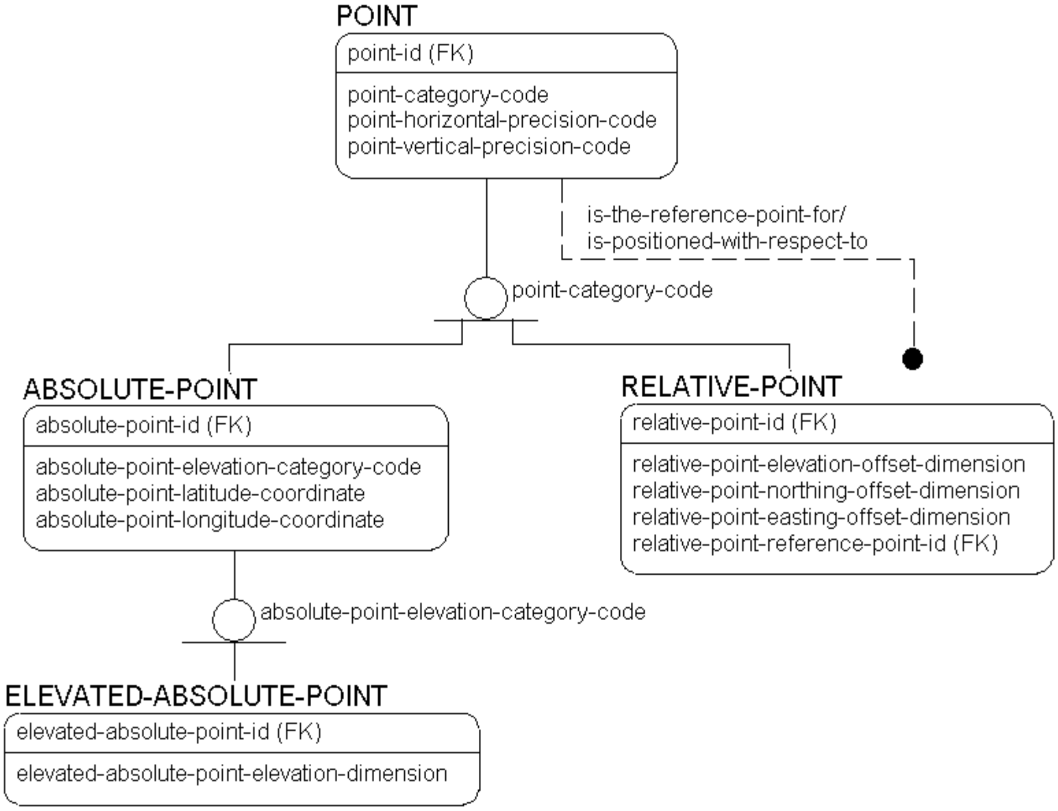


Figure 38. The POINT Structure

5.3.3 ABSOLUTE POINT is defined as a POINT that has its coordinates specified with respect to a given frame of reference. The model uses the World Geodetic System 1984 (WGS 84) frame of reference as the standard. The attributes are:

a. absolute-point-id—The point-id of a specific ABSOLUTE-POINT (a role name for location-id).

b. absolute-point-elevation-category-code—The specific value that represents or denotes the way in which elevation of an ABSOLUTE-POINT is specified. It serves as a discriminator that partitions ABSOLUTE-POINT into subtypes. The domain values are: ELEVATED-ABSOLUTE-POINT, Local terrain, Sea level, Not otherwise specified.

c. absolute-point-latitude-coordinate—The coordinate identifying the position of an ABSOLUTE-POINT relative to the equator in the World Geodetic System 1984 (WGS 84) frame of reference.

d. absolute-point-longitude-coordinate—The coordinate identifying the position of an ABSOLUTE-POINT relative to the zero meridian in the World Geodetic System 1984 (WGS 84) frame of reference.

---

[29] A normal to a plane is at an angle of 90 degrees to the plane.

5.3.4 The absolute-point-elevation-category-code is used to either specify the expected height for an ABSOLUTE-POINT in general terms (local terrain) or point to a subtype in which elevation measurements are recorded.

5.3.5 The entity ELEVATED-ABSOLUTE-POINT is defined as an ABSOLUTE-POINT that has height with respect to a specified frame of reference. Its purpose is to enable the recording of elevation measurements for ABSOLUTE-POINTs for which a general specification will not suffice. The attributes are:

a. elevated-absolute-point-id—The absolute-point-id of a specific ELEVATED-ABSOLUTE-POINT (a role name for location-id).

b. elevated-absolute-point-elevation-dimension—The elevation of an ABSOLUTE-POINT above or below the vertical datum as defined in the World Geodetic System 1984 (WGS 84).

5.3.6 Example instances for POINT and ABSOLUTE-POINT are provided in Table 32. The relevant column from ELEVATED-ABSOLUTE-POINT is included in Sub-table (c) to indicate the applicable heights. Frequent use of this table is made in discussions of other instance tables and in connection with the reference point concept for SURFACE (see Section 5.5.1).

Table 32. Example Instances for POINT

(a) POINT

point-id	point-category-code	point-horizontal-precision-code	point-vertical-precision-code
1812	ABSOLUTE-POINT	Not specified	Not specified
612	ABSOLUTE-POINT	Not specified	Not specified
999	ABSOLUTE-POINT	Not specified	Not specified
3112	ABSOLUTE-POINT	Not specified	Not specified
613	ABSOLUTE-POINT	Not specified	Not specified
1810	ABSOLUTE-POINT	Not specified	Not specified
777	ABSOLUTE-POINT	Not specified	Not specified
346	ABSOLUTE-POINT	Not specified	Not specified

(b) ABSOLUTE POINT

absolute-point-id	absolute-point-latitude-coordinate	absolute-point-longitude-coordinate	absolute-point-elevation-category-code
1812	30.860	-98.671	ELEVATED-ABSOLUTE-POINT
612	30.720	-98.588	ELEVATED-ABSOLUTE-POINT
999	30.360	-98.658	ELEVATED-ABSOLUTE-POINT
3112	30.290	-98.631	ELEVATED-ABSOLUTE-POINT
613	30.290	-98.580	ELEVATED-ABSOLUTE-POINT
1810	30.150	-98.538	ELEVATED-ABSOLUTE-POINT
777	30.647	-98.639	ELEVATED-ABSOLUTE-POINT
346	30.530	-98.518	ELEVATED-ABSOLUTE-POINT

(c) ELEVATED-ABSOLUTE-POINT

elevated-absolute-point-elevation-dimension
200
200
200
356
1000
1000
200
1000

5.3.7 The model introduces the concept of location with respect to an arbitrary origin. RELATIVE-POINT is defined as a POINT whose position is specified with respect to an arbitrary origin in a right-hand geodetic frame of reference that has its positive x-axis in the easterly longitudinal direction, its positive y-axis in the northerly latitudinal direction, and its z-axis normal to the xy-plane. Northing and easting offsets of a magnitude in which Earth's curvature may be of significance are to be measured along the Earth's surface. The attributes are:

a. relative-point-id—The point-id of a specific RELATIVE-POINT (a role name for location-id).

b. relative-point-elevation-offset-dimension—The one-dimensional linear measurement of the elevation of a specific RELATIVE-POINT with respect to the elevation of a specific reference POINT.

c. relative-point-northing-offset-dimension—The one-dimensional linear measurement of the latitudinal displacement in the northerly direction of a specific RELATIVE-POINT with respect to a specific reference POINT.

d. relative-point-easting-offset-dimension—The one-dimensional linear measurement of the longitudinal displacement in the easterly direction of a specific RELATIVE-POINT with respect to a specific reference POINT.

e. relative-point-reference-point-id—The point-id of a specific POINT that serves as the reference from which the displacement of a specific RELATIVE-POINT is measured (a role name for location-id).

5.3.8 If a truly relative geometry is to be specified, then the RELATIVE-POINT must be referenced to a specific POINT for which the value of the point-category-code is "Undefined." An example of a simple right-angle triangle serves to illustrate the concept in Table 33. Point 701 lies 4000 metres east of the reference point and Point 702 lies 3000 metres north of Point 701.

Table 33. Illustration of RELATIVE-POINT Concept

(a) POINT

point-id	point-category-code	point-horizontal-precision-code	point-vertical-precision-code
700	Undefined	Not specified	Not specified
701	RELATIVE-POINT	Not specified	Not specified
702	RELATIVE-POINT	Not specified	Not specified
703	ABSOLUTE-POINT	Not specified	Not specified
704	RELATIVE-POINT	Not specified	Not specified

(b) RELATIVE-POINT

relative-point-id	relative-point-elevation-offset-dimension	relative-point-northing-offset-dimension	relative-point-easting-offset-dimension	relative-point-reference-point-id
701	0	0	4000	700
702	0	3000	0	701
704	15	75	75	703

5.3.9 A RELATIVE-POINT can be referenced to an ABSOLUTE-POINT. In that case, such a point is absolutely determined. This is illustrte in the table above where Point 704 is referenced to Point 703.

5.3.10 The ability to specify a POINT relative to an ABSOLUTE-POINT is useful in cases where a rigid geometry needs to be translated (i.e., moved without rotation in the horizontal plane). In the latter case, the translation may be accomplished by simply giving new co-ordinates to the reference point or defining a single new reference point.

5.4 LINE

5.4.1 The specification of LOCATION for LINE and other geometric shapes is illustrated in Figure 39. The POINT substructure is omitted from this view since it is described in a previous section.

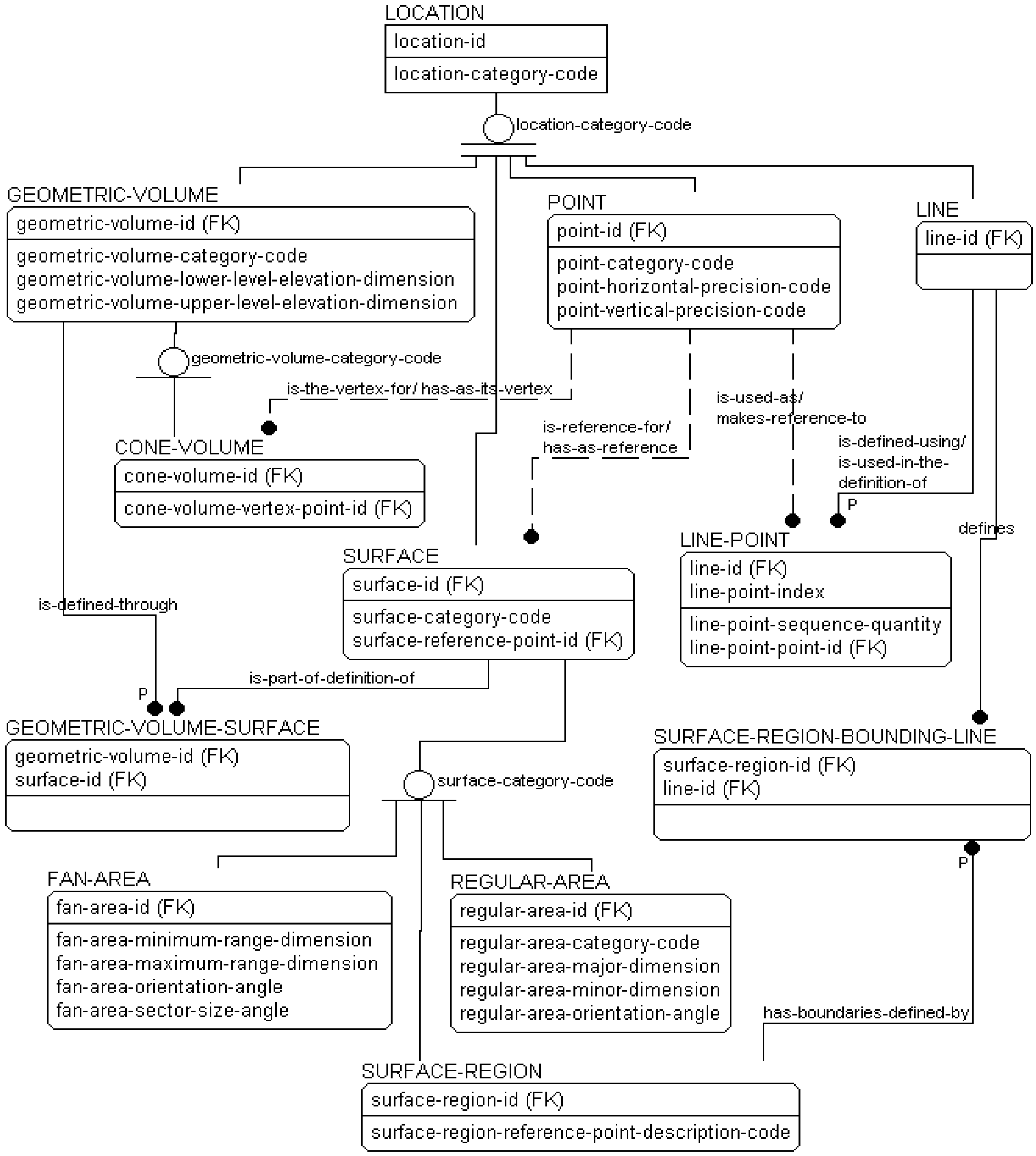


Figure 39. Specification of Lines, Surfaces, and Volumes

5.4.2 A LINE is defined as a one-dimensional LOCATION that is defined by two or more POINTs connected by straight-line segments in an ordered sequence. This concept of LINE is known as a polygonal path. If a LINE consists of a single straight segment, it is called a *line segment.* LINE has only a single attribute:

line-id—The location-id of a specific LINE (a role name for location-id).

5.4.3 Each LINE is located by two or more POINTs and is specified by an ordered sequence of POINTs that are linked to LINE by means of the entity LINE-POINT. LINE-POINT is defined as an association between a specific LINE and one of a sequence of POINTs used to define that LINE. If the first LINE-POINT and the last LINE-POINT are identical, the line is said to be closed (e.g., a boundary). The attributes are:

a. line-id—The location-id of a specific LINE (a role name for location-id).

b. line-point-index—The unique value, or set of characters, assigned to represent a specific LINE-POINT for a specific LINE and to distinguish it from all other LINE-POINTs for that LINE.

c. line-point-sequence-quantity—The non-negative number assigned to represent the relative order of a LINE-POINT among the set of LINE-POINTs associated with a specific LINE.

d. line-point-point-id—The point-id of a specific POINT that is used as a LINE-POINT in specific sequence in defining a particular LINE (a role name for location-id).

5.4.4 Example instances for LINE-POINT are given in Table 34.

Table 34. Example Instances for LINE-POINT

(a) ABSOLUTE POINT

absolute-point-id	absolute-point-latitude-coordinate	absolute-point-longitude-coordinate
1812	30.860	-98.671
612	30.720	-98.588
999	30.360	-98.658
3112	30.290	-98.631
613	30.290	-98.580
1810	30.150	-98.538
777	30.647	-98.639
346	30.530	-98.518

(b) LINE-POINT

line-id	line-point-index	line-point-sequence-quantity	line-point-point-id
Line 1	1	1	346
Line 1	2	2	613
Line 1	3	3	1810
Line 1	4	4	346
Line 2	1	1	1812
Line 2	3	3	612
Line 2	2	2	999
Line 2	4	4	1812
Line 3	1	1	3112
Line 3	2	2	613
Line 3	3	3	777

5.4.5 Line 1 has four LINE-POINTs. The first LINE-POINT (346 with sequence number 1) and the last LINE-POINT (346 with sequence number 4) are identical; therefore, Line 1 is closed. Line 2 is also closed since the first and the last points in the sequence are the same. (It will be seen later that both Line 1 and Line 2 form the perimeters of specific SURFACEs.) Line 3 has three LINE-POINTs and is not closed. Line 3 may be thought of as composed of two line segments, one from LINE-POINT 3112 to LINE-POINT 613 and another from LINE-POINT 613 to LINE-POINT 777. LINE-POINT 613 may be thought of as a vertex in common with these two line segments. The partial (two-dimensional) geometry of these POINTs and LINEs is illustrated in Figure 40.

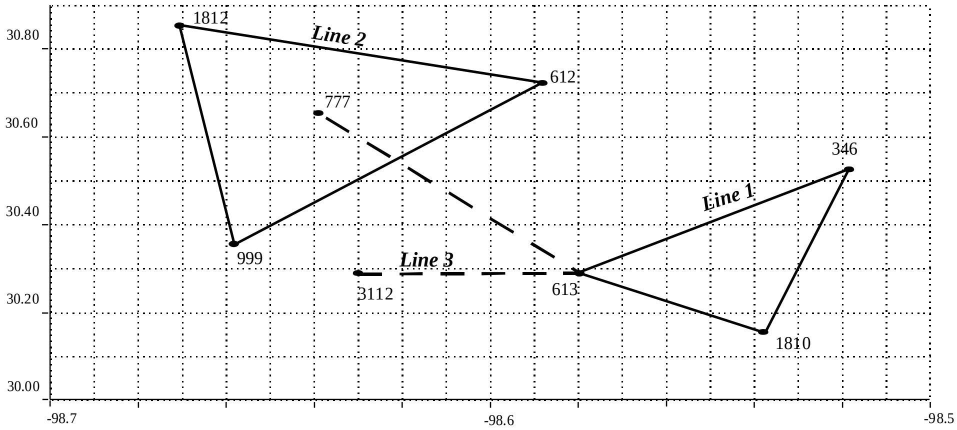


Figure 40. Top View of Lines in the Example

5.4.6 A line must have at least two points. The constraint "P" on the relationship between LINE and LINE-POINT ensures that at least one point is specified; however, a specification of a minimum of two points is an undiagrammed constraint that is part of the data model.

5.5 SURFACE

5.5.1 Specification of SURFACE

5.5.1.1 A SURFACE is defined as a LOCATION that is in two dimensions. Some surfaces may be planar, that is, lie in a single horizontal plane.

5.5.1.2 SURFACE has a non-identifying relationship "is reference for/has as reference" from POINT. The point-id that migrates to SURFACE is given the role name of surface-reference-point-id. The attributes are:

a. surface-id—The location-id of a specific SURFACE (a role name for location-id).

b. surface-category-code—The specific value that represents or denotes the class of SURFACE. It serves as a discriminator that partitions SURFACE into subtypes. The domain values are: FAN-AREA, REGULAR-AREA, SURFACE-REGION, Not otherwise specified.

c. surface-reference-point-id—The point-id of the specific POINT that lies in or near a specific SURFACE (a role name for location-id). Note: For SURFACEs that are REGULAR-AREAs (ellipses, circles, rectangles, and squares), the POINT represents the geometric centre. For SURFACEs that are FAN-AREAs, the POINT represents the vertex. An attribute (surface-region-reference-point-description-code) specifies the role of the POINT in a SURFACE that is a SURFACE-REGION.

5.5.1.3 The common elevation of the points of a specific SURFACE is derived from the elevated-absolute-point-elevation-dimension of the POINT (called the reference *point*) taken from ELEVATED-ABSOLUTE-POINT and identified by the surface-reference-point-id. For most applications, the points on a horizontal plane normal to the local vertical at the referent point can be considered to have a common elevation. However, the reference surface by which elevations are measured is ellipsoidal and the elevations of point near the reference point on the horizontal plane will differ by a few centimetres. These differences, of course, become large when large SURFACEs are being considered. Specifically, points at 1 km from the reference point have elevation differences of 8 cm, whereas points a 100 km from the reference point have elevation differences of nearly 800 m.

5.5.1.4 An example instance table for SURFACE is given in Table 35. The Sub-table (a) specifies two SURFACEs of each of the three subtypes. Sub-table (b) repeats the elevation data from Table 32 for the POINTs that are used as reference. The detailed specifications for each of these surfaces are contained in subsequent sections.

Table 35. Example Instances for SURFACE

(a) SURFACE

surface-location-id	surface-category-code	surface-reference-point-id
Surface 1	SURFACE-REGION	346
Surface 2	REGULAR-AREA	777
Surface 3	SURFACE-REGION	777
Surface 4	FAN-AREA	612
Surface 5	REGULAR-AREA	3112
Surface 6	FAN-AREA	999

(b) ELEVATED-ABSOLUTE-POINT

elevated-absolute-point-elevation-dimension
1000
200
200
200
356
200

5.5.2 Identification of SURFACE Subtypes

Each SURFACE may be one of three subtypes: FAN-AREA, REGULAR-AREA, or SURFACE-REGION.

5.5.2.1 FAN-AREAs

5.5.2.1.1 A FAN-AREA is a SURFACE that is in the form of a truncated ring sector, which is a sector lying between and being bounded by the rays emanating from the centre-point of the ring and having a specified central angle.[30] This structure is useful in describing control features such as weapon/obstacle danger templates and downwind hazard areas in the case of NBC operations. The attributes are:

a. fan-area-id—The surface-id of a specific FAN-AREA (a role name for location-id).

b. fan-area-minimum-range-dimension—The distance from the vertex to the inner ring of the ring sector used to specify the FAN-AREA.

c. fan-area-maximum-range-dimension—The distance from the vertex to the outer ring of the ring sector used to specify the FAN-AREA.

d. fan-area-orientation-angle—The angle of the rotational measurement clockwise between the line of true north and the left side of the sector central angle for a specific FAN-AREA.

e. fan-area-sector-size-angle—The angle of the rotational measurement clockwise between the left and right sides of the ring central angle of a specific FAN-AREA.

[30] The central angle (in polar co-ordinates) is measured from the fan-orientation angle to the fan-orientation-angle plus the fan-sector-size. The elevation of the sector is that of the centre point. The sector is specified by the width of the ring defined by minimum and maximum values for the range (in polar co-ordinates), and the size of the central angle of the sector.

5.5.2.1.2 The diagram in Figure 41 illustrates the essential characteristics that are needed to specify a FAN-AREA.

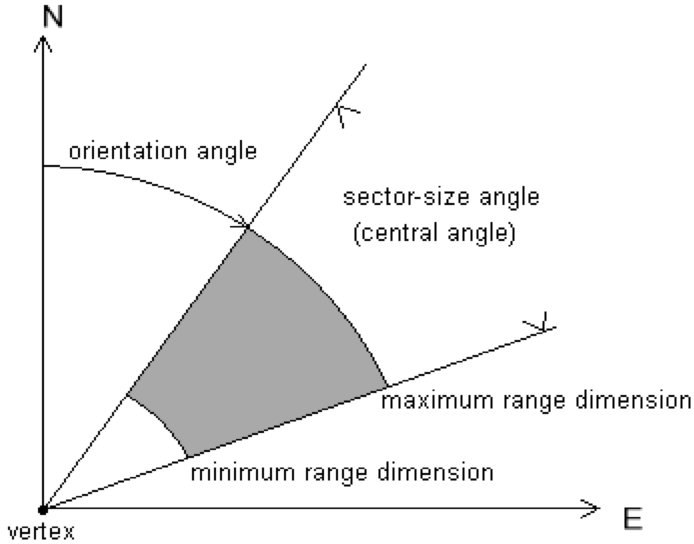


Figure 41. Specification of FAN-AREA

5.5.2.1.3 Example instances for FAN-AREA are illustrated in Table 36. Sub-tables (a) and (b) repeat data from a previous table for those POINTs that serve as references in defining FAN-AREAs. Sub-table (c) repeats the data from the SURFACE (the supertype of FAN-AREA) table and identifies the specific reference POINTs. Sub-table (d) shows that FAN-AREA "Surface 4" covers a 90 degree sector beginning at 45 degrees (Northeast) and ending at 135 degrees north (Southeast) and is therefore centred at 90 degrees and oriented eastward. FAN-AREA "Surface 6" also has a 90-degree "span" between 315 degrees (Northwest) and 405 degrees (Northeast), which is equivalent to 45 degrees; therefore, Surface 6 is oriented in a northerly direction.

Table 36. Example Instances of a FAN-AREA

(a) ABSOLUTE POINT

absolute-point-id	absolute-point-latitude-coordinate	absolute-point-longitude-coordinate	absolute-point-elevation-category-code
612	30.720	-98.588	ELEVATED-ABSOLUTE-POINT
999	30.360	-98.658	ELEVATED-ABSOLUTE-POINT

(b) ELEVATED-ABSOLUTE-POINT

elevated-absolute-point-elevation-dimension
200 (m)
200 (m)

(c) SURFACE

surface-location-id	surface-category-code	surface-reference-point-id
Surface 4	FAN-AREA	612
Surface 6	FAN-AREA	999

(d) FAN-AREA

fan-area-id	fan-area-minimum-range-dimension	fan-area-maximum-range-dimension	fan-area-orientation-angle	fan-area-sector-size-angle
Surface 4	10,000 (m)	100,000 (m)	45	90
Surface 6	50,000 (m)	250,000 (m)	315	90

5.5.2.1.4 The examples specified in the previous table are illustrated graphically in Figure 42.

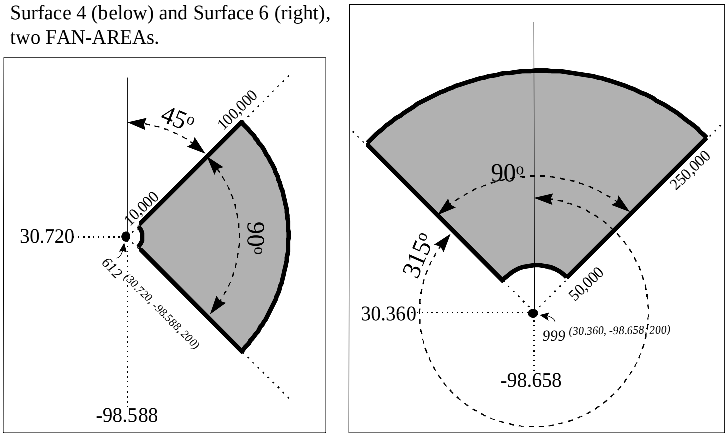


Figure 42. Two Examples of FAN-AREAs

5.5.2.2 REGULAR-AREAs

5.5.2.2.1 A REGULAR-AREA is defined as a planar SURFACE in the form of a rectangle or an ellipse. An ellipse is defined in terms of its enclosing rectangle. These constructs are useful for the general definition of many control features such as assembly areas, dumps, target areas, and the like. The attributes are:

a. regular-area-id—The surface-id of a specific REGULAR-AREA (a role name for location-id).

b. regular-area-category-code—The specific value that represents or denotes the class of REGULAR-AREA. The domain values are: Ellipse area, Rectangle area, Not otherwise specified.

c. regular-area-major-dimension—The length of the longest side of the minimum bounding rectangle of a specified REGULAR-AREA.

d. regular-area-minor-dimension—The length of the shortest side of the minimum bounding rectangle of a specified REGULAR-AREA.

e. regular-area-orientation-angle—The angle of rotational measurement measured clockwise from true North to the shortest side of the defining rectangle.

5.5.2.2.2 When the major and minor dimensions of a rectangular REGULAR-AREA are equal, the rectangle forms a square. An elliptical REGULAR-AREA is specified as the unique ellipse inscribed in a rectangle so that it is tangent to the rectangle at the midpoints of its sides. The major-dimension is twice its semi-major axis, and its minor-dimension is twice its semi-minor axis. When the major and minor dimensions are equal, the ellipse forms a circle. The orientation angle is limited to a range from 0 to 180 degrees due to symmetry. The specification of REGULAR-AREA is illustrated in Figure 43.

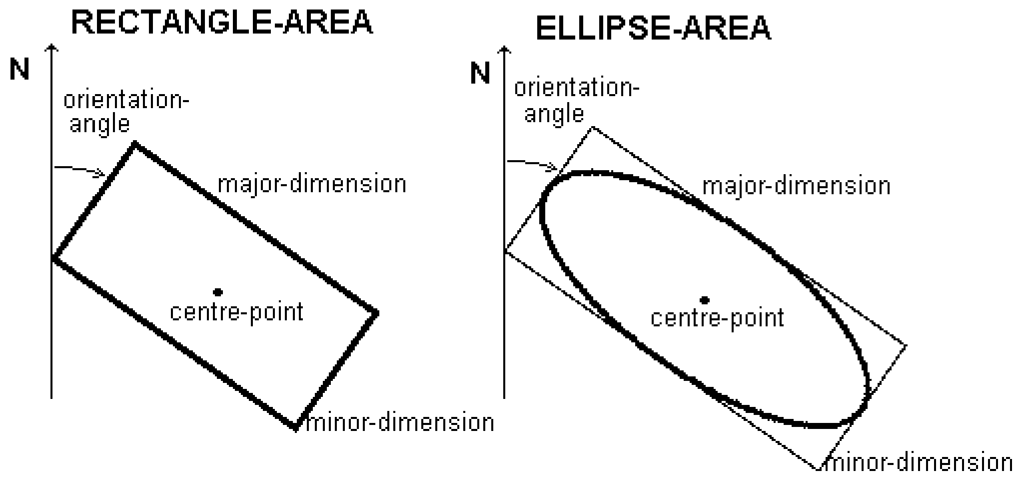


Figure 43. Specification of REGULAR-AREA

5.5.2.2.3 Example instances for REGULAR-AREA are presented in Table 37. Sub-tables (a) and (b) repeat data from previous tables for those POINTs that serve as references in defining REGULAR-AREAs. Sub-table (c) repeats the data from the SURFACE (the supertype of REGULAR-AREA) table and identifies the specific reference POINTs. Sub-table (d) specifies two areas: an ELLIPSE-AREA and a RECTANGLE-AREA. Surface 2 is an ellipse that has identical major and minor dimensions, so it describes a circle with a radius of 500 metres. By referring to Sub-table (c), it can be determined that Surface 2 has the surface-reference-point-id with a value "777." Sub-table (b) discloses that the elevation of the reference point is 200 metres. Thus, Surface 2 is a circle of radius 5000 metres centred at POINT 777 in a horizontal plane at an elevation of 200 metres.

Table 37. Example Instances for REGULAR-AREA

(a) ABSOLUTE POINT

absolute-point-id	absolute-point-latitude-coordinate	absolute-point-longitude-coordinate	absolute-point-elevation-category-code
3112	30.290	-98.631	ELEVATED-ABSOLUTE-POINT
777	30.060	-98.610	ELEVATED-ABSOLUTE-POINT

(b) ELEVATED-ABSOLUTE-POINT

elevated-absolute-point-elevation-dimension
356
200

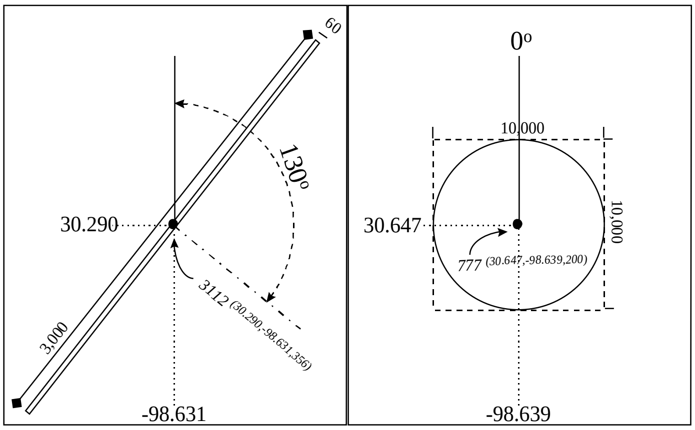
(c) SURFACE

surface-location-id	surface-category-code	surface-reference-point-id
Surface 2	REGULAR-AREA	777
Surface 5	REGULAR-AREA	3112

(d) REGULAR-AREA

regular-area-id	regular-area-category-code	regular-area-major-dimension	regular-area-minor-dimension	regular-area-orientation-angle
Surface 2	Ellipse	10,000 (m)	10,000 (m)	0
Surface 5	Rectangle	3,000 (m)	50 (m)	130

5.5.2.2.4 Surface 5 is a rectangle that has a length 60 times its width and it is oriented at 130 degrees north (approximately southeasterly). This might describe a SURFACE associated with a FEATURE that characterises the boundaries of a "runway" FACILITY. The centre of the rectangle (see Sub-table (c) is POINT 3112, which has an elevation of 356 metres (see Sub-table (b)). Thus, the rectangle is in a horizontal plane at an elevation of 356 metres (possibly the elevation of the airport at which the runway is located). The geometry of Surfaces 2 and 5 is illustrated in Figure 44.



Surface 5 Surface 2

Figure 44. Examples of REGULAR-AREAs

5.5.2.3 SURFACE-REGION

5.5.2.3.1 A SURFACE-REGION is a SURFACE that is specified using its boundary. An example is a polygonal area, which is a planar area whose boundary is in the form of an ordered sequence of line segments that begin and end at the same point (closed polygonal path). The attributes are:

a. surface-region-id—The surface-id of a specific SURFACE-REGION (a role name for location-id).

b. surface-region-reference-point-description-code—The specific value that represents or denotes the role of a reference point. Example domain values are: Centroid (centre of area), First vertex, Last vertex. Note: The purpose of the reference point is to provide a specific location for placing a map symbol when such a map symbol is used to represent an object that has a two-dimensional geometry associated with it.

5.5.2.3.2 A SURFACE-REGION as defined above is a logical element. Its geometry is actually specified through the use of one or more boundary lines. The boundary lines are specified by reference to LINE through an associative entity SURFACE-REGION-BOUNDING-LINE that is defined as a LINE used in the specification of a SURFACE-REGION. SURFACE-REGION-BOUNDING-LINE has only the two key foreign-key attributes—surface-region-id and line-id. The attribute surface-region-id is inherited from SURFACE-REGION through an identifying relationship “has boundaries defined by” and the line-id is inherited from LINE through an identifying relationship “defines.”

5.5.2.3.3 An example of two POLYGON-AREAs is given in Table 38 (Sub-tables (e) and (f)). The table identifies the bounding lines for each area. The vertices of Surface 1 are Points 346, 613, and 1810 as specified in Sub-table (c) for Line 1. The reference point for Surface 1 is specified in Sub-table (d) as Point 346 whose description code in Sub-table (e) specifies it as simply the initial point of Line 1.

Table 38. Example Instances for SURFACE-REGION (POLYGON-AREA)

(a) ABSOLUTE POINT

absolute-point-id	**absolute-point-latitude-coordinate**	**absolute-point-longitude-coordinate**	**absolute-point-elevation-category-code**
1812	30.860	-98.671	ELEVATED-ABSOLUTE-POINT
612	30.720	-98.588	ELEVATED-ABSOLUTE-POINT
999	30.360	-98.658	ELEVATED-ABSOLUTE-POINT
3112	30.290	-98.631	ELEVATED-ABSOLUTE-POINT
613	30.290	-98.580	ELEVATED-ABSOLUTE-POINT
1810	30.150	-98.538	ELEVATED-ABSOLUTE-POINT
777	30.647	-98.639	ELEVATED-ABSOLUTE-POINT
346	30.530	-98.518	ELEVATED-ABSOLUTE-POINT

(b) ELEVATED-ABSOLUTE-POINT

elevated-absolute-point-elevation-dimension
200
200
200
356
1000
1000
200
1000

(c) LINE-POINT

line-id	**line-point-index**	**line-point-sequence-quantity**	**line-point-point-id**
Line 1	1	1	346
Line 1	2	2	1810
Line 1	3	3	613
Line 1	4	4	346
Line 2	1	1	1812
Line 2	3	3	612
Line 2	2	2	999
Line 2	4	4	1812

(d) SURFACE

surface-location-id	**surface-category-code**	**surface-reference-point-id**
Surface 1	SURFACE-REGION	346
Surface 3	SURFACE-REGION	777

(e) SURFACE-REGION

surface-region-id	**surface-region-reference-point-description-code**
Surface 1	Initial point
Surface 3	Centroid

(f) SURFACE-REGION-BOUNDING-LINE

surface-region-id	**line-id**
Surface 1	Line 1
Surface 3	Line 2

5.5.2.3.4 Surface 3 is similarly defined by means of association with Line 2 as its boundary. Sub-table (d) specifies Point 777 as the reference point for this SURFACE and Sub-table (e) specifies the role of this point as a centroid. The position of the centroid is calculated by taking the arithmetic means of the co-ordinates of the vertices of Line 2. The vertices of Line 2 are specified in LINE-POINT as the point-ids that correspond to Line 2, namely POINTs 1812, 612 and 999 (see Sub-table (c)). Surface 3 is therefore a triangle with the reference point lying inside the triangle. The elevation of the triangle is 200 metres (see Sub-table (b) for the elevation of Point 777).

5.5.2.3.5 The geometry of the two SUFACE-REGIONs is illustrated in Figure 45. The upper triangle is Surface 1 of the previous example, and the lower triangle is Surface 3.

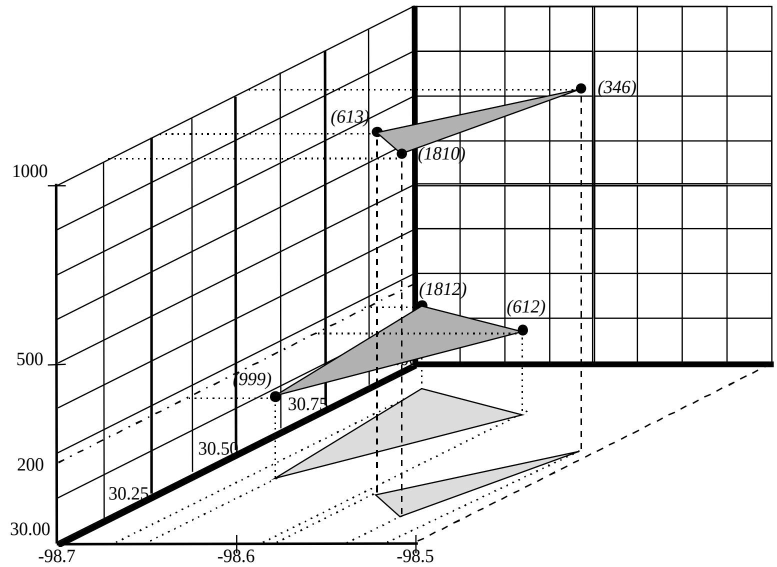


Figure 45. Examples of SURFACE-REGIONs

5.6 GEOMETRIC-VOLUME

5.6.1 Specification of GEOMETRIC-VOLUME

5.6.1.1 A GEOMETRIC-VOLUME is defined as a specific LOCATION that is a three-dimensional bounded space. This is a useful construct in describing the geometry of control features such as air corridors, surface to air missile coverage zones, and no fly zones. The attributes are:

a. geometric-volume-id—The location-id of a specific GEOMETRIC-VOLUME (a role name for location-id).

b. geometric-volume-category-code—The specific value that represents or denotes the class of GEOMETRIC-VOLUME. It serves as a discriminator that partitions GEOMETRIC-VOLUME into subtypes. The domain values are: CONE-VOLUME, Cylinder, Sphere, Not otherwise specified.

c. geometric-volume-lower-level-elevation-dimension—The elevation of the lowest point of a specified GEOMETRIC-VOLUME referenced to the Vertical Datum of the World Geodetic System 1984 (WGS 84).

d. geometric-volume-upper-level-elevation-dimension—The elevation of the highest point of a specified GEOMETRIC-VOLUME referenced to the Vertical Datum of the World Geodetic System 1984 (WGS 84).

5.6.1.2 Examples of volumes are

(a) A general cylinder, which may be defined by the vertical projection of a specific area with horizontal planes bounding its top and bottom;

(b) A sphere that may be truncated by horizontal boundary planes at the top and bottom;

(c) A cone that may be truncated by horizontal boundary planes at the top and bottom.

5.6.1.3 The full geometric specification of GEOMETRIC-VOLUME requires a reference to one or more SURFACEs. This is done by reference to an associative entity GEOMETRIC-VOLUME-SURFACE that is defined as the relationship between a specific GEOMETRIC-VOLUME and a specific SURFACE. GEOMETRIC-VOLUME-SURFACE has only two key foreign-key attributes—*geometric-volume-id* and *surface-id*.

5.6.1.4 Example instances for GEOMETRIC VOLUME are presented in Table 39. The table shows two general cylinders (Geometric Volume 1 and Geometric Volume 4) that have the same ground-level projection (namely, Surface 1, which is a triangular REGULAR-AREA). It also shows that Geometric Volume 2 is a sphere limited by elevations of 200 and 5,200 metres (from Sub-table (d)). The radius of the sphere is the radius of the circle on which it projects, namely 5,000 metres (from Sub-table (c)). The centre-point (POINT 777) has elevation of 200 metres (from Sub-tables (a) and (b)). Thus, Geometric Volume 2 is a sphere with a radius of 5,000 metres centred at a point with an elevation of 200 metres and bounded by horizontal planes at elevations of 200 and 5,200 metres. This is simply a hemisphere that has a radius of 5,000 metres. (It might represent the LOCATION associated with a “search radar” CONTROL-FEATURE of range 5,000 metres located at POINT 777.)

Table 39. Example Instances for GEOMETRIC VOLUME

(a) SURFACE

surface-location-id	surface-category-code	surface-reference-point-id
Surface 1	SURFACE-REGION	346
Surface 2	REGULAR-AREA	777
Surface 5	REGULAR-AREA	3112

(b) ELEVATED-ABSOLUTE-POINT

elevated-absolute-point-elevation-dimension
1000
200
356

(c) REGULAR-AREA

regular-area-id	regular-area-category-code	regular-area-major-dimension	regular-area-minor-dimension	regular-area-orientation-angle
Surface 2	Ellipse	10,000 (m)	10,000 (m)	0
Surface 5	Rectangle	3,000 (m)	50 (m)	130

(d) GEOMETRIC VOLUME

geometric-volume-id	geometric-volume-category-code	geometric-volume-lower-level-elevation-dimension	geometric-volume-upper-level-elevation-dimension
Geometric Volume 1	Cylinder	1,000 (m)	3,000 (m)
Geometric Volume 2	Sphere	200 (m)	5,200 (m)
Geometric Volume 4	Cylinder	6,000 (m)	8,000 (m)

(e) GEOMETRIC VOLUME SURFACE

geometric-volume-id	surface-id
Geometric Volume 1	Surface 1
Geometric Volume 2	Surface 2
Geometric Volume 4	Surface 1

5.6.1.5 Geometric illustrations of the previous examples are presented in Figure 46.

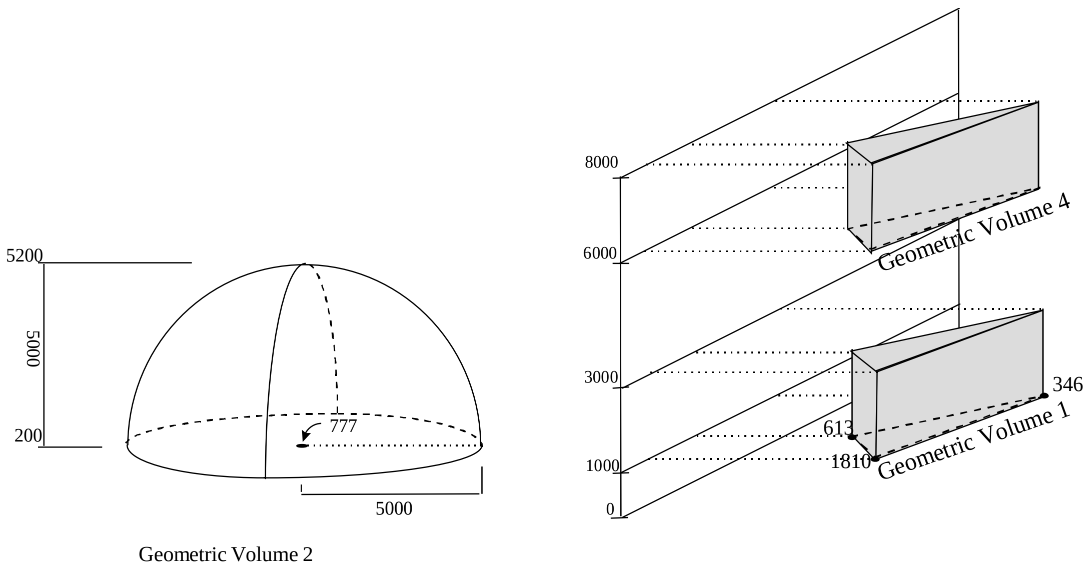


Figure 46. Examples of GEOMETRIC-VOLUMEs

5.6.2 CONE-VOLUMEs

5.6.2.1 A CONE-VOLUME is a VOLUME whose boundary is swept by a line that has one fixed point (called the vertex) and another that moves along the path defined by the border of a specific SURFACE (called the projected SURFACE). If the closed path is the boundary of a circle and the vertex is on a line perpendicular to the plane of the circle, the CONE-VOLUME will be a right circular cone.

5.6.2.2 The specification of CONE-VOLUME requires identification of a POINT that serves as its vertex. This is achieved by a non-identifying (no nulls allowed) relationship ("is the vertex for/has as its vertex") between POINT and CONE-VOLUME. The attributes of CONE-VOLUME are:

a. cone-volume-id—The geometric-volume-id of a specific CONE-VOLUME (a role name for location-id)

b. cone-volume-vertex-point-id—The point-id of the specific POINT that is the vertex of a specific CONE-VOLUME (a role name for location-id).

5.6.2.3 A notional CONE-VOLUME is illustrated in Figure 47. The reference area is the horizontal projection of the specific SURFACE that is used to generate the cone. The cone may originate at the vertex and be unbounded. It can also be truncated at either the bottom or the top by using geometric-volume-lower-level-elevation-dimension or geometric-volume-upper-level-elevation-dimension.

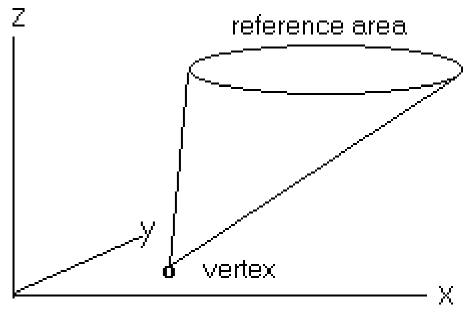


Figure 47. Illustration of CONE-VOLUME

5.6.2.4 The SURFACE used to specify a CONE-VOLUME does not have to be a circle or an ellipse. It can be any REGULAR-AREA, a FAN-AREA, or even a SURFACE-REGION. Further, the vertex does not need to lie vertically above or below the centre point of the SURFACE used to specify a CONE-VOLUME. Thus, a CONE-VOLUME does not have to be restricted to regular cones. CONE-VOLUME therefore includes more than regular, right-circular cones.

5.7 Collections of LOCATIONs and Relation to OBJECT-ITEM

5.7.1 The model construct relates FACILITY and FEATURE subtypes of OBJECT-ITEM to LOCATION through the associative entities FACILITY-LOCATION and FEATURE-LOCATION. Any geometry that is associated with an instance of FEATURE inherits meaning from the categorisation of FEATURE; if an instance of FEATURE represents a *line of contact*, then the geometry associated with that instance is that of line of contact. The geometry associated with an instance of FACILITY is restricted to depicting the inherent physical dimensions of that FACILITY.

5.7.2 The other three subtypes of OBJECT-ITEM—MATERIEL, ORGANISATION, and PERSON—are related only to the POINT subtype of LOCATION with a single meaning of specifying the centroid of the battlespace object as the nominal position. If any other meaning is to be attached to a LOCATION that is to be associated with a battlespace object, then that meaning is provided by defining a suitable CONTROL-FEATURE, giving it the appropriate geometry, and specifying its relationships to the battlespace object. As an example, if the area of responsibility, the area of interest, FLOT (a line), and airspace control volume are to be defined for a specific division, then each of these would be specified as a CONTROL-FEATURE and the geometry of each would be defined by using the LOCATION structure.

5.7.3 The overall view for associating battlespace objects with LOCATION and its subtype POINT is presented in Figure 48. The following entities are used to specify the relationships of LOCATION to OBJECT-ITEMs:

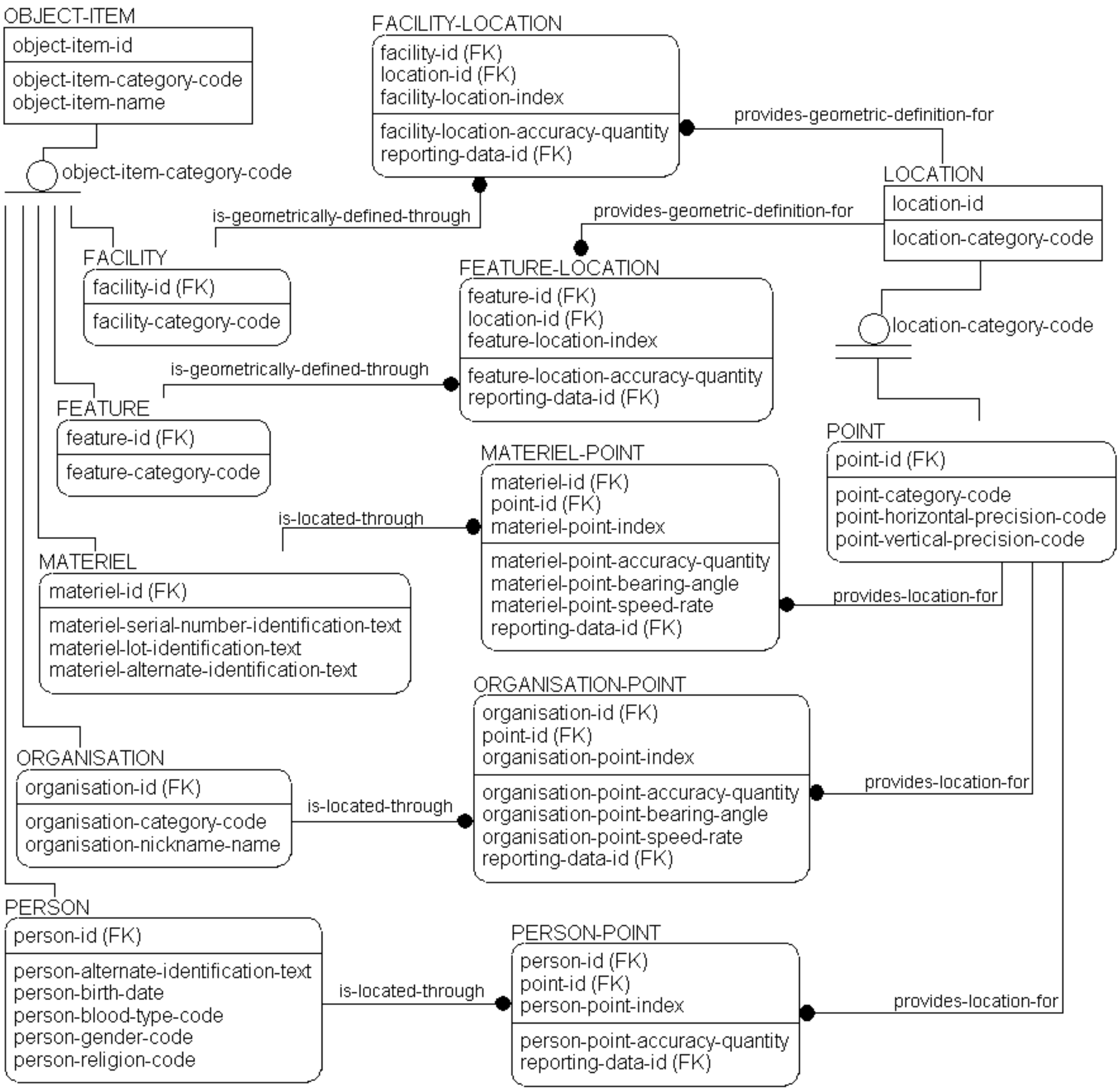


Figure 48. Association of OBJECT-ITEM Subtypes and LOCATION

a. FACILITY-LOCATION—An association of a FACILITY with a LOCATION that specifies the position and may specify the physical spatial characteristics of that FACILITY.

b. FEATURE-LOCATION—An association of a FEATURE with a LOCATION that specifies its spatial characteristics.

c. MATERIEL-POINT—An association of a MATERIEL with a POINT that specifies its position.

d. ORGANISATION-POINT—An association of an ORGANISATION with a POINT that specifies its position.

e. PERSON-POINT—An association of a PERSON with a POINT that specifies his or her position.

5.7.4 The attributes of FACILITY-LOCATION and FEATURE-LOCATION are similar. The attributes of FACILITY-LOCATION are:

a. facility-id—The object-item-id of a specific FACILITY (a role name for object-item-id).

b. location-id—The unique value, or set of characters, assigned to represent a specific LOCATION and to distinguish it from all other LOCATIONs.

c. facility-location-index—The unique value, or set of characters, assigned to represent a specific FACILITY-LOCATION for a specific FACILITY and a specific LOCATION and to distinguish it from all other FACILITY-LOCATIONs for that FACILITY and that LOCATION.

d. facility-location-accuracy-quantity—The non-monetary numeric value representing the uncertainty in the estimate of a specific FACILITY-LOCATION, expressed in units of metres.

e. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

5.7.5 The attributes of FEATURE-LOCATION are as follows:

a. feature-id—The object-item-id of a specific FEATURE (a role name for object-item-id).

b. location-id—The unique value, or set of characters, assigned to represent a specific LOCATION and to distinguish it from all other LOCATIONs.

c. feature-location-index—The unique value, or set of characters, assigned to represent a specific FEATURE-LOCATION for a specific FEATURE and a specific LOCATION and to distinguish it from all other FEATURE-LOCATIONs for that FEATURE and that LOCATION.

d. feature-location-accuracy-quantity—The non-monetary numeric value representing the uncertainty in the estimate of a specific FACILITY-LOCATION, expressed in units of metres.

e. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

5.7.6 Example instances for FEATURE-LOCATION are given in Table 40. One LOCATION (Surface5, to be specified later as a rectangular region with dimensions of 50 and 10,000 metres) is associated with Feature1, which might be the shape of a runway. Three LOCATIONs are associated with a planned location for Feature2. These LOCATIONs could be a series of volume segments to be used during a 12-hour period with an "airspace control corridor" CONTROL-FEATURE for air-defence and fire support co-ordination.

Table 40. Example Instances for FEATURE-LOCATION

FEATURE-LOCATION

feature-id	location-id	feature-location-index	feature-location-accuracy-quantity	reporting-data-id
Feature1	Surface5	00001	15 (m)	1
Feature2	Volume1	00001	23 (m)	1
Feature2	Volume2	00002	20 (m)	1
Feature2	Volume3	00003	25 (m)	1

5.7.7 The attributes of three of these—MATERIEL-POINT, ORGANISATION-POINT and PERSON-POINT—are similar. They are illustrated by providing the attributes of MATERIEL-POINT with parenthetical inserts for the other entities as applicable:

a. materiel (or organisation or person)-id—The object-item-id of a specific MATERIEL(or ORGANISATION or PERSON) (role name for object-item-id).

b. point-id—The location-id of a specific POINT (a role name for location-id).

c. materiel (or organisation or person)-point-index—The unique value, or set of characters, assigned to represent a specific MATERIEL(or ORGANISATION or PERSON)-POINT for a specific MATERIEL(or ORGANISATION or PERSON) and a specific POINT and to distinguish it from all other MATERIEL(or ORGANISATION or PERSON)-POINTs for that MATERIEL(or ORGANISATION or PERSON) and that POINT.

d. materiel (or organisation or person)-point-accuracy-quantity—The non-monetary numeric value representing the uncertainty in the estimate of a specific MATERIEL(or ORGANISATION or PERSON)-POINT, expressed in units of metres.

e. materiel (or organisation-)-point-bearing-angle—The rotational measurement clockwise from the line of true North to the direction of motion of a specific MATERIEL (or ORGANISATION) at a specific POINT.

f. materiel (or organisation-)-point-speed-rate—The value that represents the motion of a specific MATERIEL (or ORGANISATION) at a specific POINT in terms of distance per unit time, measured in units of kilometres per hour.

g. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

5.7.8 The bearing angle and speed rate attributes enable the capture of information about the direction and rate of movement for MATERIEL and ORGANISATIONs.

5.8 Business Rules

5.8.1 Some restrictions cannot be expressed by the diagrammatic rules of the IDEF1X data modelling notation. The additional specifications are expressed as business rules. The following apply to objects created in the LOCATION part of the Generic Hub:

a. A line must have at least two points.

b. When direction has a meaning for a line, ascending enumeration of the points of the line indicates the direction of the line.

c. When side has meaning for a line, the left-hand side is interpreted according to the direction of the line as determined from an ascending numeration of the points of the line (this is referred to as the Left Hand Rule).

d. The inside of an area is the left-hand side of its boundary line.

e. The projection onto the horizontal plane of a boundary line of an area may not intersect itself.

f. The values that denote the order of the points (the attribute *line-point-sequence-quantity*) in the specification of a line must be consecutive.[31]

5.8.2 There is no restriction on the re-use of instances of LOCATIONs; that is, once one cell or planner specifies a LOCATION, any other can use it. However, practitioners should carefully consider the policy on re-use and limit re-use to sets of related geometric constructs created by single planners, cells, or staffs. Such practice would simplify purging of data when it is no longer needed, because it would be known that there are no outside references to the specific instances of LOCATION.

[31] Changes to the line-point-sequence-quantity alter the geometric appearance of the line.

(This page intentionally left blank)

6. STATUS OF IDENTIFIABLE BATTLESPACE OBJECTS

6.1 Introduction

6.1.1 The planning process and situational awareness require knowledge of the status of various battlespace objects. The status may refer to the capability of these objects to perform their roles or to their hostile or non-hostile intentions. The first case is called operational status and the second hostility status. For example, the operational status of a tank could describe the degree of damage it has suffered, its current mobility, or its capacity to fire its gun. The known or perceived friendly or aggressive intentions of an object are recorded in the hostility status. Both cases are catered for in the same structure.

6.1.2 The entity-level structure for capturing status is illustrated in Figure 49. The subtypes of OBJECT-ITEM-STATUS refer directly to FACILITY, MATERIEL, ORGANISATION, and PERSON subtypes of OBJECT-ITEM. In case of FEATURE that has three subtypes, specification of status was deemed to be inappropriate for METEOROLOGIC-FEATURE. Consequently, the status subtypes include only the other two subtypes–CONTROL-FEATURE and GEOGRAPHIC-FEATURE.

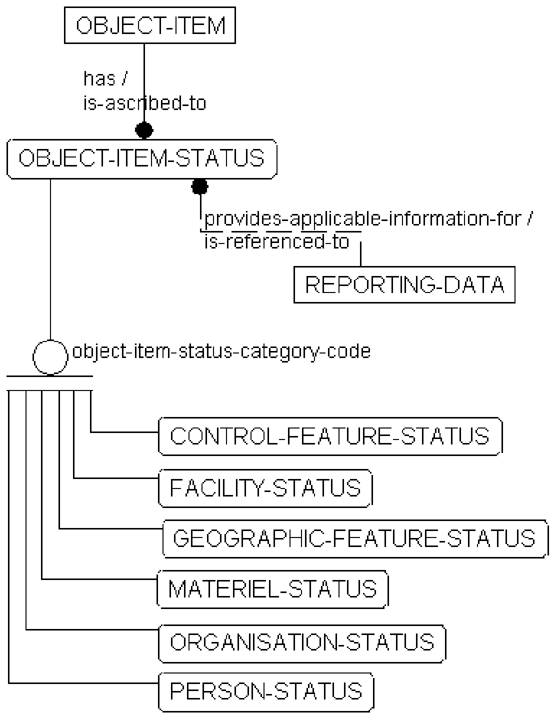


Figure 49. STATUS View

6.2 OBJECT-ITEM-STATUS and Its Subtypes

6.2.1 Specification of OBJECT-ITEM-STATUS

6.2.1.1 OBJECT-ITEM-STATUS is defined as a record of the perceived condition of a specific OBJECT-ITEM. One use of OBJECT-ITEM-STATUS is to allow multiple reports by independent observers of the same OBJECT-ITEM. Another is to maintain the historical values of status as it changes over time. The structure of OBJECT-ITEM-STATUS including its subtypes, which are described in a subsequent section, is illustrated in Figure 50.

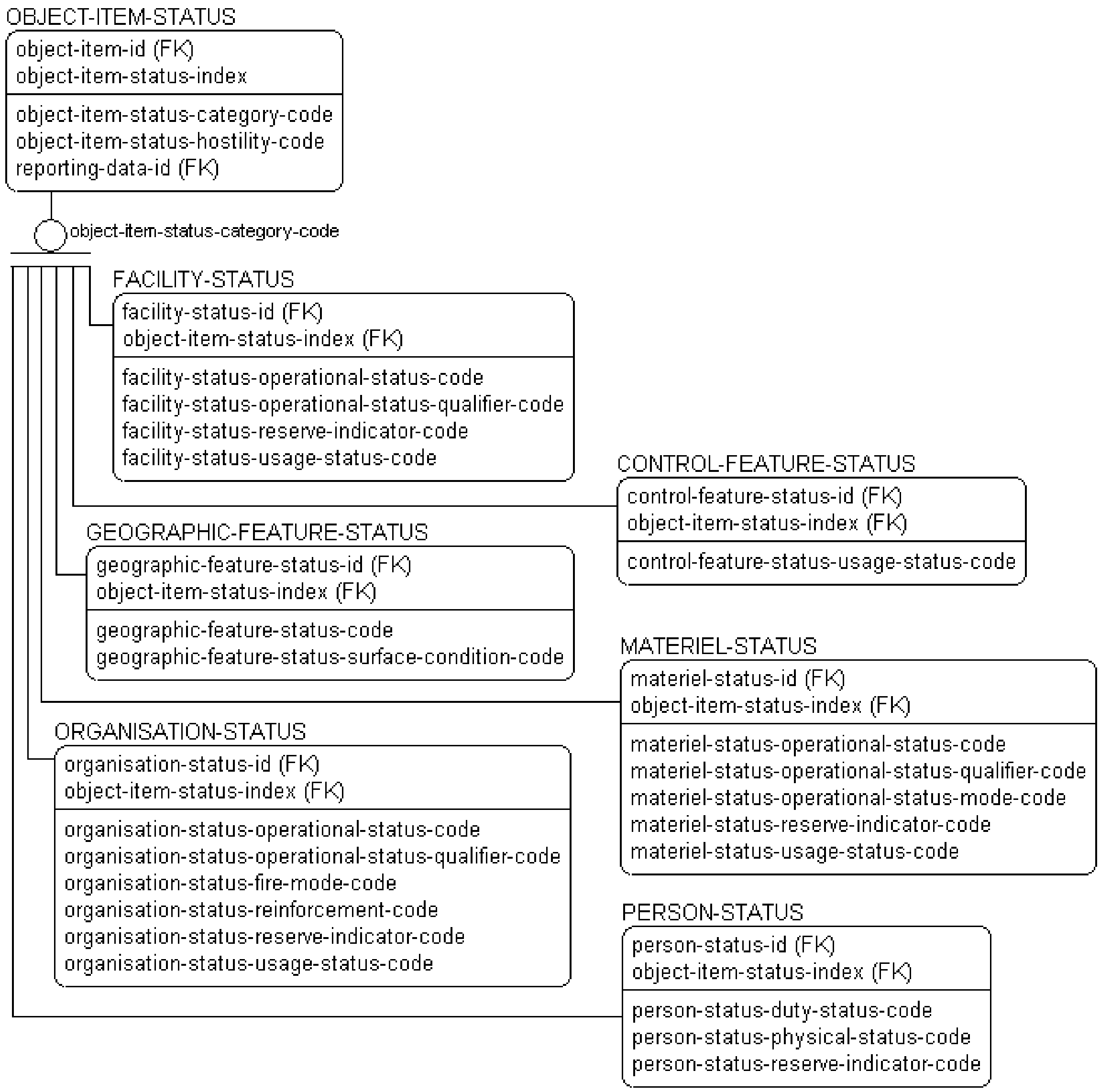


Figure 50. OBJECT-ITEM-STATUS View

6.2.1.2 The attributes are:

a. object-item-id—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEMs. It is a foreign key migrated by the identifying relationship "has/is ascribed to" from OBJECT-ITEM. The attribute identifies the specific OBJECT-ITEM that is the subject of a specific OBJECT-ITEM-STATUS estimate.

b. object-item-status-index—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM-STATUS for a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEM-STATUSs for that OBJECT-ITEM.

c. object-item-status-category-code—The specific value that represents or denotes the class of OBJECT-ITEM-STATUS. It serves as a discriminator that partitions

OBJECT-ITEM-STATUS into subtypes. The domain values are: CONTROL-FEATURE-STATUS, FACILITY-STATUS, GEOGRAPHIC-FEATURE-STATUS, MATERIEL-STATUS, ORGANISATION-STATUS, and PERSON-STATUS.

d. object-item-status-hostility-code—The specific value that represents or denotes the perceived hostility status of a specific OBJECT-ITEM. For FACILITY, FEATURE, and MATERIEL this is interpreted to indicate that it is used, owned, or controlled by friendly or hostile forces. Example domain values are: Assumed friendly, Assumed hostile, Assumed involved, Assumed neutral, Friendly, Hostile, Involved, Neutral, Not known.

e. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

6.2.1.3 The use of OBJECT-ITEM-STATUS is illustrated in Table 41. There are several instances of OBJECT-ITEMs in all categories. For some of the items, more than one status report exists as is indicated by the values of the index attribute. A set of instances of REPORTING-DATA that are referred to by instances of OBJECT-ITEM-STATUS is illustrated in the associated Table 42. The references to time in Sub-table (b) include indications of some notional relations that would be explicit if actual data were entered.

Table 41. Example Instances of OBJECT-ITEM-STATUS

OBJECT-ITEM-STATUS

object-item-id	*-index	*-category-code	*-hostility-code	reporting data-id
3051 [1 R IRISH]	1	ORGANISATION-STATUS	Friend	01
3051 [1 R IRISH]	2	ORGANISATION -STATUS	Friend	02
3051 [1 R IRISH]	3	ORGANISATION -STATUS	Friend	03
14486 [6 Guards Tank Division]	1	ORGANISATION -STATUS	Hostile	04
14486 [6 Guards Tank Division]	2	ORGANISATION -STATUS	Hostile	05
4 [SN 3-004-66772-09]	1	MATERIEL-STATUS	Friend	06
398 [1 UK Armd Div Dressing Station 1]	1	FACILITY-STATUS	Friend	07
Person 1 [José Fernández Cuesta]	1	PERSON-STATUS	Friend	09
Person 1 [José Fernández Cuesta]	2	PERSON-STATUS	Friend	10
Person 2 [Ramiro de Maeztu Barbeito]	1	PERSON-STATUS	Friend	11
Materiel 11 [M-60]	1	MATERIEL-STATUS	Hostile	101
Materiel 11 [M-60]	2	MATERIEL-STATUS	Assumed friend	102
Materiel 11 [M-60]	3	MATERIEL-STATUS	Friend	103
Organisation 22 [Guerrilla Group X]	1	ORGANISATION -STATUS	Assumed involved	104
Organisation 22 [Guerrilla Group X]	2	ORGANISATION -STATUS	Friend	105
Feature 33 [Hilltop Y]	1	GEOGRAPHIC-FEATURE-STATUS	Hostile	106

Note: * = object-item-status

Table 42. REPORTING-DATA Instances for OBJECT-ITEM-STATUS

(a) REPORTING-DATA

*-id	*-category-code	*–confirmation-indicator-code	*–counting-indicator-code	*-credibility-code	*-reporting-date	*-reporting-time	*-timing-category-code	*-reporting-organisation-id
01	Reported	No	No	Estimated	[2 Nov 99]	[1130]	[absolute]	[1 SP Div]
02	Reported	No	Yes	Trusted	[3 Nov 99]	[0912]	[absolute]	[1 SP Div]
03	Reported	No	—	Trusted	[7 Nov 99]	[1530]	[absolute]	[1 SP Div]
04	Reported	No	—	Trusted	[31 Oct 99]	[1600]	[absolute]	[11 SP Br]
05	Reported	No	—	Suspect	[15 Nov 99]	[1715]	[absolute]	[2 SP Div]
06	Reported	No	—	Trusted	[16 Nov 99]	[1345]	[absolute]	[21 SP Br]
07	Reported	No	—	Trusted	[8 Nov 99]	[0900]	[absolute]	[1 FR Div]
09	Reported	No	—	Trusted	[1 Sep 99]	[1315]	[absolute]	[15 PO Bn]
10	Reported	Yes	—	Trusted	[5 Sep 99]	[1314]	[absolute]	[1 PO Bde]
11	Reported	No	—	Suspect	[11 Nov 99]	[0732]	[absolute]	[5 CA Bde]
101	Reported	No	—	Estimated	[1 Dec 99]	[1130]	[absolute]	[1 SP Div]
102	Reported	No	—	Trusted	[1 Dec 99]	[1800]	[absolute]	[1 SP Div]
103	Reported	Yes	—	Trusted	[2 Dec 99]	[0830]	[absolute]	[21 SP Bde]
104	Reported	No	—	Trusted	[15 Nov 99]	[1330]	[absolute]	[1 FR Div]
105	Reported	Yes	—	Trusted	[17 Nov 99]	[1615]	[absolute]	[2 SP Div]
106	Reported	No	—	Trusted	[16 Dec 99]	[1045]	[absolute]	[14 UK Div]

Note: * = reporting-data

(b) REPORTING-DATA-ABSOLUTE-TIMING

*–id	*–duration	*–effective-date	*–effective-time	*–effective-time-precision-code
01	—	d1	t1	Minute
02	—	d2 (>d1)	t2 (>t1)	Minute
03	—	d3	t3	Minute
04	—	d4	t4	Hour
05	—	d5	t5	Hour
06	—	d6 (>d5)	t6 (>t5)	—
07	—	d7 (>d3)	t7 (>t3)	—
09	—	d8	—	Day
10	—	d9 (>d8)	—	Day
11	—	d10	—	Day
101	—	d101	t101	Minute
102	—	d102	t102 (>t101)	Minute
103	—	d103	t103 (>t102)	Minute
104	—	d104	t104	Hour
105	—	d105	t105 (>t104)	Hour
106	—	d106	t106	—

* = reporting-data-absolute-timing

6.2.1.4 Most objects of the battlespace can be characterised as friend or enemy; however, this information is not inherent to the specific object. The hostility status of an object is a classification that a specific organisation gives to this object. It means that a specific object may have different hostility status given by different organisations, and that the hostility status may vary with time. Some of these concepts are illustrated in the examples above, notably for data associated with reporting-data-id values 101 through 106. The status of three separate objects is reported by four different organisations as follows:

a. A tank is initially assumed to be hostile by the 1 SP Division; later the Division reports it as "assumed friendly." Additional observation by 21 SP Brigade results in a verified classification of "friendly."

b. 1 FR Division classifies a certain guerrilla group as "Assumed involved"; subsequent contact with the 2 SP Division confirms that the group is actually "Friend."

c. The 14 UK Division reports that Hilltop Y is under the control of hostile forces.

6.2.2 Subtypes of OBJECT-ITEM-STATUS

6.2.2.1 CONTROL-FEATURE-STATUS is defined as an OBJECT-ITEM-STATUS that is a record of the condition of a specific OBJECT-ITEM that is a CONTROL-FEATURE. The attributes are:

a. control-feature-status-id—The control-feature-id of the CONTROL-FEATURE that is the subject of a specific CONTROL-FEATURE-STATUS (a role name for object-item-id).

b. object-item-status-index—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM-STATUS for a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEM-STATUSs for that OBJECT-ITEM.

c. control-feature-status-usage-status-code—The specific value that represents or denotes the usage of a specific CONTROL-FEATURE. The domain values are: Activated, Deactivated, Not known.

6.2.2.2 FACILITY-STATUS is defined as an OBJECT-ITEM-STATUS that is a record of the condition of a specific OBJECT-ITEM that is a FACILITY. The attributes are:

a. facility-status-id—The facility-id of the FACILITY that is the subject of a specific FACILITY-STATUS (a role name for object-item-id).

b. object-item-status-index—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM-STATUS for a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEM-STATUSs for that OBJECT-ITEM.

c. facility-status-operational-status-code—The specific value that represents or denotes the operational status of a specific FACILITY. The domain values are: Fully operational, Marginally operational, Not operational, Substantially operational, Temporarily not operational, Not known.

d. facility-status-operational-status-qualifier-code—The specific value that represents or denotes the qualification of the operational status of a specific FACILITY. The domain values are: Denied, Destroyed, Heavily damaged, Lacking vital resources, Lightly damaged, Lost, Moderately damaged, Not known, Under construction.

e. facility-status-reserve-indicator-code—The specific value that represents or denotes whether a specific FACILITY has been placed in reserve. The domain values are: Yes, No.

f. facility-status-usage-status-code—The specific value that represents or denotes the usage of a specific FACILITY. The domain values are: Activated, Deactivated, Not known.

6.2.2.3 GEOGRAPHIC-FEATURE-STATUS is defined as an OBJECT-ITEM-STATUS that is a record of the condition of a specific OBJECT-ITEM that is a GEOGRAPHIC-FEATURE. The attributes are:

a. geographic-feature-status-id—The geographic-feature-id of the GEOGRAPHIC-FEATURE that is the subject of a specific GEOGRAPHIC-FEATURE-STATUS (a role name for object-item-id).

b. object-item-status-index—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM-STATUS for a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEM-STATUSs for that OBJECT-ITEM.

c. geographic-feature-status-code—The specific value that represents or denotes the status of a specific GEOGRAPHIC-FEATURE. The domain values are: Cleared, Denied, Destroyed, Heavily damaged, Lightly damaged, Moderately damaged, Not known.

d. geographic-feature-status-surface-condition-code—The specific value that represents or denotes the physical status of a surface area defined by a specific GEOGRAPHIC-FEATURE. The domain values are: Dust, Flooding, Grass, Ice, Marsh, Sand, Scrub, Snow, Not otherwise specified.

6.2.2.4 MATERIEL-STATUS is defined as an OBJECT-ITEM-STATUS that is a record of the condition of a specific OBJECT-ITEM that is a MATERIEL. The attributes are:

a. materiel-status-id—The materiel-id of the MATERIEL that is the subject of a specific MATERIEL-STATUS (a role name for object-item-id).

b. object-item-status-index—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM-STATUS for a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEM-STATUSs for that OBJECT-ITEM.

c. materiel-status-operational-status-code—The specific value that represents or denotes the operational status of a specific MATERIEL. The domain values are: Fully operational, Marginally operational, Not operational, Substantially operational, Temporarily not operational, Not known.

d. materiel-status-operational-status-qualifier-code—The specific value that represents or denotes the qualification of the operational status of a specific MATERIEL. The domain values are: Denied, Destroyed, Heavily damaged, Lacking vital resources, Lightly damaged, Lost, Moderately damaged, Not known.

e. materiel-status-operational-status-mode-code—The specific value that represents or denotes the firepower or mobility degradation of a specific MATERIEL. The domain values are: Firepower only, Mobility and firepower, Mobility only, Not known.

f. materiel-status-reserve-indicator-code—The specific value that represents or denotes whether a specific MATERIEL has been placed in reserve. The domain values are: Yes, No.

g. materiel-status-usage-status-code—The specific value that represents or denotes the usage of a specific MATERIEL. The domain values are: Activated, Deactivated, Not known.

6.2.2.5 ORGANISATION-STATUS is defined as an OBJECT-ITEM-STATUS that is a record of the condition of a specific OBJECT-ITEM that is a ORGANISATION. The attributes are:

a. organisation-status-id—The organisation-id of the ORGANISATION that is the subject of a specific ORGANISATION-STATUS (a role name for object-item-id).

b. object-item-status-index—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM-STATUS for a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEM-STATUSs for that OBJECT-ITEM.

c. organisation-status-operational-status-code—The specific value that represents or denotes the operational status of a specific ORGANISATION. The domain values are: Fully operational, Marginally operational, Not operational, Substantially operational, Temporarily not operational, Not known.

d. organisation-status-operational-status-qualifier-code—The specific value that represents or denotes the qualification of the operational status of a specific ORGANISATION. The domain values are: Destroyed, Heavily damaged, Lacking vital resources, Lightly damaged, Lost, Moderately damaged, Not known.

e. organisation-status-fire-mode-code—The specific value that represents or denotes the status of weapons employment constraint for a specific ORGANISATION. The domain values are: Hold fire, Weapons free, Weapons tight, Not known.

f. organisation-status-reinforcement-code—The specific value that represents or denotes whether a specific ORGANISATION has additional or detached strength. The domain values are: Detached only, Normal strength, Reinforced and detached, Reinforced only, Not known.

g. organisation-status-reserve-indicator-code—The specific value that represents or denotes whether a specific ORGANISATION has been placed in reserve. The domain values are: Yes, No.

h. organisation-status-usage-status-code—The specific value that represents or denotes the usage of a specific ORGANISATION. The domain values are: In action, Out of action, Not known.

6.2.2.6 PERSON-STATUS is defined as an OBJECT-ITEM-STATUS that is a record of the condition of a specific OBJECT-ITEM that is a PERSON. The attributes are:

a. person-status-id—The person-id of the PERSON that is the subject of a specific PERSON-STATUS (a role name for object-item-id).

b. object-item-status-index—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM-STATUS for a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEM-STATUSs for that OBJECT-ITEM.

c. person-status-duty-status-code—The specific value that represents or denotes the availability for duty of a specific PERSON. This attribute details PERSONs either as being present or holds the reason why a PERSON is not at duty. The domain values are: Absent, Arrested, At duty, Deceased, Hospitalised, Hostage, Missing, On leave, Prisoner of war, Refugee, Not known.

d. person-status-physical-status-code—The specific value that represents or denotes the physical status of a specific PERSON. The domain values are: Fit; Incapacitated, not walking; Incapacitated, walking; Slightly incapacitated; Not known.[32]

[32] The person-status-physical-status-code is a qualifier on the person-status-duty-status-code. Thus, this attribute describes qualifications or restrictions on a person's suitability for duty as a function of physical condition.

e. person-status-reserve-indicator-code—The specific value that represents or denotes whether a specific PERSON has been placed in reserve. The domain values are: Yes, No.

6.2.2.7 Example instances of status for individual objects is provided in Table 43. This table shows the status data for instances of OBJECT-ITEMs categorised as ORGANISATION, MATERIEL, and FACILITY in Table 41.

Table 43. Example Instances of Object Status

(a) ORGANISATION-STATUS

***- id	object-item-status-index	***-operational-status-code	***-status-qualifier-code	***-fire-mode-code	***-reinforcement-code	***-reserve-indicator-code	***-usage-status-code
3051 (1 R IRISH)	1	Fully operational	—	—	Normal strength	—	In action
3051 (1 R IRISH)	2	Substantially operational	Lightly damaged	—	Normal strength	—	Out of action
3051 (1 R IRISH)	3	Substantially operational	Lightly damaged	—	Normal strength	—	In action
14486 (6 Guards Tank Division)	1	Marginally operational	Moderately damaged	—	Reinforced only	—	Out of action
14486 (6 Guards Tank Division)	2	Marginally operational	Moderately damaged	—	Reinforced only	—	In action

Note: *** stands for “organisation-status.”

(b) MATERIEL-STATUS

materiel-status-id	object-item-status-index	***-operational-status-code	***-operational-status-qualifier-code	***-operational-status-mode-code	***-reserve-indicator-code	***-usage-status-code
4 (SN 3-004-66772-09)	1	Marginally operational	Heavily damaged	Mobility and firepower	—	Deactivated

Note: *** stands for “materiel-status.”

(c) FACILITY-STATUS

facility-status-id	object-item-status-index	***-operational-status-code	***-operational-status-qualifier-code	***-reserve-indicator-code	***-usage-status-code
398 (1 UK Armd Div Dressing Station 1)	1	Substantially operational	—	—	In action

Note: *** stands for “facility-status.”

6.2.2.8 Example instances for PERSON-STATUS are provided in Table 44.

Table 44. Example Instances of PERSON-STATUS

PERSON-STATUS

person-status-id	object-item-status-index	person-status-duty-status-code	person-status-physical-status-code	person-status-reserve-indicator-code
Person 1 [José Fernández Cuesta]	1	On leave	Slightly incapacitated	No
Person 1 [José Fernández Cuesta]	2	At duty	Fit	No
Person 2 [Ramiro de Maeztu Barbeito]	1	At duty	Fit	No

6.2.3 Business Rules for OBJECT-ITEM-STATUS

6.2.3.1 The attribute *materiel-status-operational-status-mode-code* applies only to instances of MATERIEL that are classified as EQUIPMENT-TYPE.

6.2.3.2 Not all combinations of domain values for FACILITY-STATUS, MATERIEL-STATUS, ORGANISATION-STATUS or PERSON-STATUS attributes are meaningful. The resulting sets of valid combinations are documented in Annex F, Tables F-6 and F-7.

6.2.3.3 An instance of OBJECT-ITEM-STATUS specifying object-item-status hostility-code *must be created* for an instance of ORGANISATION, MATERIEL, PERSON, FACILITY, and CONTROL-FEATURE, but not necessarily for GEOGRAPHIC-FEATURE or METEOROLOGIC-FEATURE.

(This page intentionally left blank)

7. OBJECT-ITEM ASSOCIATIONS

7.1 Introduction

7.1.1 There is clearly a requirement to link different OBJECT-ITEMs together and describe the relationships that exist between them. A prime example is the set of command relationships between units; battlespace relationships may be created, changed, or terminated at various times as needed in response to current operations and plans.

7.1.2 A conceptual construct for associations is illustrated in Figure 51. It allows any instance of OBJECT-ITEM to be related to any other. For example, a unit can be related to another unit to express command relationships by using the notional entity OBJECT-ITEM-Association, an entity that is not present in the data model, but serves to represent a cluster of actual entities in describing the concept of associations. The nature of a relationship is specified by means of the notional category code in OBJECT-ITEM-Association. The index attribute permits the recording of more than one relationship between the same two instances of OBJECT-ITEM, as may well happen over a period of time. The Status entity is another notional cluster entity. Its purpose is to specify whether the effective date (one of the information elements conveyed through REPORTING-DATA) is the start or end of an actual or planned association.

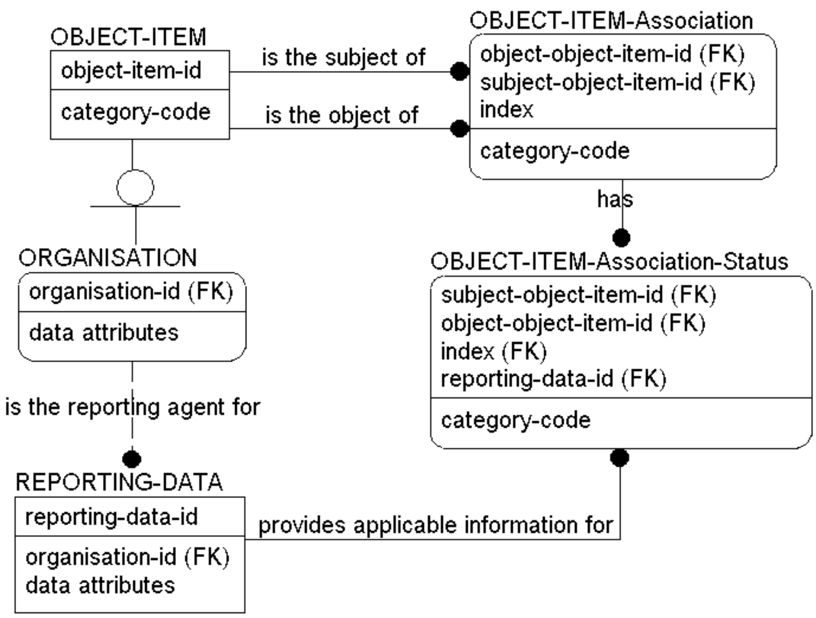


Figure 51. Concept for OBJECT-ITEM-Association

7.1.3 While all combinations of instances of OBJECT-ITEM make sense at an abstract level, the necessity to specify values for the association codes at a more detailed level makes it clear that not all possible associations between OBJECT-ITEMs are sensible or needed. The associations in the data model are constrained only to those deemed necessary to support C2 information exchange for multinational interoperability. The resulting nine are shown as a matrix in Table 45.

Table 45. Valid OBJECT-ITEM Associations[33]

	Object OBJECT-ITEM						
Subject OBJECT-ITEM	FACILITY	FEATURE	CONTROL-FEATURE	GEOG.-FEATURE	MATERIEL	ORGAN-ISATION	PERSON
FACILITY	Yes	Yes	—	—	—	—	—
CONTROL-FEATURE	—	—	Yes	Yes	—	—	—
ORGANISATION	Yes	—	Yes	—	Yes	Yes	Yes

7.1.4 The nine entities are listed below. Each is generically defined as the relationship between two subtypes of OBJECT-ITEM, where one (the first occurring in the name) is specified as the "subject" of the relationship and the other (the second occurring in the name) is specified as the "object" of the relationship. These may also be thought of as "parent" and "child" for the purpose of stating a semantically correct description of the relationship. The illustrative values for the association-category-code are listed at the end of each definition:

a. FACILITY-FACILITY-ASSOCIATION—A relationship of a FACILITY as a subject with another FACILITY as an object. The domain values for its category code are: Connected to, Contains, Utilises.

b. FACILITY-FEATURE-ASSOCIATION—A relationship of a FACILITY as a subject with a FEATURE as an object. The domain values for its category code are: Encloses, Is affected by, Is bounded by, Is contained within, Is partially bounded by, Is partially contained within.

c. CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION—A relationship of a CONTROL-FEATURE as a subject with another CONTROL-FEATURE as an object. The domain values for its category code are: Contains, Is end of, Is part of, Is start of, Is successor of.

d. CONTROL-FEATURE-GEOGRAPHIC-FEATURE-ASSOCIATION—A relationship of a CONTROL-FEATURE as a subject with a GEOGRAPHIC-FEATURE as an object. The domain values for its category code are: Coincides with, Coincides with part of, Is partially delineated by.

e. ORGANISATION-CONTROL-FEATURE-ASSOCIATION—A relationship of an ORGANISATION as a subject with a CONTROL-FEATURE as an object. Example domain values for its category code are: Controls, Establishes, Is bounded by, Is captor of, Is constrained or enabled by, Is to the left of, Is to the right of, Is user of.

f. ORGANISATION-FACILITY-ASSOCIATION—A relationship of an ORGANISATION as a subject with a FACILITY as an object. The domain values for its category code are: Controls, Disestablishes, Establishes, Is captor of, Occupies, Uses.

g. ORGANISATION-MATERIEL-ASSOCIATION—A relationship of an ORGANISATION as a subject with a MATERIEL as an object. The domain values for its category code are: Controls, Employs, Is accounting authority for, Is captor of, Transports.

---

33 A potential entity GEOGRAPHIC-FEATURE-GEOGRAPHIC-FEATURE-ASSOCIATION is not included. There appears to be little reason to enter such information as Generic Hub data. It would be available in graphical form from geographic information system implementations.

h. ORGANISATION-ORGANISATION-ASSOCIATION—A relationship of an ORGANISATION as a subject with another ORGANISATION as an object. This association has both category and subcategory codes. The domain values for organisation-organisation-association-category-code are: Command and control, Fire unit and combat support, Administrative and combat service support, Supplementary. Example domain values for organisation-organisation-association-subcategory-code are: Has full command of, Has operational command of, Has operational control of, Has tactical command of, Has tactical control of, Has as alternate, Has attached, Has in reserve, Is the same as, Reinforces. Permissible combinations of domain values for category and subcategory codes are specified in Annex F, Table F-8.

i. ORGANISATION-PERSON-ASSOCIATION—A relationship of an ORGANISATION as a subject with a PERSON as an object. The domain values for its category code are: Has as a liaison officer, Has on assignment, Has on attachment, Is captor of, Is under command of.

7.2 Data Structure for Associations

7.2.1 Figure 52 is a model view of two associations (ORGANISATION with FACILITY and ORGANISATION with itself) that serve to illustrate the details of the specification. The remaining seven associations have the same structure.

7.2.2 Each association contains subject, object, index, and category attributes. The definitions of the attributes use abbreviated notation where **xxx** is the subject (facility, control-feature, or organisation) and **yyy** is the object (organisation, facility, feature, control-feature, geographic-feature, person, or materiel). The definitions and a specific example is provided for each type of attribute.

a. **xxx-yyy**-association-subject-**xxx**-id—It is defined as the **xxx**-id of a specific **XXX** that serves as the subject of a specific **XXX-YYY**-ASSOCIATION (a role name for object-item-id). This key attribute is carried from the subtype of OBJECT-ITEM to which the association refers via an identifying relationship "is the subject of." In simple terms, the attribute specifies the "superior" CONTROL-FEATURE, FACILITY or ORGANISATION in the association. *[organisation-person-association-subject-organisation-id—The organisation-id of a specific ORGANISATION that serves as the subject of a specific ORGANISATION-PERSON-ASSOCIATION.]*

b. **xxx-yyy**-association-object-**yyy**-id—It is defined as the **yyy**-id of a specific **YYY** that serves as the object of a specific **XXX-YYY**-ASSOCIATION (a role name for object-item-id). This key attribute is carried from the subtype of OBJECT-ITEM to which the association refers via an identifying relationship "is the object of." In simple terms, the attribute specifies the "subordinate" CONTROL-FEATURE, FACILITY, FEATURE, GEOGRAPHIC-FEATURE, MATERIEL, ORGANISATION, or PERSON in the association. *[organisation-person-association-object-person-id—The person-id of a specific PERSON that serves as the object of a specific ORGANISATION-PERSON-ASSOCIATION.]*

c. **xxx-yyy**-association-index—It is defined as the unique value, or set of characters, assigned to represent a specific **XXX-YYY**-ASSOCIATION for a subject **XXX** and an object **YYY** and to distinguish it from all other **XXX-YYY**-ASSOCIATIONs for that **XXX** and that **YYY**[34]. *[organisation-person-association-index—The unique value, or set of characters, assigned to represent a specific ORGANISATION-PERSON-ASSOCIATION for a subject ORGANISATION and an object PERSON and to distinguish it from all other ORGANISATION-PERSON-ASSOCIATIONs for that ORGANISATION and that PERSON.]*

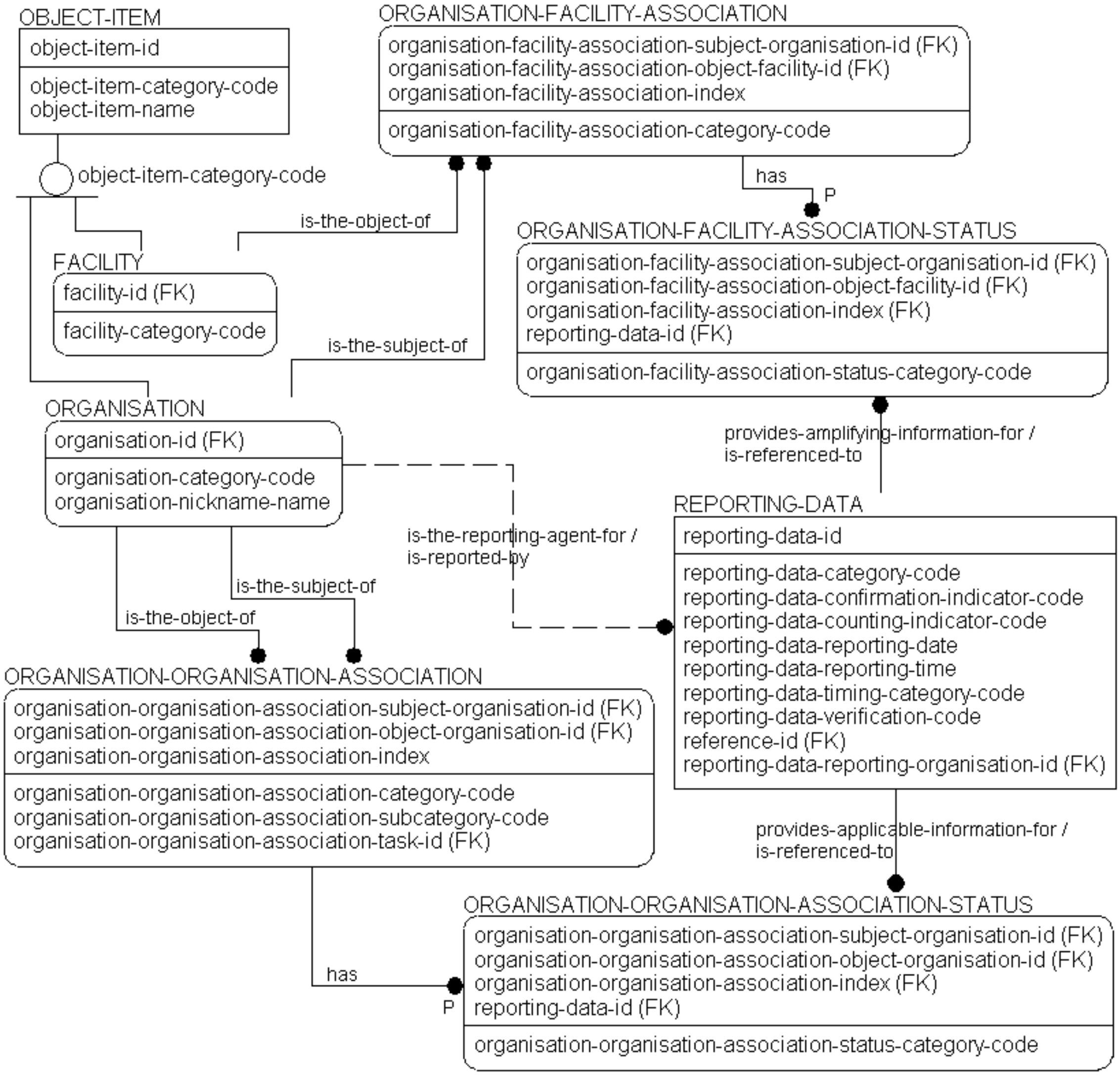


Figure 52. Illustrative OBJECT-ITEM-Associations

d. **xxx-yyy**-association-category-code—The specific value that represents or denotes the type of relationship between the subject **XXX** and the object **YYY** in a specific **XXX-YYY**-ASSOCIATION. *[organisation-person-association-category-code—The specific value that represents or denotes the type of relationship between the subject ORGANISATION and the object PERSON for a specific ORGANISATION-PERSON-ASSOCIATION].* Note: this definition does not apply in case of an association of an

---

[34] When XXX is the same as YYY, the phrase "for that XXX and that YYY" changes to "for those XXXs."

ORGANISATION to itself. The appropriate definition is presented in the following paragraph.

7.2.3 An important aspect in military operations is the specification of groupings of formations, often referred to as order of battle. The model construct of ORGANISATION-ORGANISATION-ASSOCIATION provides a mechanism for this. The categorisation is specified through two attributes as follows:

a. organisation-organisation-association-category-code—The specific value that represents or denotes the general type of relationship between the subject ORGANISATION and the object ORGANISATION in a specific ORGANISATION-ORGANISATION-ASSOCIATION. This attribute provides four general categories for grouping the associations.

b. organisation-organisation-association-subcategory-code—The specific value that represents or denotes the detailed type of relationship between the subject ORGANISATION and the object ORGANISATION in a specific ORGANISATION-ORGANISATION-ASSOCIATION. This attribute lists the specific categories that are assigned to one of the general groups.

7.2.4 Permissible doctrinal combinations of domain values for category and subcategory codes are specified in Annex F, Table F-8.

7.2.5 Examples of organisational relationships are represented in Table 46 as follows:

a. 1 RHA is under Operational Command (OPCOMD) of the 52nd Mechanised Infantry Division.

b. 1 R IRISH is under Tactical Control (TACON) of the 52nd Mechanised Infantry Division.

c. 1 RHA is in Direct Support (DS) of the 1 R IRISH.

d. 1 R IRISH is Under Command for Administration (UCADMIN) of the 52nd Mechanised Infantry Division.

Table 46. ORGANISATION-ORGANISATION-ASSOCIATION Instances

ORGANISATION-ORGANISATION-ASSOCIATION

***-subject-organisation-id	***-object-organisation-id	***-index	***-category-code	***-subcategory-code
57 [52 Inf Div (M)]	1793 (1 RHA)[35]	1	Command and control	Has operational command of
57 [52 Inf Div (M)]	3051 (1 R IRISH)	1	Command and control	Has tactical control of
3051 (1 R IRISH)	1793 (1 RHA)	1	Fire unit and combat support	Has in direct support
57 [52 Inf Div (M)]	3051 (1 R IRISH)	1	Administrative and combat service support	Has under command for administration

Note: *** denotes “organisation-organisation-association”

7.3 Data Structure for Association Status Entities

7.3.1 The structure of status entities and their relationship to parent association entities is illustrated in the previous figure. Association status is defined generically as a relationship between a specific **XXX-YYY**-ASSOCIATION and a specific REPORTING-DATA in order to indicate the

[35] 1 RHA: 1st Regiment Royal Horse Artillery, which is a UK field artillery regiment.

current status of the association. The symbols **XXX** and **YYY** have the same meaning as defined in paragraph 7.2.2.

7.3.2 Each association status has five attributes, four of them are key attributes and one is a data attribute. Three of the key attributes are migrated from a parent association entity: **xxx-yyy**-association-subject-**xxx**-id, **xxx-yyy**-association-object-**yyy**-id, and **xxx-yyy**-association-index. The fourth key attribute is reporting-data-id that is migrated from REPORTING-DATA. The fifth attribute is a native data attribute—**xxx-yyy**-association-status-category-code—that is defined as:

> The specific value that indicates if the status of a specific **XXX-YYY**-ASSOCIATION-STATUS refers to the beginning or termination of the association.

7.3.3 Table 47 provides example instances of ORGANISATION-PERSON-ASSOCIATION. This example also includes the extension to status in Sub-table (b) as well as the appropriate instances of REPORTING-DATA as illustrated in Sub-tables (c) and (d).

Table 47. ORGANISATION-PERSON-ASSOCIATION Instances

(a) ORGANISATION-PERSON-ASSOCIATION

***-subject-organisation-id	***-object-person-id	*** -index	*** -category-code
3051	Person 1	1	Has on attachment
3051	Person 1	2	Has on assignment
1793	Person 4	1	Has on assignment

Note: *** denotes "organisation-person-association"

(b) ORGANISATION-PERSON-ASSOCIATION-STATUS

***-subject-organisation-id	***-object-person-id	*** -index	reporting-data-id	***-status-category-code
3051	Person 1	1	21	[Start]
3051	Person 1	2	23	[End]
1793	Person 4	1	37	[Start]
3051	Person 1	3	55	[Start]
3051	Person 1	4	61	[End]

Note: *** denotes "organisation-person-association"

(c) REPORTING-DATA

reporting-data-id	**-category-code	**-credibility-code	**-timing-category-code	**-reporting-organisation-id
21	Reported	Trusted	[absolute]	3051
23	Reported	Trusted	[absolute]	3051
37	Reported	Trusted	[absolute]	1793
55	Reported	Trusted	[absolute]	3051
61	Planned	Trusted	[absolute]	3051

Note: ** denotes "reporting-data"

(d) REPORTING-DATA-ABSOLUTE-TIMING

**-reporting-data-id	**-duration	**-effective-date	**-effective-time	**-effective-time-precision-code
21	[2 days]	[1 Dec 1999]	[0900]	[minute]
21	[3 weeks]	[2 Jan 2000]	[1200]	[hour]
37	[4 months]	[15 Feb 2000]	—	[day]
55	[2 years]	[1 Mar 2000]	[0900]	[hour]
61	—	[28 Feb 2002]	—	[day]

Note: ** denotes "reporting-data-absolute-timing"

(This page intentionally left blank)

8. CAPABILITIES OF OBJECTS AND TYPES

8.1 Introduction

8.1.1 Requirements

8.1.1.1 There is a need to specify and monitor the capability of battlespace objects. Information concerning capabilities can be used within the planning process to analyse the feasibility of actions that may be open to friendly forces and to examine the likelihood of actions that may be open to enemy forces.

8.1.1.2 There is a need to describe the way in which the capability of battlespace objects can be affected by various kinds of conditions. For example, the speed with which a vehicle can manoeuvre over land may depend on the type of terrain, and the range of a weapon may depend on the type of ammunition that is used.

8.1.2 Overview

8.1.2.1 The design of capability structure embodies two concepts: the need to characterise capability itself and to link it to other parts of the model that use specifications of capability. The balance of this section introduces the concept of capability as an entity, shows how it is related to other objects and activities, and then describes the details of the capability specification itself.

8.1.2.2 CAPABILITY is defined as the potential ability to do work, perform a function or mission, achieve an objective, or provide a service. The entity represents the list of generic capabilities that are available to objects and their types. This list covers a diverse range of abilities such as their maximum speed or their maximum storage capacity, some of which may not be applicable to certain classes of objects. The list of abilities is stored in the attributes capability-category-code and capability-subcategory-code. The category-code refers to a general class of abilities (e.g., the ability to transport things) while the subcategory-code refers to a single ability within that class (e.g., the ability to transport a given amount of liquid). A specific ability can be identified by referring to the instance of CAPABILITY that has the appropriate category and subcategory codes.

8.1.2.3 The structure that links CAPABILITY to other parts of the model is illustrated in Figure 53. This structure can be used to describe both (a) the abilities of OBJECT-TYPEs (in the form of normal or expected capabilities) and (b) the abilities of OBJECT-ITEMs (insofar as these differ from the normal capabilities of their corresponding types).

8.1.2.3 CAPABILITY is linked to three user entities. First, it is linked to OBJECT-TYPE via OBJECT-TYPE-CAPABILITY-NORM, which describes the normal or expected capabilities for a specified class of objects. Second, it is linked to OBJECT-ITEM via OBJECT-ITEM-CAPABILITY, which estimates the actual capability of a specific battlespace object. Third, it is linked to ACTION through ACTION-REQUIRED-CAPABILITY which states the capability required in order to perform a specified action. Each of the associative entities provides an attribute with which to specify a numerical value for that particular ability.

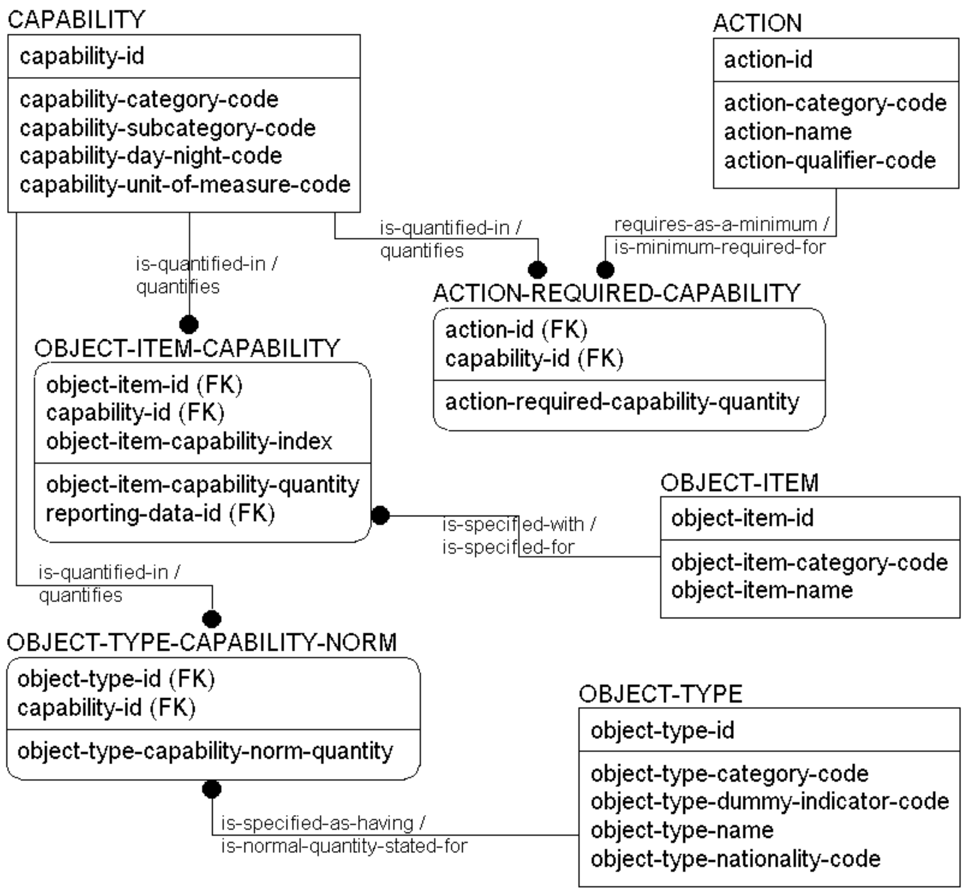


Figure 53. The Basic Uses of CAPABILITY

8.1.2.4 A detailed specification of CAPABILITY is aided by subtyping along functional lines. This subtyping is based on capability-category-code where each subtype identifies a particular ability in more detail, that is, each subtype describes the conditions affecting the CAPABILITY in question. For instance, LAND-MANOEUVRE-CAPABILITY has a code to identify the type of terrain and FIRE-CAPABILITY identifies the type of ammunition that is discharged. The subtyping structure is displayed in Figure 54.

8.1.3 Rationale

8.1.3.1 There are several reasons underlying the choice for the CAPABILITY structure:

a. The structure explicitly and unambiguously identifies those abilities that are available within the model—a fundamental requirement for information exchange.

b. The structure provides support for the classification of EQUIPMENT-TYPEs. The values in capability-category-code (which are used in the subtyping) provide a mutually exclusive set of basic capability classes that can be used to classify equipment. For example, an EQUIPMENT-TYPE that has a LAND-MANOEUVRE-CAPABILITY is a vehicle of some kind; an EQUIPMENT-TYPE with a FIRE-CAPABILITY is a weapon of some kind. Furthermore, an OBJECT-ITEM may have multiple capabilities, therefore allowing an EQUIPMENT-TYPE to be classified in multiple ways. For example, a Chinook CH47D transport helicopter has both an air manoeuvre capability and a transport capability. Such classifications can aid in searching for specific types of equipment.

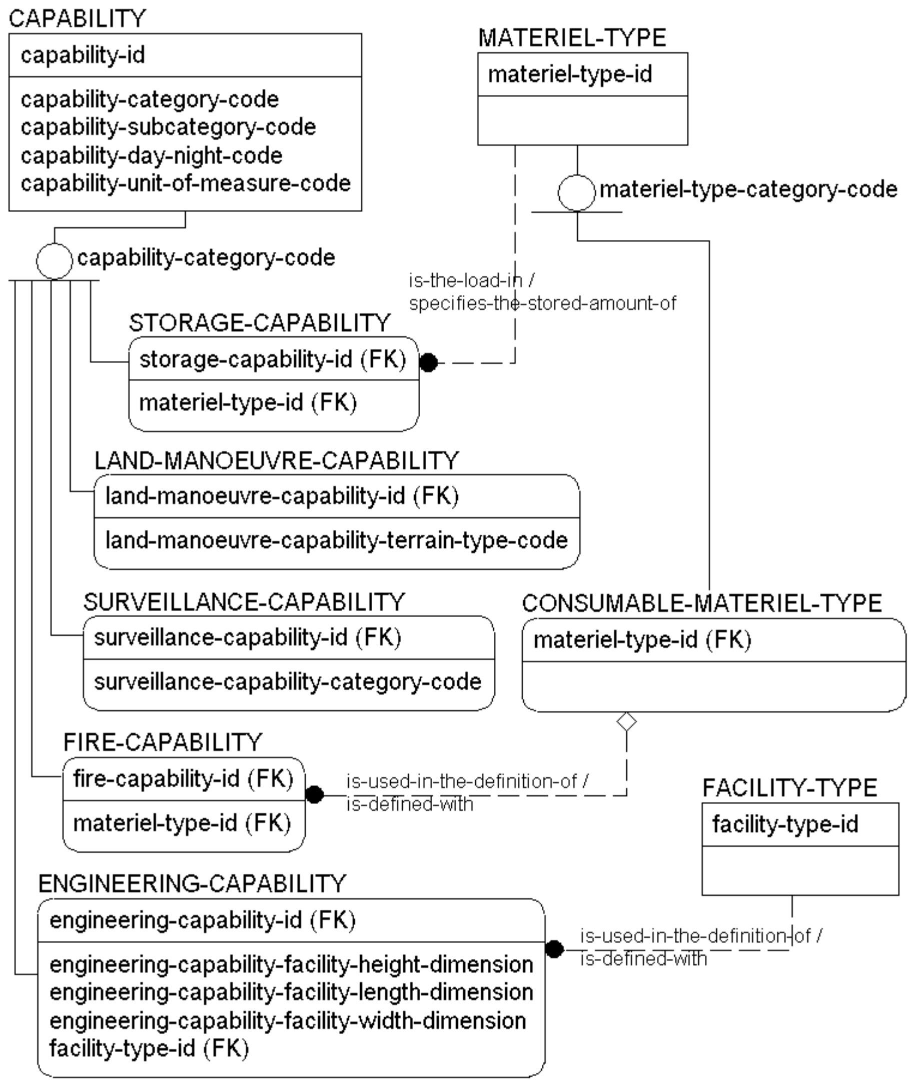


Figure 54. CAPABILITY Subtyping Structure

c. The structure is flexible in that the list of abilities can easily be extended. New classes of abilities can be added by extending the domain of capability-category-code; within such a class new abilities can be added by extending the domain of capability-subcategory-code. In certain cases this may require the addition of new subtypes to CAPABILITY; however, this will not affect the existing structure. Such extensions can be performed at a national level also.

8.1.3.2 It should be noted that CAPABILITY is intended only to describe the abilities of an object, not to describe its properties in general. Characteristics pertaining to an OBJECT-ITEM or OBJECT-TYPE, such as the number of wheels on a vehicle or the type of motor it has, should be modelled as descriptive attributes of OBJECT-ITEM and OBJECT-TYPE or their subtypes.

8.2 The CAPABILITY Entity

8.2.1 Structure

8.2.1.1 The basic structure describing abilities of objects comprises the entity CAPABILITY and one level of subtyping along functional lines. The attributes are:

a. capability-id—The unique value, or set of characters, assigned to represent a specific CAPABILITY and to distinguish it from all other CAPABILITYs.

b. capability-category-code—The specific value that represents or denotes the general class of a CAPABILITY. It serves as a discriminator that partitions CAPABILITY into subtypes. The domain values are: Air manoeuvre capability, ENGINEERING-CAPABILITY, FIRE-CAPABILITY, LAND-MANOEUVRE-CAPABILITY, Maintenance capability, Medical capability, Obstacle crossing capability, STORAGE-CAPABILITY, SURVEILLANCE-CAPABILITY, Transport capability, and Water manoeuvre capability, Not otherwise specified.

c. capability-subcategory-code—The specific value that represents or denotes the detailed class of a CAPABILITY. Example domain values are: Breaching time; Bulk liquid; Demolition time; Maximum cargo length; Maximum range; Maximum speed; Minimum depth; Minimum range; Planning range; Planning speed; Sustained fire rate.

d. capability-day-night-code—The specific value that defines the light conditions that apply to a particular CAPABILITY. The domain values are: Day; Day and Night; Night.

e. capability-unit-of-measure-code—The specific value that represents or denotes the quantities in terms of which the magnitude of a CAPABILITY category is stated. The domain values are: Cubic metre; Degree; Each; Hour; Kilogram; Kilogram(s) per hour; Kilometre; Kilometre(s) per hour; Litre; Metric ton; Round(s) per minute; Second.

8.2.1.2. The capability-category-code and capability-subcategory-code attributes form a complex domain; that is, not every subcategory is applicable to every category. The valid combinations are displayed in Table 48.

Table 48. Valid Combinations of CAPABILITY Categories and Subcategories

capability-category-code	capability-subcategory-code	capability-unit-of-measure-code
Air-manoeuvre capability	Maximum altitude Maximum range Maximum speed Minimum landing distance Minimum range Minimum take off distance Planning range Planning speed	Kilometre, Metre Kilometre, Metre Kilometre(s) per hour Kilometre, Metre Kilometre, Metre Kilometre, Metre Kilometre, Metre Kilometre(s) per hour
ENGINEERING-CAPABILITY	Breaching time Breaching rate Construction time Construction rate Demolition time Demolition rate	Hour, Second Metres/hr, Square metres/hr Hour, Second Metres/hr, Square metres/hr, Cubic metres/hr Hour, Second Metres/hr, Square metres/hr, Cubic metres/hr
FIRE-CAPABILITY	Burst fire rate Maximum fire rate Sustained fire rate	Round(s) per minute Round(s) per minute Round(s) per minute
LAND-MANOEUVRE-CAPABILITY	Maximum range Maximum speed Minimum range Planning range Planning speed	Kilometre Kilometre(s) per hour Kilometre Kilometre Kilometre(s) per hour
Maintenance capability	Maintenance station count	Each
Medical capability	Bed count Operating table count	Each Each
Obstacle-crossing capability	Maximum fording depth Maximum obstacle gradient angle Maximum side slope angle Maximum trench width	Kilometre Degree Degree Kilometre
STORAGE-CAPABILITY	Bulk liquid Bulk volume Bulk weight Pallet count	Litre Cubic metre Kilogram Each
SURVEILLANCE-CAPABILITY	Maximum range Minimum range	Kilometre Kilometre
Transport capability	Bulk liquid Bulk volume Bulk weight Maximum cargo length Maximum cargo width Maximum cargo height Pallet count Sitting persons count	Litre Cubic metre Kilogram Kilometre, Metre Kilometre, Metre Kilometre, Metre Each Each
Water-manoeuvre capability	Maximum depth Maximum range Maximum speed Minimum depth Minimum range Planning range Planning speed	Kilometre, Metre Kilometre, Metre Kilometre(s) per hour Kilometre, Metre Kilometre, Metre Kilometre, Metre Kilometre(s) per hour

8.2.1.3 Illustrative instances of CAPABILITY may be found in Table 49. These examples are used in a subsequent section to specify standard and actual capabilities of battlespace objects and types. The specification of capabilities in this table is not complete wherever the value for the attribute capability-category-code is capitalised. It indicates that there is an associated subtype that specifies additional parameters that apply to that instance of CAPABILITY. For example, instances 100348 and 100349 have identical data values, but a subsequent example (see Section 8.2.4.4) shows that the capability is specified for different terrain types. The subtypes of CAPABILITY are described in the following sections.

Table 49. CAPABILITY Example Instances

CAPABILITY

capability-id	capability-category-code	capability-subcategory-code	capability-day-night-code	capability-unit-of-measure
567003	ENGINEERING-CAPABILITY	Construction time	Night	Hour
100369	FIRE-CAPABILITY	Maximum range	—	Kilometre
124773	LAND-MANOEUVRE-CAPABILITY	Planning speed	Day and night	Kilometre(s) per hour
100348	LAND-MANOEUVRE-CAPABILITY	Maximum speed	Day	Kilometre(s) per hour
100349	LAND-MANOEUVRE-CAPABILITY	Maximum speed	Day	Kilometre(s) per hour
134553	Transport capability	Sitting person count	Day	Each
567778	Transport capability	Pallet count	—	Each

8.2.2 ENGINEERING-CAPABILITY as a Subtype of CAPABILITY

8.2.2.1 ENGINEERING-CAPABILITY is defined as a CAPABILITY, required for planning, of those OBJECT-ITEMs or OBJECT-TYPEs that are deemed as having the ability to perform construction or destruction activities in support of military operations. This includes performing mobility and counter-mobility tasks. This category of CAPABILITY applies to ORGANISATIONs, ORGANISATION-TYPEs, MATERIEL, or MATERIEL-TYPEs.

8.2.2.2 The entity ENGINEERING-CAPABILITY provides additional information concerning the conditions for which the engineering capability is defined, that is, the type of facility which is being constructed or destroyed (or in the case of obstacles, breached) as well as the dimensions of that facility. The attributes are:

a. engineering-capability-id—The capability-id of a specific ENGINEERING-CAPABILITY (a role name for capability-id).

b. engineering-capability-facility-height-dimension—The one-dimensional linear measurement which denotes the vertical distance, measured from the lowest to the highest reference, of either the FACILITY-TYPE itself (in the case of construction) or the breach in the FACILITY-TYPE (in the case of destruction).

c. engineering-capability-facility-length-dimension—The one-dimensional linear measurement which denotes the horizontal distance, measured from end to end and parallel to the central axis, of either the FACILITY-TYPE itself (in the case of construction) or the breach in the FACILITY-TYPE (in the case of destruction).

d. engineering-capability-facility-width-dimension—The one-dimensional linear measurement which denotes the horizontal distance, measured from side to side and perpendicular to the central axis, of either the FACILITY-TYPE itself (in the case of construction) or the breach in the FACILITY-TYPE (in the case of destruction).

e. facility-type-id—The object-type-id of a specific FACILITY-TYPE (a role name for object-type-id). It represents the specific instance of FACILITY-TYPE that is the objective of the capability.

8.2.2.3 An example of the use of ENGINEERING-CAPABILITY is illustrated in Table 50. It specifies a requirement to build a one square kilometre anti-tank minefield during the day. The unit of measure is to be in hours.

Table 50. An Example Instance of ENGINEERING-CAPABILITY

(a) CAPABILITY

capability-id	capability-category-code	capability-subcategory-code	capability-day-night-code	capability-unit-of-measure-code
677	ENGINEERING-CAPABILITY	Construction time	Day	Hour

(b) ENGINEERING-CAPABILITY

engineering-capability-id	*-height-dimension	*-length-dimension	*-width-dimension	facility-type-id
677	—	300 [m]	1000 [m]	[Minefield, anti-tank]

Note: * denotes “engineering-capability”.

8.2.2.4 Note that it is possible to describe engineering capabilities at various levels of command. For instance, a bridge-building platoon may be capable of either constructing two bridges, each 20 metres long, or a single bridge that is 40 metres long. A company that is made up of three platoons may therefore be capable of building a single bridge that is 120 metres long. The first capability can be described at platoon level, the second at company level.

8.2.3 FIRE-CAPABILITY as a Subtype of CAPABILITY

8.2.3.1 FIRE-CAPABILITY is defined as a CAPABILITY, required for planning, of those OBJECT-ITEMs or OBJECT-TYPEs that are deemed as having the ability to discharge or launch a projectile. This capability applies to ORGANISATIONs, ORGANISATION-TYPEs, MATERIEL, MATERIEL-TYPEs, FACILITYs, and FACILITY-TYPEs.

8.2.3.2 The FIRE-CAPABILITY entity provides additional information concerning the conditions under which the fire capability is defined, viz., the type of projectile which is being discharged or launched. The attributes are:

a. fire-capability-id—The capability-id of a specific FIRE-CAPABILITY (a role name for capability-id).

b. consumable-materiel-type-id—The materiel-type-id of a specific CONSUMABLE-MATERIEL-TYPE (a role name for object-type-id). It represents the specific instance of CONSUMABLE-MATERIEL-TYPE that denotes the type of projectile that can be fired.

8.2.4 LAND-MANOEUVRE-CAPABILITY as a Subtype of CAPABILITY

8.2.4.1 LAND-MANOEUVRE-CAPABILITY is defined as a CAPABILITY, required for planning, of those OBJECT-ITEMs or OBJECT-TYPEs that are deemed as having the nominal ability to move over a specific type of terrain. This capability applies to ORGANISATIONs, ORGANISATION-TYPEs, MATERIEL and MATERIEL-TYPEs.

8.2.4.2 The LAND-MANOEUVRE-CAPABILITY entity provides additional information concerning the conditions under which the manoeuvre capability is defined, that is, the type of terrain which is being traversed. This class of capabilities is particularly useful with regard to manoeuvre of friendly or enemy forces. The attributes are:

a. land-manoeuvre-capability-id—The capability-id of a specific LAND-MANOEUVRE-CAPABILITY (a role name for capability-id).

b. land-manoeuvre-capability-terrain-type-code—The specific value that represents or denotes the class of terrain to which a particular LAND-MANOEUVRE-CAPABILITY pertains. The domain values are: Cross-country; Road; Terrain independent; Not known; Not otherwise specified.

8.2.4.3 Example instances of LAND-MANOEUVRE-CAPABILITY are depicted in Table 51. The table illustrates that the user, in specifying a day maximum speed for land manoeuvres for a specific OBJECT-ITEM or OBJECT-TYPE (or as required for an ACTION), can differentiate between cross-country manoeuvre and road manoeuvres by referring to different instances of CAPABILITY, namely 100348 and 100349, respectively.

Table 51. Example Instances for LAND-MANOEUVRE-CAPABILITY

(a) CAPABILITY (reproduced from Table 49)

capability-id	capability-category-code	capability-subcategory-code	capability-day-night-code	capability-unit-of-measure
100348	LAND-MANOEUVRE-CAPABILITY	Maximum speed	Day	Kilometre(s) per hour
100349	LAND-MANOEUVRE-CAPABILITY	Maximum speed	Day	Kilometre(s) per hour

(b) LAND-MANOEUVRE-CAPABILITY

land-manoeuvre-capability-id	land-manoeuvre-capability-terrain-type-code
100348	Cross-country
100349	Road

8.2.5 STORAGE-CAPABILITY as a Subtype of CAPABILITY

8.2.5.1 STORAGE-CAPABILITY is defined as a CAPABILITY, required for planning, of those OBJECT-ITEMs or OBJECT-TYPEs that are deemed as having the nominal ability to hold a specific MATERIEL-TYPE. This capability applies to ORGANISATIONs, ORGANISATION-TYPEs, MATERIEL, MATERIEL-TYPEs, FACILITYs, or FACILITY-TYPEs. The attributes are:

a. storage-capability-id—The capability-id of a specific STORAGE-CAPABILITY (a role name for capability-id).

b. materiel-type-id—The object-type-id of a specific MATERIEL-TYPE (a role name for object-type-id). It identifies the specific instance of MATERIEL-TYPE that is the objective of the capability.

8.2.6 SURVEILLANCE-CAPABILITY as a Subtype of CAPABILITY

SURVEILLANCE-CAPABILITY is defined as a CAPABILITY, required for planning, of those OBJECT-ITEMs or OBJECT-TYPEs that are deemed as having the nominal ability to observe aerospace, surface or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means. This capability applies to ORGANISATIONs, ORGANISATION-TYPEs, MATERIEL, MATERIEL-TYPEs, FACILITYs, or FACILITY-TYPEs. The attributes are:

a. surveillance-capability-id—The capability-id of a specific SURVEILLANCE-CAPABILITY (a role name for capability-id).

b. surveillance-capability-category-code—The specific value that defines or denotes the class of SURVEILLANCE-CAPABILITY. The domain values are: Communications; Electronic; Human; Imaging; Signal; Not known, Not otherwise specified.

8.3 OBJECT-TYPE-CAPABILITY-NORM

8.3.1 The entity OBJECT-TYPE-CAPABILITY-NORM is defined as the standard value of a specific CAPABILITY of an OBJECT-TYPE. The entity represents staff planning data concerning the capabilities of OBJECT-TYPEs.

8.3.2 OBJECT-TYPE-CAPABILITY-NORM links OBJECT-TYPE to CAPABILITY (as may be seen in Figure 53). An OBJECT-TYPE may be associated with any number of standard capabilities. Since OBJECT-TYPE-CAPABILITY-NORM refers to types rather than items, the capabilities it defines tend to be static. The attributes are:

a. object-type-id—The unique value, or set of characters, assigned to represent a specific OBJECT-TYPE and to distinguish it from all other OBJECT-TYPEs. It identifies a specific OBJECT-TYPE for which a particular OBJECT-TYPE-CAPABILITY-NORM is specified.

b. capability-id—The unique value, or set of characters, assigned to represent a specific CAPABILITY and to distinguish it from all other CAPABILITYs.

c. object-type-capability-norm-quantity—The non-monetary numeric value representing the aggregated units of a specific CAPABILITY that is specified in a particular OBJECT-TYPE-CAPABILITY-NORM to be attainable for a specific OBJECT-TYPE.

8.3.3 An example of how this is utilised is detailed in Table 52, which shows some OBJECT-TYPE-CAPABILITY-NORMs for a number of different OBJECT-TYPEs relating to the CAPABILITYs specified in Table 49. This table specifies the following:

a. ABBOT 105-mm self-propelled (SP) gun[36] normally has a fire range of 10 km. The applicable ammunition could be specified via FIRE-CAPABILITY.

b. Combat Engineer Tractor (CET)[37] is normally able to achieve a maximum cross-country velocity of 57 kilometres per hour (the terrain type is specified in Table 51).

c. A US Transport Company equipped with 8-ton flatbed trucks can normally carry 250 persons or 60 standard pallets in one lift. This is an example of specifying a unit capability rather than individual equipment capability.

---

[36] The ABBOT 105-mm SP is a self-propelled armoured 105-mm Artillery Gun currently in use in several NATO armies.

[37] CET—Combat Engineer Tractor (a UK-manufactured vehicle in service).

Table 52. OBJECT-TYPE-CAPABILITY-NORM Example

(a) CAPABILITY (reproduced from Table 49)

capability-id	capability-category-code	capability-subcategory-code	capability-day-night-code	capability-unit-of-measure
100369	FIRE-CAPABILITY	Maximum range	—	Kilometre
100348	LAND-MANOEUVRE-CAPABILITY	Maximum speed	Day	Kilometre(s) per hour
134553	Transport capability	Sitting person count	Day	Each
567778	Transport capability	Pallet count	—	Each

(b) OBJECT-TYPE-CAPABILITY-NORM

object-type-id	capability-id	object-type-capability-norm-quantity
[ABBOT 105-mm SP Guns]	100369	10
[Combat Engineer Tractor]	100348	57
[US Tpt Coy equipped with 8-ton flat bed trucks]	134553	250
[US Tpt Coy equipped with 8-ton flat bed trucks]	567778	60

8.4 OBJECT-ITEM-CAPABILITY

8.4.1 The entity OBJECT-ITEM-CAPABILITY is defined as a perceived value of a specific CAPABILITY of an OBJECT-ITEM. OBJECT-ITEM-CAPABILITY allows an ORGANISATION to make an estimate of the actual capability of an OBJECT-ITEM to carry out a specified action whose value may differ from its OBJECT-TYPE-CAPABILITY-NORM, that is, the standard capability of its type, or for which a norm is not specified.

8.4.2 Since OBJECT-ITEM-CAPABILITY refers to items rather than types, the capabilities it represents are likely to be more dynamic than norms. A new assessment of the capability of an OBJECT-ITEM may be made by an ORGANISATION, and the same ORGANISATION may reassess capabilities as they change or as the need for reassessment arises. Each time this occurs a new instance of OBJECT-ITEM-CAPABILITY must be created. The attributes are:

a. object-item-id—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEMs. It identifies a specific OBJECT-ITEM that is the objective of an OBJECT-ITEM-CAPABILITY.

b. capability-id—The unique value, or set of characters, assigned to represent a specific CAPABILITY and to distinguish it from all other CAPABILITYs. It identifies the specific CAPABILITY that is the subject of an OBJECT-ITEM-CAPABILITY.

c. object-item-capability-index—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM-CAPABILITY for a specific OBJECT-ITEM and a specific CAPABILITY and to distinguish it from all other OBJECT-ITEM-CAPABILITYs for that CAPABILITY and that OBJECT-ITEM.

d. object-item-capability-quantity—The non-monetary numeric value representing the aggregated units of a specific CAPABILITY that is estimated to be attainable for a specific OBJECT-ITEM.

e. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

8.4.3 An example of OBJECT-ITEM-CAPABILITY is provided in Table 53. The Sub-table (a) shows two OBJECT-ITEMs: a Challenger main battle tank (MBT) and a Transport Company. The relevant instances of CAPABILITYs are shown in Sub-table (b). Sub-table (c) shows that both the MBT and the unit have LAND-MANOEUVRE-CAPABILITY specified in the form of a planning speed for either day or night conditions. The values of this capability are different, as may be expected, for an entire unit in contrast to an individual item of equipment. The third instance of OBJECT-ITEM-CAPABILITY specifies that the Transport Company has the current ability to transport persons at the rate of 275 per lift. The attribute reporting-data-id references the amplifying information, such as reporting organisation and time for these estimates.

Table 53. CAPABILITY Example

(a) OBJECT-ITEM

object-item-id	object-item-category-code
25920583 (a specific Challenger MBT)	MATERIEL
78593908 (1 Tpt Coy 7th Tpt Bn—a US Tpt Coy equipped with 8-ton flatbed trucks)	ORGANISATION

(b) CAPABILITY

Capability-id	capability-category-code	capability-subcategory-code	capability-day-night-code	capability-unit-of-measure
124773	LAND-MANOEUVRE-CAPABILITY	Planning speed	Day and night	Kilometre(s) per hour
134553	Transport capability	Sitting person count	Day	Each

(c) OBJECT-ITEM-CAPABILITY

object-item-id	capability-id	object-item-capability-index	object-item-capability-quantity	reporting-data-id
25920583	124773	1	60	rd711
78593908	124773	1	30	rd712
78593908	134553	1	275	rd713

8.4.4 OBJECT-ITEM-CAPABILITY is intended to be used to specify capabilities for an OBJECT-ITEM when those capabilities differ from the standard capabilities defined through OBJECT-TYPE-CAPABILITY-NORM or no norm is specified. Generally, OBJECT-ITEM-CAPABILITY should be used to supersede a standard capability (or, for that matter, a previous estimate) which has been defined for a given OBJECT-ITEM. If no instance of OBJECT-ITEM-CAPABILITY exists which defines a particular CAPABILITY for a specific OBJECT-ITEM, it is to be assumed that OBJECT-TYPE-CAPABILITY-NORM applies for that OBJECT-ITEM (if defined).

8.4.5 OBJECT-ITEM-CAPABILITY is not intended to be used for recording every change in the capabilities of an OBJECT-ITEM. Changes in terrain, weather conditions, and operational status can all affect the capabilities of a battlespace object. OBJECT-ITEM-CAPABILITY should only be used to record those changes in capabilities that the operational user deems necessary for the planning process.

8.5 ACTION-REQUIRED-CAPABILITY

ACTION-REQUIRED-CAPABILITY and its use are described in Chapter 13.

9. SPECIFICATION OF ESTABLISHMENT

9.1 Introduction

9.1.1 Primary relationships among subtypes of OBJECT-TYPE are specified using the concept of establishment. The basic meaning of establishment is what an OBJECT-TYPE is intended or authorised to have by some authority in terms of quantities of other OBJECT-TYPEs. One of the uses of establishment structure is to capture the type of information that is contained in tables of organisation and equipment.

9.1.2 The model splits the concept of establishment into two clusters: Establishment and Establishment-Detail.[38] The abstract view of these clusters is illustrated in Figure 55. The Establishment cluster contains the identification of each OBJECT-TYPE that is being established through the relationship "is made up through." An Establishment can authorise quantities of more than one OBJECT-TYPE and the Establishment-Detail cluster provides this specification. The Establishment-Detail cluster permits an OBJECT-TYPE to participate in Establishment as a constituent part through the relationship "is specified as part of."

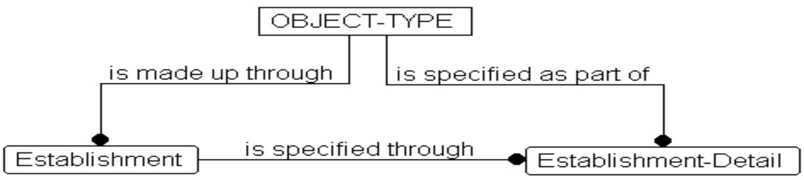


Figure 55. The Concept of Establishment

9.1.3 The general concept of Establishment has been restricted to specify only those instances that are thought to be necessary for C2. Table 54 details those Establishments that are currently deemed relevant for C2. Reading down the columns, the table shows that MATERIEL-TYPEs can be authorised to hold quantities of other MATERIEL-TYPEs (e.g., as a parts list); ORGANISATION-TYPEs can be authorised to hold quantities of MATERIEL-TYPEs, other ORGANISATION-TYPEs, and PERSON-TYPEs. PERSON-TYPEs do not have an Establishment authorised, because no requirement for multinational exchange is envisioned. FACILITY-TYPEs[39] and FEATURE-TYPEs do not have an Establishment authorised, nor do they serve as constituents in Establishments for other OBJECT-TYPEs.

Table 54. Establishment Structure

	OBJECT-TYPE That Is Being Established				
OBJECT-TYPE for Details	**FACILITY-TYPE**	**FEATURE-TYPE**	**MATERIEL-TYPE**	**ORGANISATION-TYPE**	**PERSON-TYPE**
MATERIEL-TYPE	—	—	Yes	Yes	—
ORGANISATION-TYPE	—	—	—	Yes	—
PERSON-TYPE	—	—	—	Yes	—

---

[38] The words Establishment and Establishment-Detail are capitalised here to denote notional (conceptual) entities for purposes of exposition. They represent clusters of entities in the actual model.

[39] It is assumed that an Establishment for FACILITY would be defined as part of the Establishment of the controlling ORGANISATION.

9.2 Structure

9.2.1 An establishment is defined as the authorisation or other form of specification that associates under specified conditions an OBJECT-TYPE with numbers of specific PERSON-TYPEs, MATERIEL-TYPEs, or other OBJECT-TYPEs to an ORGANISATION-TYPE or other OBJECT-TYPE. The structure is shown in Figure 56, which contains all the ESTABLISHMENT entities. For example, ORGANISATION-TYPEs have zero, one, or many establishments specified in ORGANISATION-TYPE-ESTABLISHMENT. The details, including quantities, are specified in three additional entities: ORGANISATION-TYPE-ESTABLISHMENT-*MATERIEL*-TYPE-DETAIL, ORGANISATION-TYPE-ESTABLISHMENT-*ORGANISATION*-TYPE-DETAIL, and ORGANISATION-TYPE-ESTABLISHMENT-*PERSON*-TYPE-DETAIL. MATERIEL-TYPE-ESTABLISHMENT has only a single detail entity: MATERIEL-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL.

9.2.2 The attributes in Establishment are listed below. In order to avoid excessive repetition of essentially similar attributes, notional definitions are presented in which **xxx** denotes the common object class for all "Establishment" entities; an example of each attribute is given in italics:

a. established-**xxx**-type-id—The **xxx**-type-id of a specific **XXX**-TYPE that is authorised in a specific **XXX**-TYPE-ESTABLISHMENT and whose establishment details are specified in [Establishment-Detail] (a role name for object-type-id). In simple terms, this attribute specifies the OBJECT-TYPE that is being authorised to have other OBJECT-TYPEs as part of its definition. *[established-organisation-type-id—The organisation-type-id of a specific ORGANISATION-TYPE that is authorised in a specific ORGANISATION-TYPE-ESTABLISHMENT and whose establishment details are specified in ORGANISATION-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL, ORGANISATION-TYPE-ESTABLISHMENT-ORGANISATION-TYPE-DETAIL, and ORGANISATION-TYPE-ESTABLISHMENT-PERSON-TYPE-DETAIL.]*

b. **xxx**-type-establishment-index—The unique value, or set of characters, assigned to represent a specific **XXX**-TYPE-ESTABLISHMENT for a specific "established" **XXX**-TYPE and to distinguish it from all other **XXX**-TYPE-ESTABLISHMENTs for that **XXX**-TYPE. *[organisation-type-establishment-index—The unique value, or set of characters, assigned to represent a specific ORGANISATION-TYPE-ESTABLISHMENT for a specific "established" ORGANISATION-TYPE and to distinguish it from all other ORGANISATION-TYPE-ESTABLISHMENTs for that ORGANISATION-TYPE.]*

c. **xxx**-type-establishment-effective-date—The date that designates the beginning of the period of effectiveness of a specific **XXX**-TYPE-ESTABLISHMENT. *[The date that designates the beginning of the period of effectiveness of a specific ORGANISATION-TYPE-ESTABLISHMENT.]* Note: The effective date for establishments can be given only to the nearest day.

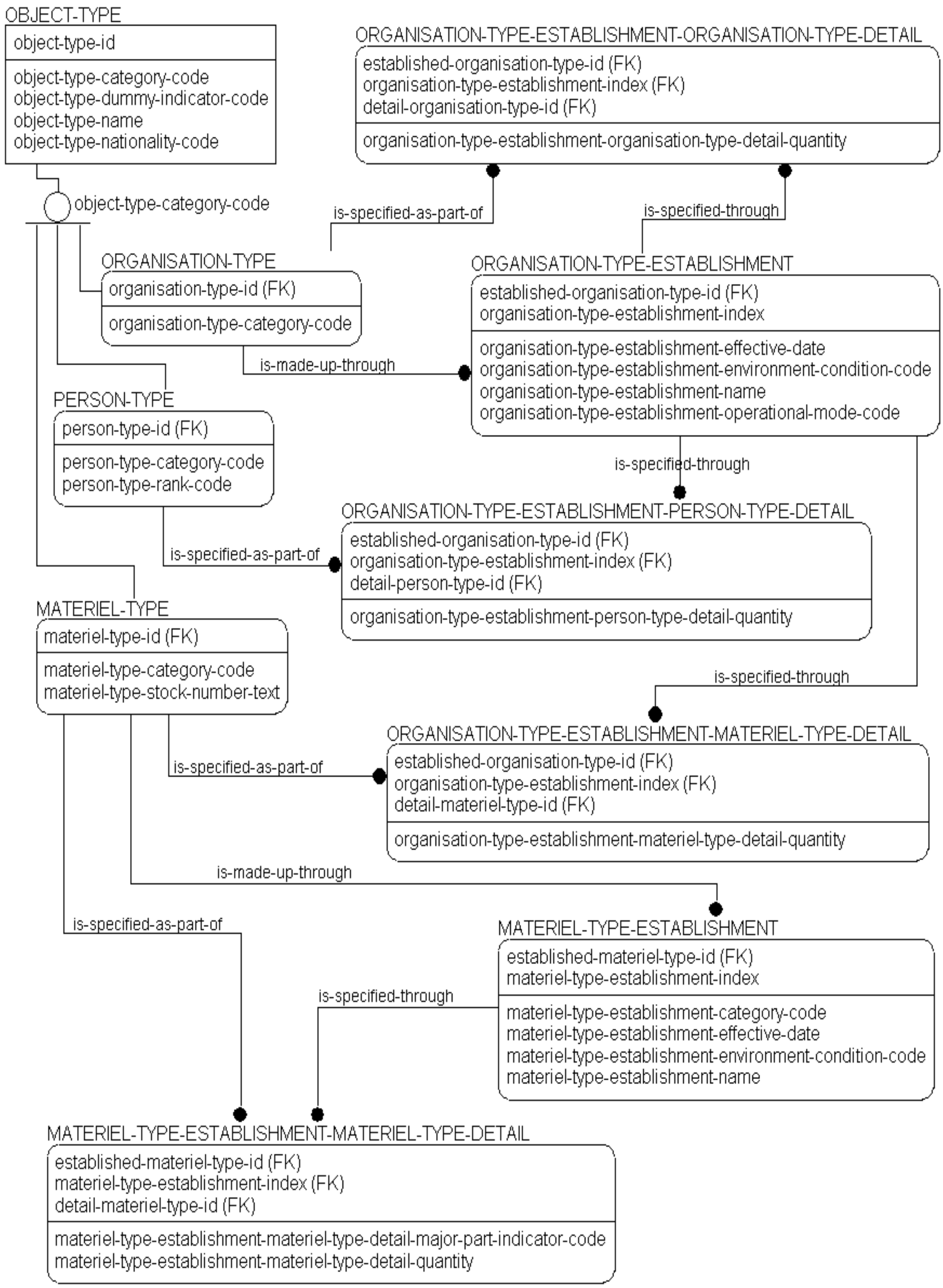


Figure 56. Establishment View

d. **xxx**-type-establishment-environment-condition-code—The specific value that represents or denotes the environmental conditions for which a specific **XXX**-TYPE-ESTABLISHMENT is authorised. The domain values are: Arctic, Desert, Jungle, Mountain, Temperate, Tropical. *[organisation-type-establishment-environment-*

condition-code—The specific value that represents or denotes the environmental conditions for which a specific ORGANISATION-TYPE-ESTABLISHMENT is authorised.]

e. xxx-type-establishment-name—A designation, expressed in a word or phrase, of a specific **XXX**-TYPE-ESTABLISHMENT. *[A designation, expressed in a word or phrase, of a specific MATERIEL-TYPE-ESTABLISHMENT.]*

9.2.3 The following additional attributes are provided only in the MATERIEL-TYPE-ESTABLISHMENT and ORGANISATION-TYPE-ESTABLISHMENT, respectively:

a. materiel-type-establishment-category-code—The specific value that represents or denotes the class of MATERIEL-TYPE-ESTABLISHMENT. The domain values are: Complete equipment, Parts catalogue.

b. organisation-type-establishment-operational-mode-code—The specific value that represents or denotes the operational mode for which a specific ORGANISATION-TYPE-ESTABLISHMENT is authorised. The domain values are: Civil support, Humanitarian support, Internal security, Peace, Peace support, Peace keeping, War.

9.2.4 An Establishment-Detail is generically defined as the number of a specific OBJECT-TYPE that is authorised by a specific Establishment. As before, **XXX** denotes the common object class for all “Establishment” entities. The symbol **YYY** denotes the name of another object class that is being counted for the **XXX** establishment. The notional and actual attributes are:

a. established-**xxx**-type-id—The **xxx**-type-id of a specific **XXX**-TYPE that is authorised in a specific **XXX**-TYPE-ESTABLISHMENT and whose establishment details are specified in [Establishment-Detail] (a role name for object-type-id). In simple terms, this attribute specifies the OBJECT-TYPE that is being authorised to have other OBJECT-TYPEs as part of its definition. *[established-organisation-type-id—The organisation-type-id of a specific ORGANISATION-TYPE that is authorised in a specific ORGANISATION-TYPE-ESTABLISHMENT and whose establishment details are specified in ORGANISATION-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL, ORGANISATION-TYPE-ESTABLISHMENT-ORGANISATION-TYPE-DETAIL, and ORGANISATION-TYPE-ESTABLISHMENT-PERSON-TYPE-DETAIL.]*

b. detail-organisation-type-id—The organisation-type-id of a specific ORGANISATION-TYPE that is authorised to be held by a particular ORGANISATION-TYPE (a role name for object-type-id).

c. detail-person-type-id—The person-type-id of a specific PERSON-TYPE that is authorised to be held by a particular ORGANISATION-TYPE (a role name for object-type-id).

d. materiel-type-establishment-materiel-type-detail-materiel-type-id—The materiel-type-id of a specific MATERIEL-TYPE that is authorised to be held by a particular MATERIEL-TYPE (a role name for object-type-id).

e. organisation-type-establishment-materiel-type-detail-mateirel-type-id—The materiel-type-id of a specific MATERIEL-TYPE that is authorised to be held by a particular ORGANISATION-TYPE (a role name for object-type-id).

f. **xxx**-type-establishment-index—The unique value, or set of characters, assigned to represent a specific **XXX**-TYPE-ESTABLISHMENT for a specific “established”

XXX-TYPE and to distinguish it from all other **XXX**-TYPE-ESTABLISHMENTs for that **XXX**-TYPE. *[organisation-type-establishment-index—The unique value, or set of characters, assigned to represent a specific ORGANISATION-TYPE-ESTABLISHMENT for a specific "established" ORGANISATION-TYPE and to distinguish it from all other ORGANISATION-TYPE-ESTABLISHMENTs for that ORGANISATION-TYPE.]]*

g. **xxx-**type-establishment-**yyy**-type-detail-quantity—The non-monetary numeric value representing the count of the numbers of a specific **YYY**-TYPE authorised to be part of a specific **XXX**-TYPE-ESTABLISHMENT-**YYY**-TYPE-DETAIL. *[organisation-type-establishment-materiel-type-detail-quantity—The non-monetary numeric value representing the count of the numbers of a specific MATERIEL-TYPE authorised to be part of a specific ORGANISATION-TYPE-MATERIEL-TYPE-DETAIL.]*

9.2.5 The following attribute only exists for MATERIEL-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL:

materiel-type-establishment-materiel-type-detail-major-part-indicator-code—The specific value that represents or denotes whether the MATERIEL-TYPE specified in a specific MATERIEL-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL is a major part. The domain values are: No, Yes.

9.2.6 The use of entities ORGANISATION-TYPE-ESTABLISHMENT and ORGANISATION-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL is illustrated with an example of war and peace establishments for a UK Armoured Regiment.

a. A UK Armd Rgt is established to have 48 operational Challenger MBTs in peace and 57 operational in war.

b. A UK Armd Rgt is established with 40 UK Armoured Regiment Standard Ammunition Packs in war.

The data for these examples are contained in Table 55.

Table 55. Example of ORGANISATION-TYPE-ESTABLISHMENT and Its Detail

(a) ORGANISATION-TYPE-ESTABLISHMENT

established-organisation-type-id	***-index	***-effective-date	***-environment-condition-code	***-operational-mode-code
Unit Type 1 (UK Army Armd Rgt)	1	Mar 89	Temperate	War
Unit Type 1 (UK Army Armd Rgt)	2	Mar 89	Temperate	Peace

(b) ORGANISATION-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL

established-organisation-type-id	***-index	detailed-materiel-type-id	***-materiel-type-detail-quantity
Unit Type 1 (UK Army Armd Rgt)	1	Materiel Type 1 (Challenger MBT)	48
Unit Type 1 (UK Army Armd Rgt)	2	Materiel Type 1 (Challenger MBT)	57
Unit Type 1 (UK Army Armd Rgt)	1	Materiel Type 8 (UK Armd Rgt Std Ammo Pack)	40

Note: *** denotes "organisation-type-establishment".

9.3 Linking OBJECT-ITEMs to Establishments

9.3.1 Any particular OBJECT-TYPE may have more than one establishment at any given time. If the direct relationship between OBJECT-TYPE and OBJECT-ITEM were to be used as a means for associating establishments with OBJECT-ITEMs, then there would be no way to specify which of the multiple establishments is actually effective for a specific OBJECT-ITEM. In fact, an OBJECT-ITEM may not have an establishment at all, even if every item must be of a type. Furthermore, an object may have more than one establishment associated with it at any one time. In order to cope with these complexities explicitly, intersecting entities[40] have been introduced between the relevant establishments of the subtypes of OBJECT-TYPE and the relevant OBJECT-ITEM subtypes. The intersecting entities, shown in Figure 57, are the following: MATERIEL-MATERIEL-TYPE-ESTABLISHMENT and ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENT. The figure has been simplified by removing descriptive attributes from all except linking entities.

9.3.2 The two linking entities are defined as follows:

a. MATERIEL-MATERIEL-TYPE-ESTABLISHMENT—A specification of a MATERIEL-TYPE-ESTABLISHMENT that is authorised for a specific MATERIEL.

b. ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENT—A specification of an ORGANISATION-TYPE-ESTABLISHMENT that is authorised for a specific ORGANISATION.

9.3.3 Each intersecting entity carries only one native key attribute generically labelled "-establishment-index.." It permits more than one Establishment to be associated with or authorised for any of the allowable subtypes of OBJECT-ITEM. The other primary attributes are foreign keys that identify the relevant Establishment. In addition, each entity has one data attribute to record effective time. The definition of the native attributes are as follows:

a. materiel-materiel-type-establishment-index—The unique value, or set of characters, assigned to represent a specific MATERIEL-MATERIEL-TYPE-ESTABLISHMENT for a specific MATERIEL and a specific MATERIEL-TYPE-ESTABLISHMENT and to distinguish it from all other MATERIEL-MATERIEL-TYPE-ESTABLISHMENTs for that MATERIEL and that MATERIEL-TYPE-ESTABLISHMENT.

b. materiel-materiel-type-establishment-effective-date—The date that designates the effective assignment of a specific MATERIEL-TYPE-ESTABLISHMENT to a specific MATERIEL.

c. organisation-organisation-type-establishment-index —The unique value, or set of characters, assigned to represent a specific ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENT for a specific ORGANISATION and a specific ORGANISATION-TYPE and to distinguish it from all other ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENTs for that ORGANISATION and that ORGANISATION-TYPE.

d. organisation-organisation-type-establishment-effective-date—The date that designates the effective assignment of a specific ORGANISATION-TYPE-ESTABLISHMENT to a specific ORGANISATION.

---

[40] "Intersecting entity" is an alternative term for "associative entity."

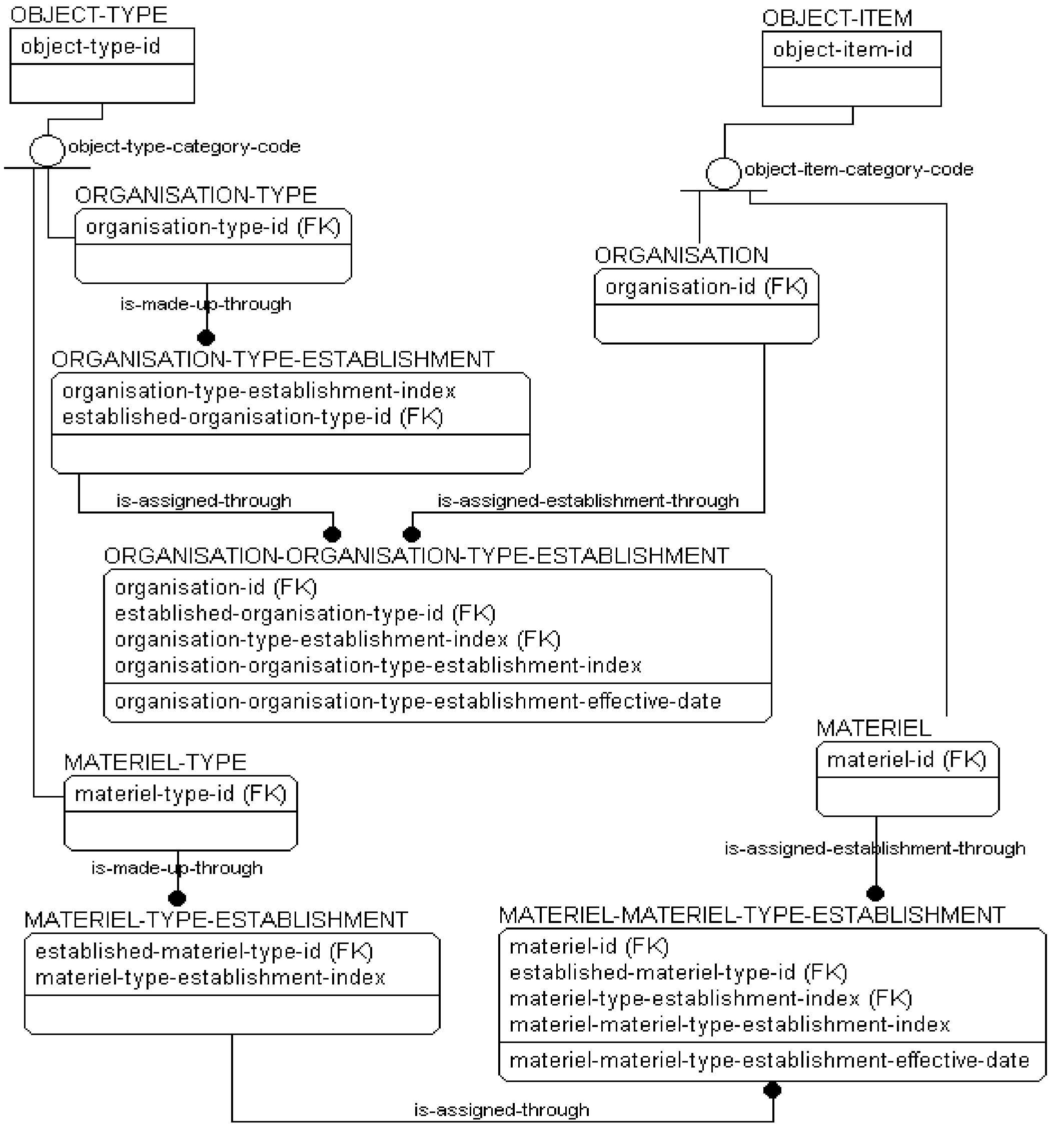


Figure 57. Establishment Relationships between OBJECT-TYPE and OBJECT-ITEM

9.3.4 As has been described in Section 9.2.4, the quantities of OBJECT-TYPE that are contained in a particular establishment are specified in the establishment detail entities that are associated with that establishment. This is illustrated in Table 56 below, which shows the basic establishment data in Sub-tables (a) and (b), such as the number of tanks established for particular unit-types in peace and in war. The associative entity ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENT then shows the UK Armoured Regiment (2 RTR) as well as the 6 Guards Tank Division changing from Peace to War establishment while the respective establishments for the unit types remain the same.

9.3.5 Sub-table (c), in relation to Sub-tables (a) and (b), shows the following:

a. The following establishments became effective in January 1985: a UK Armoured Regiment was authorised to have 48 Challenger MBTs for use in peacetime in an unspecified climate environment, and 57 Challenger MBTs for use in wartime in a desert climate.

b. A peacetime establishment (authorising 48 MBTs) was assigned to 2 RTR effective as of 6 January 1994.

c. A wartime establishment (authorising 57 MBTs) was assigned to 2 RTR effective 13 March 1994

d. 2 RTR was re-assigned the peacetime establishment effective 13 June 1994 (authorised to hold 48 MBTs again).

e. The following establishments for arctic climate became effective in March 1990: an OR Armoured Division was authorised to have 170 T64s for use in peacetime and 190 T64s for use in wartime.

f. A peacetime establishment (authorising 170 T64s) was assigned to 6 Guards Tank Division on 2 January 1994.

g. A wartime establishment (authorising 190 T64s) was assigned to 6 Guards Tank Division on 17 March 1994.

Table 56. Use of ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENT

(a) ORGANISATION-TYPE-ESTABLISHMENT

established-organisation-type-id	***** -index**	***** -effective-date**	***** -environment-condition-code**	***** -name**	***** -operational-mode-code**
1234 (UK Armd Rgt)	1	Jan 85	—	Peace TOE	Peace
1234 (UK Armd Rgt)	2	Jan 85	Desert	War TOE	War
644 (OR Armd Div)	1	Mar 90	Arctic	Peace TOE	Peace
644 (OR Armd Div)	2	Mar 90	Arctic	War TOE	War

Note: *** = organisation-type-establishment

(b) ORGANISATION-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL

established-organisation-type-id	*****-index**	**detailed-materiel-type-id**	*****-materiel-type-detail-quantity**
1234 (UK Armd Rgt)	1	68763 (Challenger MBT)	48
1234 (UK Armd Rgt)	2	68763 (Challenger MBT)	57
644 (OR Armd Div)	1	706 (T64)	170
644 (OR Armd Div)	2	706 (T64)	190

(c) ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENT

organisation-id	**established-organisation-type-id**	***** -index**	**organisation-***-index**	**organisation-***-effective-date**
1917 (2 RTR)	1234 (UK Armd Rgt)	1	1	06 Jan 94
1917 (2 RTR)	1234 (UK Armd Rgt)	2	1	13 Mar 94
1917 (2 RTR)	1234 (UK Armd Rgt)	1	2	13 Jun 94
14486 (6 Guards Tank Division)	644 (OR Armd Div)	1	1	02 Jan 94
14486 (6 Guards Tank Division)	644 (OR Armd Div)	2	1	17 Mar 94

9.3.7 In summary, the use of the Establishment and Establishment-Detail specifications, together with the intersecting entity, allow the quantity of OBJECT-TYPEs authorised to another OBJECT-TYPE to be related to a specific OBJECT-ITEM (e.g., how many tanks an actual unit of a particular type is supposed to have at a particular point in time).

(This page intentionally left blank)

10. SPECIFICATION OF HOLDING

10.1 Introduction

10.1.1 The concept of holding addresses the association of a specific object (OBJECT-ITEM) with a class of objects (OBJECT-TYPEs) where the relationship is defined by the general notion of inclusion in the sense of ownership, possession, assignment, or control. The staff officer may wish to know how many tanks of a given type a certain unit possesses and how many of them are operational, or how many enemy companies there are within a given area, or how many rounds of an ammunition type are stored in a particular arsenal, or how many cargo pallets are contained on a particular airlift aircraft, or how many mechanics does a given maintenance company have, or which types of weapons and sensors are held by a specific weapons platform (e.g., instance of an aircraft or tank)[41]. This type of information can be recorded in the data structure that is described in this chapter.

10.1.2 Holding specifies what an OBJECT-ITEM actually has or is estimated to have at a particular time. The holding may be an estimate for a future date, such as the expected count of a given type of equipment a week from now. In this way, expected replenishment or repair of materiel can be reflected in the holdings that serve as one of the sources of information for combat operations planning.

10.1.3 A previous chapter introduced the concept of establishment as a way of relating an OBJECT-TYPE to another OBJECT-TYPE. Such an establishment details what an OBJECT-TYPE is authorised to have in terms of other OBJECT-TYPEs. An establishment assigned to a particular OBJECT-ITEM shows what the OBJECT-ITEM is authorised to have. Comparison of establishment and holding can disclose information about surpluses and deficiencies.

10.2 Design Considerations

10.2.1 The key requirement in specifying holdings for the purpose of international exchange of information is assumed to be the total quantity and the part of the total that is considered to be in an operational status. It is expected that considerably more detailed status information about non-operational holdings will be required at the local unit level. Such information may be used to derive the GH4-specified data.

10.2.2 The structural concept of HOLDING at the basic entity level is shown in Figure 58. The figure illustrates the two fundamental relationships:

a. An OBJECT-ITEM is the holder cited for a HOLDING.

b. An OBJECT-TYPE is included in a HOLDING.

10.2.3 The HOLDING structure illustrated in the figure permits the participation of any of the OBJECT-ITEM subtypes with any of the OBJECT-TYPE subtypes. If any restriction is to be placed on allowable combinations of items and types for HOLDING, it would have to be done with business rules.

---

[41] The load of weapons carried by a specific close air support aircraft is a case in point.

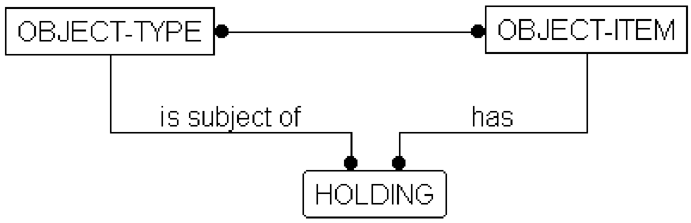


Figure 58. The Holdings of OBJECT-TYPEs by OBJECT-ITEMs

10.3 The Detailed Structure

10.3.1 HOLDING is defined as the quantity of each specific OBJECT-TYPE that is held by, installed in, or included with a specific OBJECT-ITEM. The detailed structure for representing holdings in the specification is illustrated in Figure 59. The entities OBJECT-TYPE, OBJECT-ITEM, and HOLDING correspond to those shown in the previous figure.

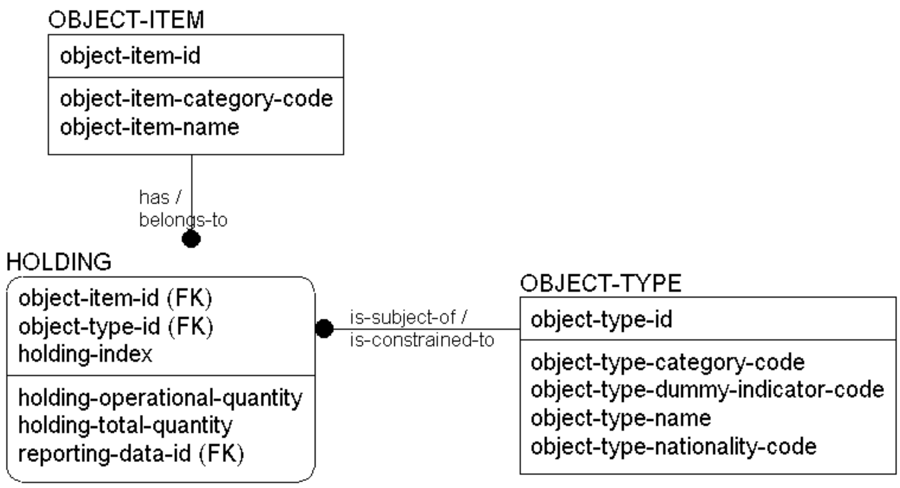


Figure 59. HOLDING as a Relationship between OBJECT-TYPEs and OBJECT-ITEM

10.3.2 The attributes are:

a. object-item-id—The unique value, or set of characters, assigned to represent a specific OBJECT-ITEM and to distinguish it from all other OBJECT-ITEMs.

b. object-type-id—The unique value, or set of characters, assigned to represent a specific OBJECT-TYPE and to distinguish it from all other OBJECT-TYPEs.

c. holding-index—The unique value, or set of characters, assigned to represent a specific HOLDING for a specific OBJECT-ITEM and a specific OBJECT-TYPE and to distinguish it from all other HOLDINGs for that OBJECT-ITEM and that OBJECT-TYPE.

d. holding-operational-quantity—The non-monetary numeric value representing in a specific HOLDING the perceived count of specific OBJECT-TYPEs that are in operational status.

e. holding-total-quantity—The non-monetary numeric value representing in a specific HOLDING the perceived total count of specific OBJECT-TYPEs.

f. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.[42]

10.3.3 The purpose of the attributes is self-explanatory with the exception of holding-index. In order to cope with multiple estimates of holdings of the same OBJECT-ITEM, each holding has its own unique identifier (holding-index, a primary key attribute). The presence of this attribute permits a historical record of the holdings of an OBJECT-ITEM to be maintained.

10.3.4 The use of HOLDING is illustrated in Table 57. The table lists the kind of records that may be maintained for own forces (in this case, two fictional units—a 101st (US) Mechanized Brigade and its parent, the 19th (US) Mechanized Division) and for reporting the estimated holdings of some opposing force units. The own force unit holdings example lists several materiel items and the total military personnel assets.

10.3.5 Specifically in the first record, the holdings of OBJECT-ITEM 41822010 (which happens to be the 101st Mechanized Brigade) include the OBJECT-TYPE 214012 (which happens to be the M113 APC). The identifying information for OBJECT-ITEMs and OBJECT-TYPEs is included in this table only for purposes of illustration and ease of comprehension. In an actual database this information would be held in related tables. The record identifies the total holding quantity to be 44, of which 41 are operational. The last column contains a cross-reference to REPORTING-DATA where the data about the holding estimate itself is specified. It should be noted that five records refer to a single reporting-data-id p1. The REPORTING-DATA data referenced through p1 would show that the reporting was done by the unit itself and that the holding is an actual count of both equipment and personnel. This example equates in broad terms to a normal unit situation report of major equipment and personnel holdings.

10.3.6 Three additional entries for the 101st Brigade have an index 41000002, since these are updates for several items reported earlier, namely, BFV, M1A1, and military personnel. All of these refer to reporting-data-id p20 that could correspond to the next reporting cycle.[43]

10.3.7 The holdings of the 19th Division follow the same table format. However, it should be noted that the initial Division holdings refer to two different reporting-data-ids: p5 and p6. Two instances of REPORTING-DATA are required in this case since the reporting was done at one time but the effective times for the holdings are different. The divisional data also contains updates, one of which shows the decrease in the number of operational AH-64 attack helicopters from 26 to 24. The change in divisional personnel includes both a decrease in the number of operationally ready personnel and an increase in the total holdings of military personnel. The latter could be due to arrival of replacements.

---

42 Since each instance of HOLDING is an estimate, REPORTING-DATA provides the amplifying information about that estimate. Part of the amplifying information identifies the organisation that is reporting the HOLDING, since the estimate is likely to have little value unless its source is known. The details of REPORTING-DATA entity are described in a subsequent chapter.

43 The update on an OBJECT-TYPE in the example is placed immediately after the original entry for ease in reading and comparing. This could correspond to the way the operational user requires the display to be organised. The actual database table order is immaterial to the user, since the data is accessed through the key attributes.

Table 57. Illustration of HOLDING

HOLDING

object-item-id	object-type-id	holding-index	holding-operational-quantity	holding-total-quantity	reporting-data-id
41822010 [101 Mech Bde]	214012 [Armoured Personnel Carrier, M113]	41000001	41	44	p1
41822010 [101 Mech Bde]	214015 [Bradley Fighting Vehicle (BFV), M-2]	41000001	94	102	p1
41822010 [101 Mech Bde]	214015 [Bradley Fighting Vehicle (BFV), M-2]	41000002	88	102	p20
41822010 [101 Mech Bde]	220012 [Howitzer SP, 155mm, M-109]	41000001	22	24	p1
41822010 [101 Mech Bde]	229005 [Tank, Main Battle, M1A1]	41000001	55	58	p1
41822010 [101 Mech Bde]	229005 [Tank, Main Battle, M1A1]	41000002	49	58	p20
41822010 [101 Mech Bde]	41600 [Military person-type]	41000001	3607	3943	p1
41822010 [101 Mech Bde]	41600 [Military person-type]	41000002	3511	3943	p20
41822012 [19 (US) Mech Div]	212010 [AD Missile System, HAWK]	41000001	6	6	p5
41822012 [19 (US) Mech Div]	221001 [Helicopter, Attack, AH-64 (APACHE)]	41000001	26	26	p5
41822012 [19 (US) Mech Div]	221001 [Helicopter, Attack, AH-64 (APACHE)]	41000002	24	26	p21
41822012 [19 (US) Mech Div]	229005 [Tank, Main Battle, M1A1]	41000001	280	290	p6
41822012 [19 (US) Mech Div]	229005 [Tank, Main Battle, M1A1]	41000002	265	290	p21
41822012 [19 (US) Mech Div]	323001 [Multiple Launch Rocket System (MLRS)]	41000001	9	9	p5
41822012 [19 (US) Mech Div]	41600 [Military person-type]	41000001	15227	15569	p5
41822012 [19 (US) Mech Div]	41600 [Military person-type]	41000002	15202	15711	p28

10.4 Business Rules

10.4.1 A fundamental challenge in maintaining organisational holding information for echeloned formations is the treatment of aggregation in moving from the lower echelons to the higher. In order to provide a uniform way of specifying holdings the following rule is postulated:

> *The total or operational quantity entered for an OBJECT-TYPE in a HOLDING of an ORGANISATION at any echelon is taken to be the aggregation of all OBJECT-TYPEs held by that ORGANISATION and all organisations at echelons below.*

10.4.2 Thus, the holding of PERSON-TYPEs by a brigade will include all the PERSON-TYPEs not only in the brigade headquarters and headquarters company but also those in all its constituent units. Likewise, the holdings of tracked vehicles comprises all those in the brigade manoeuvre battalions as well as the supporting units and the brigade headquarters. It is anticipated that the holding quantities will be entered by the staff at each echelon level.

10.4.3 One of the advantages of the rule in the previous paragraph is that the reporting of holdings at any echelon does not depend on the availability of data from the lower echelon levels. It assures that an entry is made at each echelon regardless of the status of reporting below that echelon level, even if the staff must make estimates of holdings for units below its own echelon. Furthermore, even if the replication contract for holdings is filtered by omitting data for echelons below a certain level, the recipient will not be deprived of vital information.

10.4.4 The OBJECT-TYPE under which a holding is reported may change with echelon to reflect differing needs with respect to the granularity of data. The example of Table 58 illustrates the concept. Battalion ABC has three companies under its command each with its own complement of equipment. The battalion itself has 6 APCs in its table of equipment. Sub-table (a) shows the holdings for individual units. Each company reports to the battalion its holdings as shown in the first three records. The battalion may report its total holdings at the detailed level that is shown as Option 1. In this case, each type of equipment is reported separately. On the other hand, the battalion may report its total holdings aggregated at the tank and APC level. The latter option is shown as Option 2. The choice of the type of reporting is based on operational considerations or command guidance.

Table 58. Options for Reporting Holdings at Higher Echelon

(a) Unit Holdings

Unit	Equipment Type	Total Number	Number Operational
Coy A	Tank Type 1	16	15
Coy B	Tank Type 2	12	10
Coy C	APC Type 17	18	15
Bn ABC	APC Type 11	6	5

(b) Holdings Reported by Battalion

Option 1

Equipment Type	Total Number	Number Operational
Tank Type 1	16	15
Tank Type 2	12	10
APC Type 17	18	15
APC Type 11	6	5

Option 2

Equipment Type	Total Number	Number Operational
Tank	28	25
APC	24	20

(This page intentionally left blank)

11. REPORTING-DATA

11.1 Introduction

11.1.1 The independent entity REPORTING-DATA plays a significantly different role from the other entities that have been introduced so far. The other entities specify data that directly addresses the information about battlespace objects and their types. REPORTING-DATA provides amplifying information about the data that is captured in many of the other entities.

11.1.2 A considerable amount of the information about the battlespace situation consists of interpretations of the ever-changing battlespace by persons or organisations. These generally refer to dynamic types of information—those having to do with locations, status, holdings, associations, and classifications, regardless of whether the information refers to friendly, neutral, or hostile elements in the battlespace. Much of this information is passed in the form of reports, and some of the key information associated with a report is who made it and when was it made. In addition, it is desirable to have some indication about the degree of validity of the collected information. Information about information is sometimes referred to as *metadata*, and the prime purpose in having the REPORTING-DATA entity is to record metadata that are relevant to command and control.

11.1.3 A historical record of the dynamic information in the battlespace often needs to be maintained. The REPORTING-DATA entity provides the mechanism for recording such information. The concept can be readily extended to apply not only to the past and present, but also to the future. Thus, it is just as easy to record that the *required* stockage level of an ammunition stock should be 10,000 three days from now as it is to record that the *reported* stockage level yesterday was 8,200.

11.1.4 The functionality of REPORTING-DATA is extended to enable the specification of relative time in relation to tasks that are being planned. For example, a unit may be given a mission with a starting time of D-Day and H-Hour. All tasks that are subordinate to that mission could then be specified in relation to the starting time of the mission. The starting time for a task that is to begin 24 hours later would be specified as D+1.

11.2 Overview

The functions required of the REPORTING-DATA concept entail the specification of absolute times as well as relative times. The absolute and relative time characteristics are captured in a subtype hierarchy consisting of REPORTING-DATA-ABSOLUTE-TIMING and REPORTING-DATA-RELATIVE-TIMING, respectively. The resultant structure is the REPORTING-DATA entity with its subtyping, as illustrated in Figure 60.

11.3 The REPORTING-DATA Structure

11.3.1 The REPORTING-DATA Entity

REPORTING-DATA is defined as the specification of source, quality, and timing that applies to reported data. The attributes are:

a. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

b. reporting-data-category-code—The specific value that represents or denotes the nature of a specific REPORTING-DATA. The domain values are: Assumed, Erroneous, Inferred, Planned, Reported.

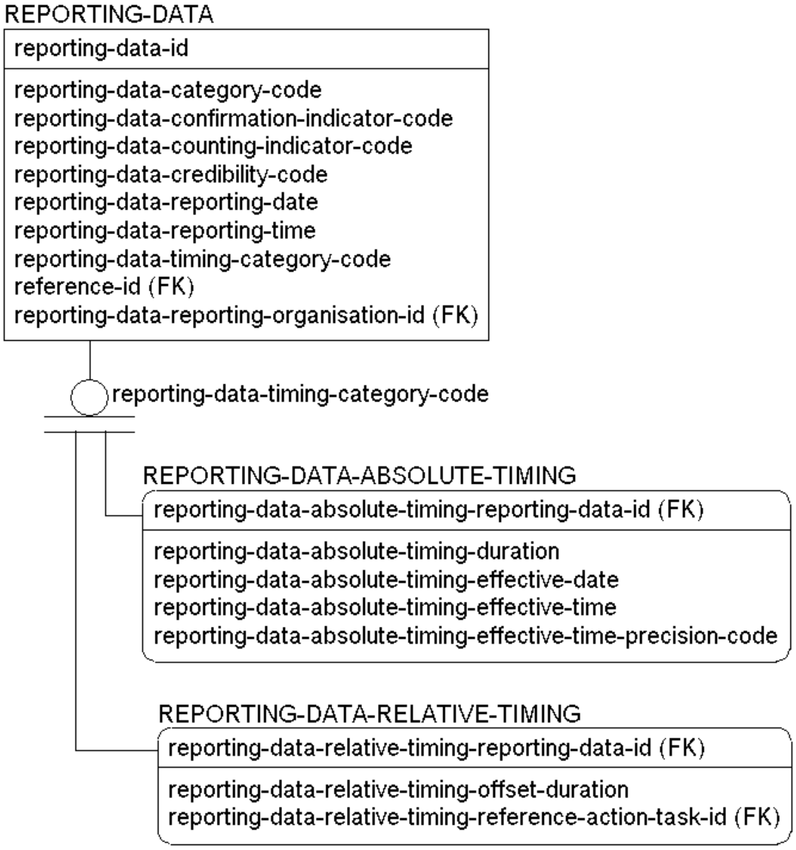


Figure 60. The Structure of REPORTING-DATA

c. reporting-data-confirmation-indicator-code—The specific value that denotes whether the data referred to by the specific REPORTING-DATA has been corroborated by an independent second source. The domain values are: Yes, No.

d. reporting-data-counting-indicator-code—The specific value that denotes whether the data referred to by a specific REPORTING-DATA is based on a count of objects. The domain values are: Yes, No.

e. reporting-data-credibility-code—The specific value that represents or denotes the degree of trustworthiness of the data referenced by a specific REPORTING-DATA. The domain values are: Estimated, Indeterminate, Suspect, Trusted.

f. reporting-data-reporting-date—The date on which the data referenced to the REPORTING-DATA is provided.

g. reporting-data-reporting-time—The time at which the data referenced to the REPORTING-DATA is provided.

h. reporting-data-timing-category-code—The specific value that represents or denotes the absolute or relative effective date and time for a specific REPORTING-DATA. It serves as a discriminator that partitions REPORTING-DATA into subtypes. The domain values are: REPORTING-DATA-ABSOLUTE-TIMING, REPORTING-DATA-RELATIVE-TIMING.

i. reference-id—The unique value assigned to represent a specific REFERENCE and to distinguish it from all other REFERENCEs.

j. reporting-data-reporting-organisation-id—The identifier of the ORGANISATION that is responsible for providing the data that is referenced by the specific REPORTING-DATA (a role name for object-item-id).

11.3.2 REPORTING-DATA ABSOLUTE-TIMING

REPORTING-DATA-ABSOLUTE-TIMING is defined as a REPORTING-DATA that specifies effective date and time that are referenced to Universal Time. The purpose of this entity is to enable a specification of effective date and time in absolute terms for any data referenced by an instance of REPORTING-DATA. The specified epoch can be in the past, the present, or the future. The attributes are:

a. reporting-data-absolute-timing-reporting-data-id—The reporting-data-id of a specific REPORTING-DATA-ABSOLUTE-TIMING (a role name for reporting-data id).

b. reporting-data-absolute-timing-duration—The non-monetary numeric value representing the aggregated units of time for which the data referenced by a specific REPORTING-DATA is determined to be effective.

c. reporting-data-absolute-timing-effective-date—The date that indicates the beginning of the period of effectiveness for the data referenced by a specific REPORTING-DATA-ABSOLUTE-TIMING.

d. reporting-data-absolute-timing-effective-time—The time that indicates the beginning of the period of effectiveness for the data referenced by a specific REPORTING-DATA.

e. reporting-data-absolute-timing-effective-time-precision-code—The specific value that represents the uncertainty in the estimate of the effective date and time for a specific REPORTING-DATA-ABSOLUTE-TIMING. The domain values are: Day, Hour, Minute, Month, Second, Week, Year, Not known.

11.3.3 REPORTING-DATA-RELATIVE-TIMING

REPORTING-DATA-RELATIVE-TIMING is defined as a REPORTING-DATA that specifies effective timing that is referenced to a specific ACTION-TASK. Relative timing makes operational sense only in relation to planned activities; consequently, the origin of the time scale is established in relation to an instance of ACTION-TASK. The attributes are:

a. reporting-data-relative-timing-reporting-data-id —The reporting-data-id of a specific REPORTING-DATA-RELATIVE-TIMING (a role name for reporting-data-id).

c. reporting-data-relative-timing-offset-duration—The non-monetary numeric value representing the aggregated units of time from a given reference for a specific REPORTING-DATA-RELATIVE-TIMING.

b. reporting-data-relative-timing-reference-action-task-id—The action-task-id of a specific ACTION-TASK that serves as the origin for the time scale of a specific REPORTING-DATA-RELATIVE-TIMING (a role name for action-task-id). The initial point of ACTION-TASK constitutes the reference.

11.4 REPORTING-DATA in Relation to Other Entities

11.4.1 The primary function of REPORTING-DATA structure is to provide amplifying information related to dynamic data. It can specify a past or future time when a piece of dynamic information is perceived to be valid, its general quality or reliability, its source, and its reporting time. This type of amplifying information allows a staff officer to compare different reports and make a sensible interpretation of the data. It also allows the staff officer to enter his own perception of reality based upon the raw data; this may be particularly applicable to the intelligence function which may produce new correlated information at a higher quality level.

11.4.2 Figure 61 illustrates the relationships that REPORTING-DATA has to other entities in the model. These are generally referred to as dynamic, since the information to be recorded in these entities is expected to be more subject to change than that represented in reference data (such as OBJECT-TYPE).

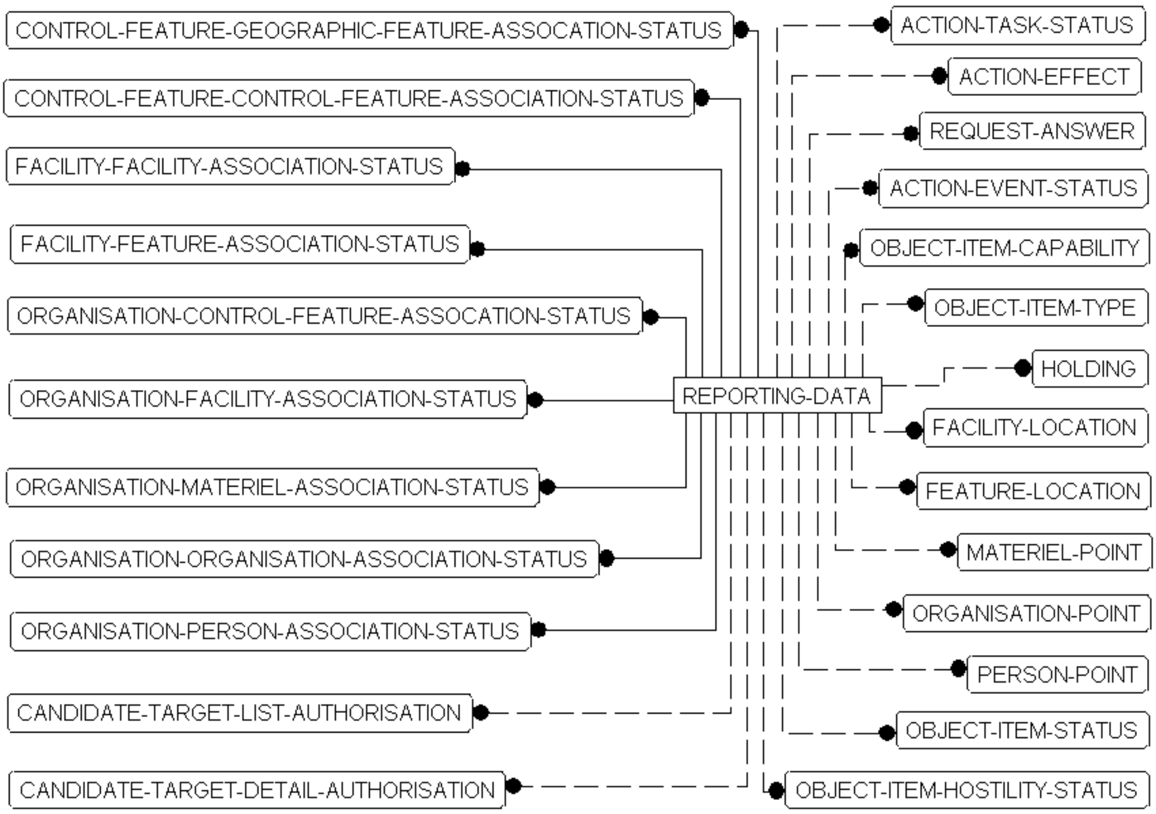


Figure 61. REPORTING-DATA and Its Relationships to Dynamic Data

11.4.3 The structure of the data model is such that the REPORTING-DATA entity is related to most, if not all, pieces of dynamic data within the data model. These pieces of information include:

a. Classification of OBJECT-ITEMs, held in the OBJECT-ITEM-TYPE entity.

b. Friend-foe-neutral indication for OBJECT-ITEMs, held in the OBJECT-ITEM-STATUS entity.

c. Operational status of individual OBJECT-ITEMs, held in the OBJECT-ITEM-STATUS entity and its subtypes.

d. Locations, held in the ORGANISATION-POINT, MATERIEL-POINT, PERSON-POINT, FACILITY-LOCATION, and FEATURE-LOCATION entities.

e. Status and quantities of OBJECT-TYPEs in the possession of OBJECT-ITEMs, held in the HOLDING entity.

f. Status of associations between pairs of OBJECT-ITEMs of different categories, held in the OBJECT-ITEM association entities.

g. Actual capabilities of individual OBJECT-ITEMs, held in the OBJECT-ITEM-CAPABILITY entity.

h. Associations between individual ORGANISATIONs and ACTION-TASKs, held in the ORGANISATION-ACTION-TASK-ASSOCIATION entity.

i. Status of subtypes of ACTION, held in the ACTION-TASK-STATUS and ACTION-EVENT-STATUS entities.

j. Authorisation of candidate targets, held in the CANDIDATE-TARGET-LIST-AUTHORISATION and CANDIDATE-TARGET-DETAIL-AUTHORISATION entities.

k. Responses to REQUESTs that are recorded as REQUEST-ANSWERs.

11.4.4 REPORTING-DATA is linked to most of these entities through a non-identifying mandatory relationship “provides applicable information for.” The relationship to association status entities is identifying. Both types of relationship require that a record in REPORTING-DATA be created for every new piece of dynamic information. The reasons are twofold. If information is provided without an indication of the source, the validity, and the applicable times, it raises questions as to the source (Who says so?), the quality (Is this information verified?), and timing (When did it happen and when was this reported?). A secondary reason is to provide a capability to refer to each item of dynamic information when that information is required to create a broader context for information—a topic discussed in the succeeding chapter.

11.5 An Example of REPORTING-DATA Usage

11.5.1 This section presents an extended example in the use of REPORTING-DATA in connection with six other entities that contain dynamic information. Table 59 consists of a group of instance tables. An instance of REPORTING-DATA may be referred to by one or more instances of dynamic data, but only from within a single table. If a unit submits a unit report by entering a number of records in different tables that together comprise the contents of the report, then as many instances of REPORTING-DATA must be created as there are tables. Such may be the case with Reporting Data 01 and Reporting Data 011, reported by 2 (SP) Cav Bde.

11.5.2 Reporting Data 01 is referred to by one record in OBJECT-ITEM-STATUS [Table 59(b)] that specifies the status of Item 0122, the 9th Cavalry Regiment[44]. Actually, the substantive status information would be found in the table ORGANISATION-STATUS that is not shown here.

11.5.3 Reporting Data 011 is referred to by three records in HOLDING [Table 59(c)]. These records specify the holdings of the units 0122, 0129, and 0345. It can be seen from the HOLDING entity that object-item 0122 has a total of 1000 items of the type 0312 and all of them are operational. The same kind of information can be determined about items 0129 and 0345.

---

[44] While there is no instance table of OBJECT-ITEM, the identity of this unit can be determined by looking at the reporting organisation of Reporting-Data 04.

11.5.4 Reporting Data 02 provides metadata about the specification of command relationships in ORGANISATION-ORGANISATION-ASSOCIATION (Sub-table (d1)) through the associative entity ORGANISATION-ORGANISATION-ASSOCIATION-STATUS (Sub-table (d2)). Unit 0345 is under full command of unit 0129 and unit 0129 is under full command of unit 0122. Since the two records in ORGANISATION-ORGANISATION-ASSOCIATION-STATUS have the same reporting-data-id both have been reported at the same time by the same organisation, and have the same effective times.

11.5.5 Reporting Data 03 provides metadata about the unit's own report about its position; this is item 0122 (the Spanish Cavalry Regiment) in Sub-table (e) with point-id 10552.

11.5.6 The 9th Spanish Cavalry Regiment reports the presence of an enemy unit (object-item 0332). The instances of REPORTING-DATA have been given the numbers 04, 041, and 042. Reporting Data 04 is referred to in Table 59(e) for the position of the enemy unit (point-id 11892); Reporting Data 041 in Table 59(f) for its classification by type (object-type-id 035), and Reporting Data 042 in Table 59(b) for its hostility status (Hostile).

11.5.7 Reporting Data 05 is associated with the classification of object-item 0331 in Sub-table (f). Reporting Data 07 refers to the determination of the hostility status (Sub-table (b)) for the same object-item by another unit.

11.5.8 The 4th Armd Regt reports under Reporting Data 06 an enemy unit (object-item-id 0333) to be at a position identified by point-id 11893. In the same report, this object has also been classified as type 035 in Table 59(f) (referred to by Reporting Data 061) and as hostile in Table 59(b) (referred to by Reporting Data 062).

11.5.9 NATO Corps G-2 reports the estimated position, bearing angle, and speed of object-item 0332 in Sub-table (e), as indicated by Reporting Data 08.

11.5.10 Reporting Datas 051 and 052 indicate the desired position for object-items 0532 and 0533 in Sub-table (e) as specified by the 2nd (SP) Cavalry Brigade.

Table 59. Example REPORTING-DATAs and Related Dynamic Information

(a1) REPORTING-DATA

***-id	***-category-code	***_confirmation-indicator-code	***_counting-indicator-code	***-credibility-code	***-reporting-date	***-reporting-time	***-timing-category-code	***-reporting-organisation-id
01	Reported	—	—	Trusted	d11	—	Absolute	[2 (SP) CAV BDE]
011	Reported	—	No	Trusted	d11	—	Absolute	[2 (SP) CAV BDE]
02	Reported	—	—	Trusted	d11	—	Absolute	[2 (SP) CAV BDE]
03	Reported	No	—	Trusted	d11	—	Absolute	[2 (SP) CAV BDE]
04	Reported	—	—	Trusted	d12	—	Absolute	0122 [9 Cavalry Rgt]
041	Reported	—	—	Estimated	d12	—	Absolute	0122 [9 Cavalry Rgt]
042	Reported	—	—	Trusted	d12	—	Absolute	0122 [9 Cavalry Rgt]
05	Reported	Yes	—	Trusted	d13	—	Absolute	[11 Cavalry Rgt]
06	Reported	—	—	Indeterminate	d14	—	Absolute	[4 Armd Rgt]
061	Reported	—	—	Indeterminate	d14	—	Absolute	[4 Armd Rgt]
062	Reported	—	—	Indeterminate	d14	—	Absolute	[4 Armd Rgt]
07	Reported	No	—	Estimated	d12	—	Absolute	0122 [9 Cavalry Rgt]
08	Reported	No	—	Estimated	d8	—	Absolute	[NATO Corps G-2]
051	Planned	—	—	—	d9	—	Absolute	[2 (SP) CAV BDE]
052	Planned	—	—	—	d9	—	Absolute	[2 (SP) CAV BDE]

Note: *** stands for "reporting-data"

(a2) REPORTING-DATA-ABSOLUTE-TIMING

***_ id	***_ duration	***_ effective-date[45]	***_ effective-time	***_ effective-time-precision-code
01	—	d1 (< d11)	—	—
011	—	d1 (< d11)	—	—
02	—	d1 (< d11)	—	—
03	—	d2 (< d11)	—	—
04	—	d3 (<d12)	—	—
041	—	d3 (<d12)	—	—
042	—	d3 (<d12)	—	—
05	—	d4 (>d13)	—	—
06	—	d5 (<d14)	—	—
061	—	d5 (<d14)	—	—
062	—	d5 (<d14)	—	—
07	—	d6 (>d12)	—	—
08	—	d88	—	—
051	—	d21	—	—
052	—	d22	—	—

Note: *** stands for “reporting-data-absolute-timing”

(b) OBJECT-ITEM-STATUS

object-item-id	object-item-status-index	object-item-status-category-code	object-item-status-hostility-code	reporting-data-id
0122	027	ORGANISATION-STATUS	Friendly	01
0332	1	ORGANISATION-STATUS	Hostile	042
0333	2	ORGANISATION-STATUS	Hostile	062
0331	1	ORGANISATION-STATUS	Assumed Friendly	07

(c) HOLDING

object-item-id	object-type-id	holding-index	holding-operational-quantity	holding-total-quantity	reporting-data-id
0122	0312	01	1000	1000	011
0129	0341	04	500	600	011
0345	0427	02	20	30	011

(d1) ORGANISATION-ORGANISATION-ASSOCIATION

***-subject-organisation-id	***-object-organisation-id	***-index	***-subcategory-code	reporting-data-id
0122	0129	06	Has full command of	02
0129	0345	01	Has full command of	02

Note: *** stands for “organisation-organisation-association”

(d2) ORGANISATION-ORGANISATION-ASSOCIATION-STATUS

***-subject-organisation-id	***-object-organisation-id	***-index	reporting-data-id	***-category-code
0122	0129	06	02	Start
0129	0345	01	02	Start

Note: *** stands for “organisation-organisation-association”

45 The symbols < and > indicates the relative timing of related reports.

(e) ORGANISATION-POINT

object-item-id	point-id	organisation-point-index	organisation-point-accuracy-quantity	organisation-point-bearing-angle	organisation-point-speed-rate	reporting-data-id
0332	11892	01	100 m	30º	40 km/hr	04
0333	11893	01	100 m	45º	60 km/hr	06
0224	22893	01	1000 m	—	—	06
0122	10552	027	—	—	—	03
0332	11892	01	100 m	30º	40 km/hr	08
0532	31212	01	—	—	—	051
0533	31213	01	—	—	—	052

(f) OBJECT-ITEM-TYPE

object-item-id	object-type-id	object-item-type-index	reporting-data-id
0331	0147	03	05
0332	035	01	041
0333	035	01	061

11.5.11 To some extent the REPORTING-DATA entity also provides a means to keep related pieces of information together by using the same reporting-data-id (and indeed the same meta information) as a pointer to more than one piece of dynamic data within the same table.

11.5.12 Not all pieces of information, however, can be linked using the same reporting-data-id. In general, different pieces of dynamic information receive different reporting-data-id's because the meta information associated is different (for example, any of the values for effective data or time, reporting date or time, credibility code, or reporting organisation are different). This implies that not all of the contents of reports and returns can be reproduced on the basis of a single reporting-data-id. A mechanism for such linking is described in the following chapter.

11.6 REFERENCE for Amplifying REPORTING-DATA

11.6.1 It is useful to be able to cite sources of information that are external to the data structures. The sources may be ADatP-3 messages, printouts of electronic mail, memoranda of telephone conversations, and other physical storage means that may be consulted as necessary. The means for this functionality is an independent entity called REFERENCE. It is defined as an allusion to a source of information that may have military significance. The structure of REFERENCE and its relationship to REPORTING-DATA is illustrated in Figure 62. The information that instances of REFERENCE point to can be associated with one or more instances of REPORTING-DATA in order to amplify the data that is referenced by REPORTING-DATA.

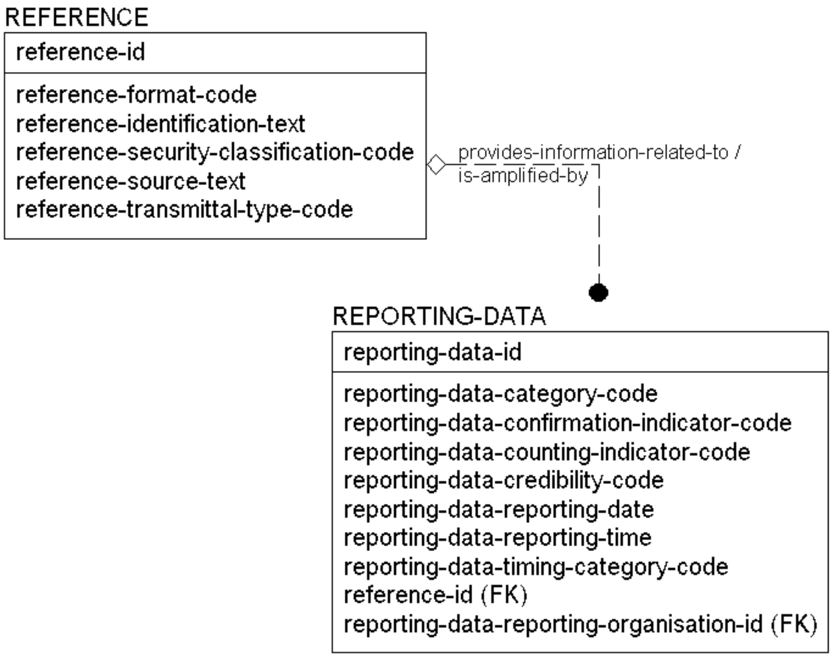


Figure 62. REFERENCE and Relationship to REPORTING-DATA

11.6.2 The attributes are:

a. reference-id—The unique value assigned to represent a specific REFERENCE and to distinguish it from all other REFERENCEs.

b. reference-format-code—The specific value that represents or denotes the prescribed format of a specific REFERENCE. The domain values are: ACP 127, AdatP-3 Version 10, AdatP-3 Version 11, AdatP-3 Version 8, USMTF, Not known, Not otherwise specified.

c. reference-identification-text—An unformatted character string assigned to describe a specific REFERENCE.

d. reference-security-classification-code—The specific value that represents the security classification of a specific REFERENCE. The domain values are: NATO UNCLASSIFIED, NATO RESTRICTED, NATO CONFIDENTIAL, NATO SECRET, COSMIC TOP SECRET.

e. reference-source-text—An unformatted character string assigned to identify the originator of the specific REFERENCE.

f. reference-transmittal-type-code—The specific value that represents or denotes the means by which a specific REFERENCE is transmitted to the recipient. The domain values are: Courier message, E-mail message, Fax message, Phone message, Radio message, Secure fax message, Telex message, Not known, Not otherwise specified.

(This page intentionally left blank)

12. CONTEXT

12.1 Introduction

12.1.1 The fact that REPORTING-DATA is linked to many other entities in the model presents an opportunity to combine information in complex ways. The primary mechanism for this is the CONTEXT structure that is set up to point to various items of information as being logically linked. This construct can be used to establish a link between derived and raw information, as in the case of an intelligence analyst deducing the presence of an enemy unit at a certain location based on a number of sighting reports. The estimate from the analyst is as much data as any other report and would be entered in the database with its own REPORTING-DATA data. Identification of the original sources could be maintained by linking REPORTING-DATA to CONTEXT.

12.1.2 CONTEXT can be used to group data without creating new information, such as a collection of data that is relevant to the situation, background, or environment for a particular ACTION. It can specify conditions that must precede an ACTION or those that should result from the execution of an ACTION. The planner can use the context information to judge the merits of a plan or order, and make changes in plans in order to respond to a changing battlespace situation. The commander can use the context information to choose between multiple courses of action. The construct can also be used to re-capture a situation as it existed at some time in the past or is expected to exist at a future date.

12.1.3 The grouping of data by means of CONTEXT can also help to manage dynamic information by helping to prevent inadvertent loss of significant information that may not be recognised as such if it is not linked to a situational description.

12.1.4 The remaining sections provide the details of CONTEXT data structure, and examples that illustrate its application for operational users. The chapter concludes with a description of a child entity of CONTEXT that enables the entry of assessments in text form.

12.2 Defining CONTEXT

12.2.1 The entity CONTEXT is defined as a reference to one or more REPORTING-DATAs. In fact, an instance of CONTEXT is essentially a collection of instances of REPORTING-DATA under a single label. Its structure is illustrated in Figure 63. Its two attributes are defined as follows:

a. context-id—The unique value, or set of characters, assigned to represent a specific CONTEXT and to distinguish it from all other CONTEXTs.

b. context-name—A designation, expressed in a word or phrase, of a specific CONTEXT.

The name permits an instance of CONTEXT to be labelled in natural language, for example, "Current situation at noon on 1 January 2000."

12.2.2 An instance of CONTEXT is created by associating with it the appropriate instances of REPORTING-DATA. This is accomplished by means of a child entity CONTEXT-ELEMENT. It is defined as a reference to a specific REPORTING-DATA that is a constituent part of a specific CONTEXT. CONTEXT-ELEMENT has only one native attribute:

context-element-index—The unique value, or set of characters, assigned to represent a specific CONTEXT-ELEMENT for a specific CONTEXT and to distinguish it from all other CONTEXT-ELEMENTs for that CONTEXT.

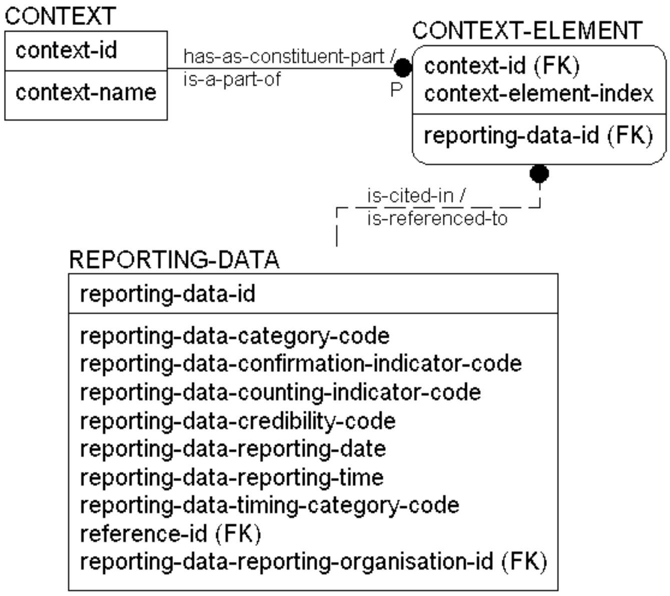


Figure 63. Structure for CONTEXT

12.3 Association of CONTEXT to REPORTING-DATA and OBJECT-ITEM

12.3.1 Introduction

12.3.1.1 The CONTEXT construct permits the specification of various combinations of instances of REPORTING-DATA, ranging from a single to multiple instances of REPORTING-DATA. The linking of CONTEXT to REPORTING-DATA enables the user to give meaning to related sets of data. For example, this structure can be used by the G2 staff officer to create links between related reports (e.g., this piece of information confirms this other piece of information and replaces yet another piece of information). In committing part of his thought process to a database, the G2 staff officer can communicate his thoughts to the G2 staff cell at a higher echelon.

12.3.1.2 The linkage of multiple REPORTING-DATAs through CONTEXT can be considered to be another REPORTING-DATA. Thus, an analyst may create an intelligence appreciation about the location of an enemy unit by basing it on a number of different observations that place nominally different units at approximately the same place and the same time. The analyst then creates an entry in ORGANISATION-POINT with an associated entry in REPORTING-DATA which points through CONTEXT to all the data that he used, for example, analyst’s Reporting Data X is associated with previous Reporting Data 1, Reporting Data 2, and Reporting Data 3.

12.3.1.3 CONTEXT can also be related directly to OBJECT-ITEM in order to provide amplifying information about an instance of OBJECT-ITEM. This information represents a package that has meaning and “context” for the staff planner. It is noteworthy that data without a direct relationships to OBJECT-ITEM within the data structure can be given significance. For example, the fact that an enemy unit is moving to a position from which it would pose an immediate threat to a friendly unit may be implicitly seen from a map display; however, it can be made explicit in situational awareness by linking the data about enemy position and movement to the position or status of the friendly unit.[46]

12.3.2 Structure of CONTEXT Relationships

12.3.2.1 CONTEXT relationships are illustrated in Figure 64.

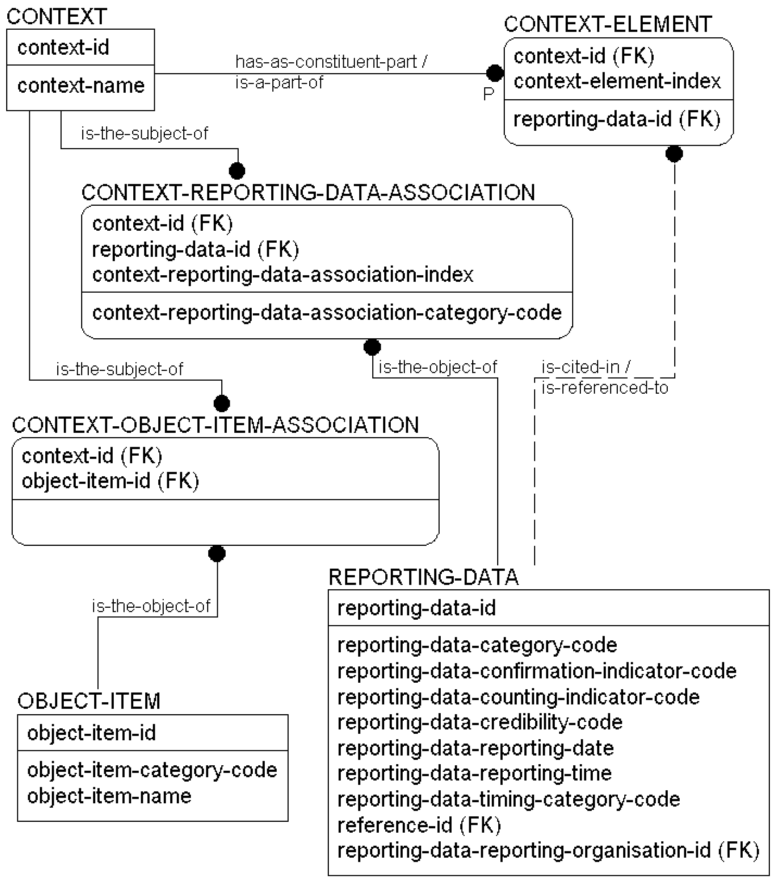


Figure 64. Relating CONTEXT to REPORTING-DATA

12.3.2.2 CONTEXT-REPORTING-DATA-ASSOCIATION is defined as a relationship of a CONTEXT as a subject and a REPORTING-DATA as an object. Its attributes are:

a. context-id—The unique value, or set of characters, assigned to represent a specific CONTEXT and to distinguish it from all other CONTEXTs.

b. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

c. context-reporting-data-association-index—The unique value, or set of characters, assigned to represent a specific CONTEXT-REPORTING-DATA-ASSOCIATION

---

[46] A third association of CONTEXT is to ACTION; it is discussed in Chapter 13.

and to distinguish it from all other CONTEXT-REPORTING-DATA-ASSOCIATIONs.

d. context-reporting-data-association-category-code—The specific value that represents or denotes the type of relation of a specific CONTEXT with a specific REPORTING-DATA. The domain values are: Implies, Is confirmed by, Is corrected by, Is defined to be, Is negated by, Is superseded by.

12.3.2.3 CONTEXT-OBJECT-ITEM-ASSOCIATION is defined as a relationship of a CONTEXT as a subject with an OBJECT-ITEM as an object. It has no native attributes.

12.4 Examples of REPORTING-DATA and CONTEXT Usage

12.4.1 Introduction

This section contains three examples that illustrate some of the uses of the CONTEXT and REPORTING-DATA structures. The first example deals with a report that turns out to be false. The second example shows how a previously reported HOLDING that has an error is supplanted by a correct report of HOLDING, and contrasts the handling of a correction with a normal update. The third example demonstrates how data that is derived from other data—as is likely in developing intelligence assessments—can be linked to the source data to document the origins of derived information.

12.4.2 Correction of Erroneous Data

12.4.2.1 The Multi-National Division (MND) reports a sighting of the 8th Bradyland Battalion at location Y at date and time (d1, t1). The reporting date and time (d2, t2) is somewhat later than (d1, t1). The data records corresponding to this report are presented in Table 60.

Table 60. Initial MND Report

(a) OBJECT-ITEM

object-item-id	object-item-category-code	object-item-name
0000001	ORGANISATION	Multi National Division
0000002	ORGANISATION	8^{th} BJ Battalion

(b) POINT

point-id
0003043 [*Y*]

(c) ORGANISATION-POINT

organisation-id	point-id	organisation-point-index	reporting-data-id
0000002	0003043	0000001	915

(d) REPORTING-DATA

***-id	***-category-code	***–confirmation-indicator-code	***–counting-indicator-code	***-credibility-code	***-reporting-date	***-reporting-time	***-timing-category-code	***-reporting-organisation-id
915 [RD_1]	Reported	No	—	Trusted	d1	t1	Absolute	0000001

Note: *** stands for "reporting-data"

(e) REPORTING-DATA-ABSOLUTE-TIMING

***_ id	***_ duration	***_ effective-date	***_ effective-time	***_ effective-time-precision-code
915	—	d2	t2	Minute

Note: *** stands for “reporting-data-absolute-timing”

12.4.2.2 At date and time (d3, t3), the MND sends another report stating that the 8th Bradyland Battalion had not been seen and, in fact, the previous report was in error. The technique for handling this new information from the data perspective entails, as the first step, the creation of a new REPORTING-DATA record with the same effective time as in the previous report. The new record is shown in Table 61.

Table 61. The REPORTING-DATA Record for Second Report

(a) REPORTING-DATA

***-id	***-category-code	***_ confirmation-indicator-code	***_ counting-indicator-code	***-reporting-date	***-reporting-time	***-timing-category-code	***-credibility-code	***-reporting-organisation-id
992 [*RD_2*]	Reported	—	—	d3	t3	Absolute	Trusted	0000001

Note: *** stands for “reporting-data”

(b) REPORTING-DATA-ABSOLUTE-TIMING

***_ id	***_ duration	***_ effective-date	***_ effective-time	***_ effective-time-precision-code
992	—	d2	t2	Minute

Note: *** stands for “reporting-data-absolute-timing”

12.4.2.3 The next step is to link the new instance of REPORTING-DATA with the previous one. This is done using the CONTEXT structure. The first REPORTING-DATA (RD1) is identified as an instance of CONTEXT-ELEMENT. The new instance of CONTEXT is linked via a CONTEXT-REPORTING-DATA-ASSOCIATION record with the second REPORTING-DATA record (RD2), using the value “Is negated by” for the context-reporting-data-association-category-code. The data records are shown in Table 62.

Table 62. Linkage of Two Instances of REPORTING-DATA

(a) CONTEXT

context-id	context-name
0555097	Incorrect Data ABC

(b) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
0555097	12301	915

(c) CONTEXT-REPORTING-DATA-ASSOCIATION

context-id	reporting-data-id	context-reporting-data-association-index	context-reporting-data-association-category-code
0555097	992	0000001	Is negated by

12.4.3 Correcting and Updating HOLDINGs

12.4.3.1 The MND reports that the 8th (Bradyland) Mechanised Infantry Company holds 12 Leopards of which 11 are operational, 5 mortars of which 4 are operational and 10 trucks of which 8 are operational (see left part of Figure 65). In the second report, the MND reports that the company has APCs instead of Leopards. The corrected holdings of the 8th Mechanised Infantry Company are displayed in the right part of the figure.

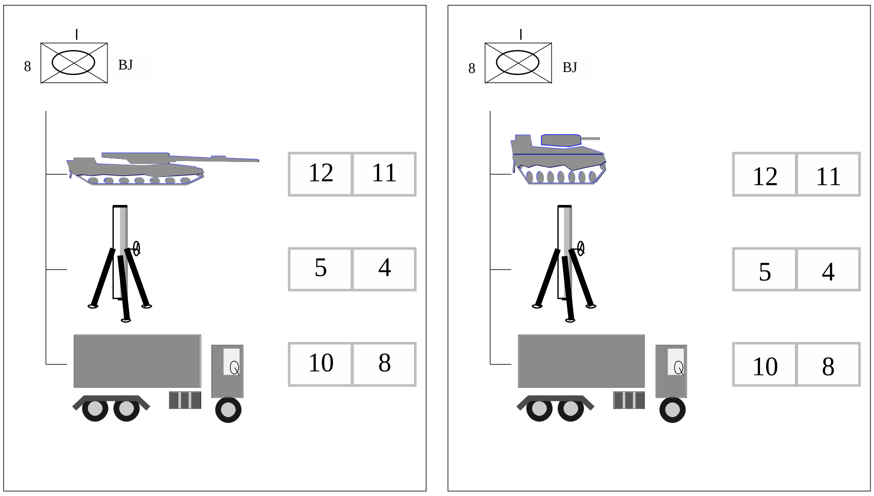


Figure 65. Two Reports about HOLDINGs of Bradyland Unit

12.4.3.2 The modelling of the two reports and their relationship requires several steps. However, the first step is the identification of the battlespace objects or types for which data is to be held. This is shown in Table 63. It is expected that the data represented in this table would be held in the database and only the data about holdings that is illustrated in the following tables would be new.

Table 63. OBJECT-ITEMs and OBJECT-TYPEs of Interest

(a) OBJECT-ITEM

object-item-id	object-item-category-code
0100001	ORGANISATION (*Multi National Division*)
0100002	ORGANISATION (*8th Bradyland Mechanised Infantry Company*)

(b) OBJECT-TYPE

object-type-id	object-type-category-code	object-type-name	object-type-nationality-code
0200001	MATERIEL-TYPE	Battle tank, heavy	[Bradyland]
0200002	MATERIEL-TYPE	Armoured personnel carrier	[Bradyland]
0200003	MATERIEL-TYPE	Weapon, mortar	[Bradyland]
0200004	MATERIEL-TYPE	Truck	[Bradyland]

12.4.3.3 The first report of Bradyland unit holdings is shown as model data in Table 64 and those for the second report in Table 65. In both cases, the three instances of HOLDING are reported under the same instance of REPORTING-DATA as permitted by the business rules adopted for the model.

Table 64. HOLDINGs of Bradyland Unit According to the First Report

(a) HOLDING

object-item-id	object-type-id	holding-index	holding-operational-quantity	holding-total-quantity	reporting-data-id
0100002	0200001	0000001	11	12	0011001
0100002	0200003	0000001	4	5	0011001
0100002	0200004	0000001	8	10	0011001

(b) REPORTING-DATA

reporting-data-id	reporting-data-category-code	reporting-data-counting-indicator-code	reporting-data-credibility-code	reporting-data-reporting-date	reporting-data-reporting-organisation
0011001 (*RD_1*)	Reported	Yes	Trusted	[d1]	0100001

Table 65. HOLDINGs of Bradyland Unit According to the Second Report

(a) HOLDING

object-item-id	object-type-id	holding-index	holding-operational-quantity	holding-total-quantity	reporting-data-id
0100002	0200002	0000001	11	12	0011002
0100002	0200003	0000002	4	5	0011002
0100002	0200004	0000002	8	10	0011002

(b) REPORTING-DATA

reporting-data-id	reporting-data-category-code	reporting-data-counting-indicator-code	reporting-data-credibility-code	reporting-data-reporting-date	reporting-data-reporting-organisation
0011001 (*RD_1*)	Reported	Yes	Trusted	[d2]	0100001

12.4.3.4 The procedure for recording the fact that the data in the first report is corrected by the data in the second report entails creating a CONTEXT that has the first instance of REPORTING-DATA (RD_1) as an element. In turn, CONTEXT is linked via CONTEXT-REPORTING-DATA-ASSOCIATION to the second instance of REPORTING-DATA (RD_2). The relationship of the first instance of REPORTING-DATA to the second is characterised by the phrase "Is corrected by." The data records are shown in Table 66.

Table 66. Indication of Data Correction

(a) CONTEXT

context-id	context-name	reporting-data-id
0023001	—	0110001 (*RD_1*)

(b) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
0023001	12304	0110001 (*RD_1*)

(c) CONTEXT-REPORTING-DATA-ASSOCIATION

context-id	reporting-data-id	context-reporting-data-association-index	context-reporting-data-association-category-code
0023001	0110002 (*RD_2*)	0000001	Is corrected by

12.4.3.5 The previous table contains data that shows that the first report was incorrect. By giving the context-reporting-data-association-category-code the value "Is corrected by" the first HOLDINGs are "marked" as wrong. The value "Is corrected by" indicates that the new HOLDINGs constitute a <u>complete</u> revision of a previous one that was in error. Merely stating in the second report that there are APCs is not sufficient. This could be interpreted as a statement that the Bradyland unit is now holding only APCs and no mortars or trucks.

12.4.3.6 An update of a report offers a comparison with the example just discussed. An update does not indicate that the previous report was wrong. It is merely new data. A specific example is shown in Figure 66. The operational HOLDINGs have decreased due to heavy damage in the course of a battle. The data records are presented in Table 67.

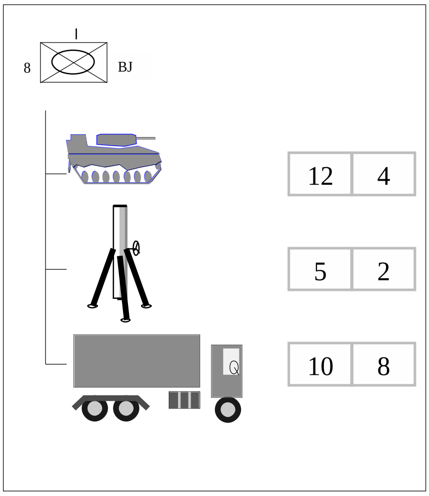


Figure 66. An Update of HOLDINGs for Bradyland Unit

Table 67. An Update of the Second Report

(a) HOLDING

object-item-id	object-type-id	holding-index	holding-operational-quantity	holding-total-quantity	reporting-data-id
0100002	0200002	0000002	4	12	0011003
0100002	0200003	0000003	2	5	0011003
0100002	0200004	0000003	8	10	0011003

(b) REPORTING-DATA

reporting-data-id	reporting-data-category-code	reporting-data-counting-indicator-code	reporting-data-credibility-code	reporting-data-reporting-date	reporting-data-reporting-organisation
0011003 (*RD_3*)	Reported	Yes	Trusted	[d3]	0100001

12.4.3.7 It should be noted that in this case there is no need to link the new instance of REPORTING-DATA with any previous one.

12.4.4 Deriving New Data from Existing Data

12.4.4.1 The example described in this section deals with the creation of new information from sets of existing data. This is sometimes referred to as fusion or correlation of data. The scenario includes reports made by two NATO nations about the movement of a Bradyland unit. One report is provided by the 2nd (DA) Battalion and two reports by the 7th (SP) Battalion. The situation is graphically portrayed in Figure 67. The first panel shows the Bradyland unit as perceived by the Danish battalion. The Danish battalion reports that the 8th Bradyland Battalion is at location W at time dt1 and is moving in a specified direction with speed v1. The second panel shows the situation as first reported by the 7th (SP) Battalion. The Spanish report that the Bradyland is located at position X at time dt2 (dt2>dt1). The second report by the Spanish indicates that the same Bradyland battalion has moved to location *Y* moving with speed v_2 in a specified direction at time *dt3* (*dt3* > *dt2*).

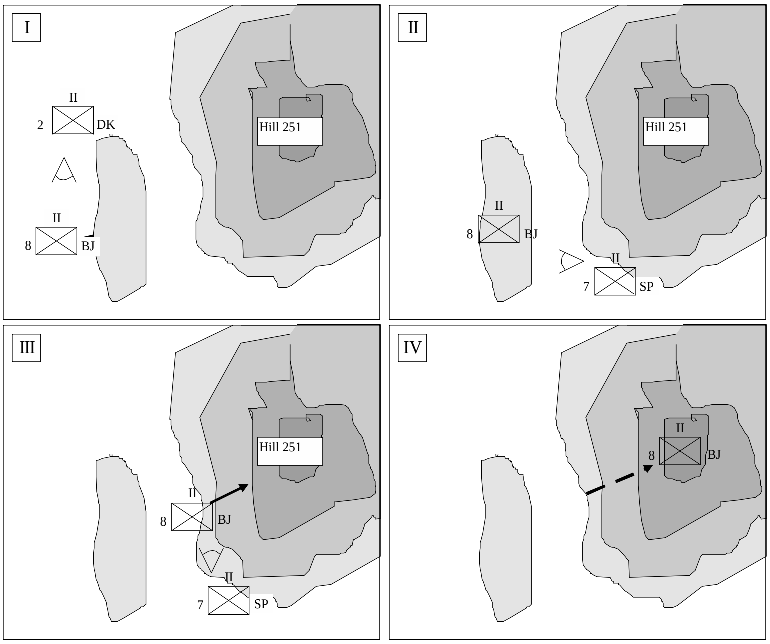


Figure 67. Four Views of the Tactical Situation

12.4.4.2 The data resulting from these reports is presented in Table 68.

Table 68. Three Reports on the Location of 8th Bradyland Battalion

(a) OBJECT-ITEM

object-item-id	object-item-category-code	object-item-name
0000001	ORGANISATION	*Multi National Division*
0000002	ORGANISATION	*2nd DK Battalion*
0000003	ORGANISATION	*7th SP Battalion*
0000004	ORGANISATION	*8th BJ Battalion*

(b) POINT

point-id
0003041 (*W*)
0003042 (*X*)
0003043 (*Y*)

(c) ORGANISATION-POINT

organisation-id	point-id	organisation-point-index	organisation-point-speed-rate	reporting-data-id
0000004	0003041	0000001	*v1*	0099007
0000004	0003042	0000001	—	0099008
0000004	0003043	0000001	*v2*	0099009

(d) REPORTING-DATA

***-id	***-category-code	***-reporting-date	***-reporting-time	***-timing-category-code	***-credibility-code	***-reporting-organisation-id
0099007	Reported	[d1]	[t1]	Absolute	Trusted	0000002
0099008	Reported	[d1]	[t2 *(t2 > t1)*]	Absolute	Trusted	0000003
0099009	Reported	[d1]	[t3 *(t3 > t2)*]	Absolute	Trusted	0000003

Note: *** stands for "reporting-data"

(e) REPORTING-DATA-ABSOLUTE-TIMING

***– id	***– duration	***–effective-date	***–effective-time	***–effective-time-precision-code
0099007	—	[d1]	[t1+12min]	Minute
0099008	—	[d1]	[t2+27min]	Minute
0099009	—	[d1]	[t3+5min]	Minute

Note: *** stands for “reporting-data-absolute-timing”

12.4.4.3 The Multi-National Division now uses the three reports to predict that the Bradyland unit is expected to be at position *Z* (Hill 251) at time *dt4*. This is depicted in the fourth panel of the previous figure. The data corresponding to this prediction is presented in Table 69.

Table 69. The Predicted Location of the 8th Bradyland Battalion

(a) POINT

point-id
0003044 (*Z*)

(b) ORGANISATION-POINT

organisation-id	point-id	organisation-point-index	reporting-data-id
0000004	0003044	0000001	0099004

(c) REPORTING-DATA

***-id	***-category-code	***-reporting-date	***-reporting-time	***-timing-category-code	***-credibility-code	***-reporting-organisation-id
0099010	Estimated	[d2 (d2>d1)]]	[t4]	Absolute	Trusted	0000001

Note: *** stands for “reporting-data”

(d) REPORTING-DATA-ABSOLUTE-TIMING

***– id	***– duration	***–effective-date	***–effective-time	***–effective-time-precision-code
0099010	—	[d2]	[t5>t4]	Minute

Note: *** stands for “reporting-data-absolute-timing”

12.4.4.4 Since the prediction by the Multi-National Division is derived from other data, it is necessary to record this fact in the database. The mechanism for this is the CONTEXT structure. The results are shown in Table 70.

Table 70. Construction of a CONTEXT Record from Three REPORTING-DATA Records

(a) CONTEXT

context-id	context-name
0555091	Data for estimation

(b) ELEMENTARY-CONTEXT

context-id	reporting-data-id
0555091	0099007
0555091	0099008
0555091	0099009

12.4.4.5 Once the CONTEXT records based on the three reports are created , the appropriate instance of CONTEXT is linked to the instance of REPORTING-DATA that points to the data derived by MND. The result is shown in Table 71.

Table 71. Linking Derived Data with Original Data

CONTEXT-REPORTING-DATA-ASSOCIATION

context-id	reporting-data-id	context-reporting-data-association-index	context-reporting-data-association-category-code
0555091	0099010	0000001	Implies

12.5 Assessments

12.5.1 Structure

12.5.1.1 Commander's or staff assessments can touch upon many topics either singly or in combination. In order to provide the capability to record assessments about the broadest range of data structures in the model, a child entity of CONTEXT has been added to the model. The structure is illustrated in Figure 68.

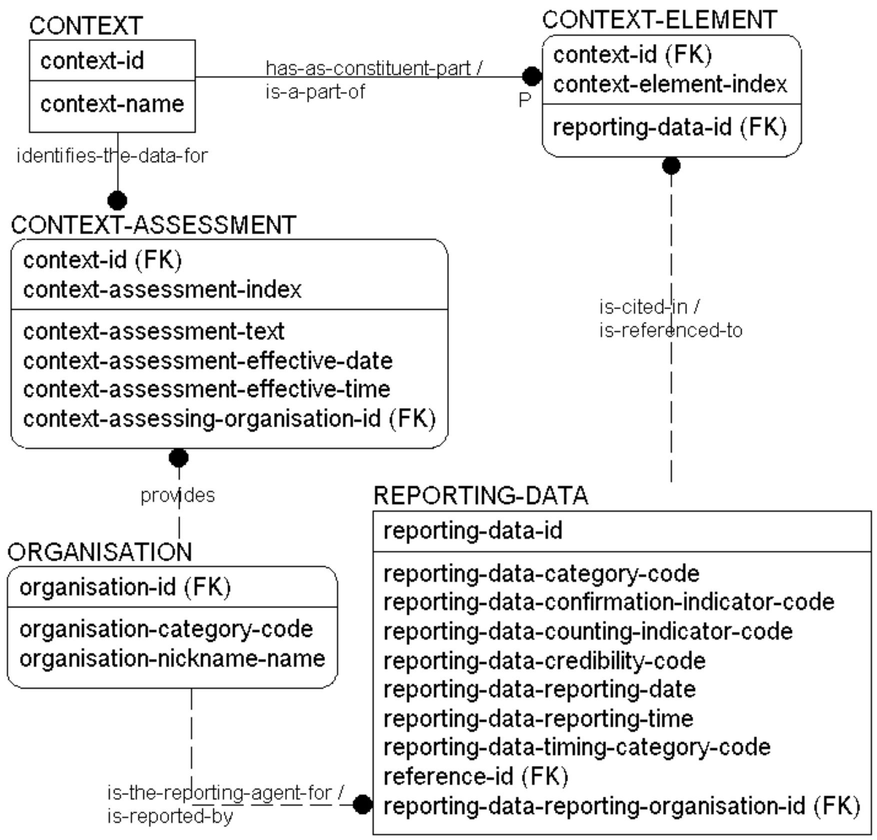


Figure 68. Data Structures for Recording Assessments

12.5.1.2 The new structure consists of the entity CONTEXT-ASSESSMENT with its non-identifying relationship to ORGANISATION. The five surrounding entities exist in the current LC2IEDM and are included for context. The basis for this construct is the role that REPORTING-

DATA plays in the model. Because REPORTING-DATA is linked to most of the data structures that carry dynamic information, it can be used to access that information indirectly.

12.5.1.3 The CONTEXT structure generalises the role that REPORTING-DATA plays by enabling the linking of data to which more than one instance of REPORTING-DATA refers. The linked data taken together constitutes a "context." A situation report would normally include various data and would require the CONTEXT structure to capture multiple elements of information that may include the identification of friendly and hostile units, their locations, their holdings, their status, and their organisational structures. By attaching a child entity for recording assessments to CONTEXT, the capability is provided to record assessments about any of the dynamic data to which an instance of CONTEXT refers.

12.5.1.4 The entity CONTEXT-ASSESSMENT is defined as a record of appraisal provided by a specific ORGANISATION regarding the information that is referenced by a specific instance of CONTEXT. The attributes are:

a. context-id—The unique value, or set of characters, assigned to represent a specific CONTEXT and to distinguish it from all other CONTEXTs.

b. context-assessment-index—The unique value, or set of characters, assigned to represent a specific CONTEXT-ASSESSMENT for a specific CONTEXT and to distinguish it from all other CONTEXT-ASSESSMENTs for that CONTEXT.

c. context-assessment-text—A statement of appraisal regarding the information that is referenced by a specific instance of CONTEXT.

d. context-assessment-effective-date—The date that indicates the beginning of the period of effectiveness for a specific CONTEXT-ASSESSMENT.

e. context-assessment-effective-time—The time that indicates the beginning of the period of effectiveness for a specific CONTEXT-ASSESSMENT.

f. context-assessing-organisation-id—The identifier of the ORGANISATION that is responsible for providing a specific CONTEXT-ASSESSMENT (a role name for object-item-id).

12.5.2 Examples

12.5.2.1 Introduction

Three examples are presented to illustrate the use of concepts described in this section. The first one concerns inadequate resources to accomplish a mission; the second one deals with differing interpretations about an observed enemy force; and the last one is a situation assessment involving a group of several types of battlespace information.

12.5.2.2 Asessment of Holding

An armoured brigade is planning its operations for the next day. It has just reported its current holdings of MBTs as well as the projections for the next 24 and 48 hours. It has been assigned an attack mission for the next day against a strong enemy force. The data is shown in Table 72 that consists of three parts. Sub-table (a) presents the actual and the predicted holdings of the type of MBT that equips the brigade. The appropriate characterisations of these data are contained in Sub-table (b). Sub-table (c) links the instances of REPORTING-DATA to CONTEXT. The commander of the brigade inserts his views on the adequacy of the available equipment for the mission at hand in Sub-table (d). He also affirms his confidence in being able to achieve the degree of operational equipment readiness that was projected for a time two days hence.

Table 72. Unit MBT Holdings

(a) HOLDING

object-item-id	object-type-id	holding-index	holding-operational-quantity	holding-total-quantity	reporting-data-id
[AR Bde]	[MBT]	1	32	56	rd1
[AR Bde]	[MBT]	2	37	56	rd2
[AR Bde]	[MBT]	3	49	56	rd3

(b) REPORTING-DATA

reporting-data-id	***-category-code	***-counting-indicator-code	***-credibility-code	***-reporting-date	***-reporting-time	***-reporting-organisation-id
rd1	Reported	Counted	Trusted	[8 Aug 98]	[0830]	[AR Bde]
rd2	Planned	—	Estimated	[8 Aug 98]	[0830]	[AR Bde]
rd3	Planned	—	Estimated	[8 Aug 98]	[0830]	[AR Bde]

Note: *** stands for “reporting-data”

(c) REPORTING-DATA-ABSOLUTE-TIMING

***–id	***–duration	***–effective-date	***–effective-time	***–effective-time-precision-code
rd1	—	[8 Aug 98]	[0800]	Minute
rd2	—	[9 Aug 98]	[0900]	Minute
rd3	—	[10 Aug 98]	[0600]	Minute

Note: *** stands for “reporting-data-absolute-timing”

(d) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
c1	1	rd1
c2	1	rd3

(e) CONTEXT-ASSESSMENT

context-id	context-assessment-index	context-assessment-text	context-assessment-effective-date	context-assessment-effective-time	context-assessing-organisation-id
c1	1	The success of the operation assigned to this unit tomorrow is questionable due the low number of MBTs expected to be operational. A delay of 24 hours would see the operational ready rate increase to 88% with a substantial improvement in the likelihood of mission success.	[8 Aug 98]	[0915]	[AR Bde]
c2	1	I am highly confident of being able to have this number of operational MBTs	[8 Aug 98]	[1120]	[AR Bde]

12.5.2.3 Assessment of Enemy Forces

12.5.2.3.1 A mechanised company, that is occupying forward defensive positions, spots enemy activity and reports the presence of an enemy battalion. Such a relatively large force is judged to be a significant threat to the company. However, the Division G-2 staff, relying on collection assets made available to them, concludes that the enemy formation that was initially sighted by the forward-deployed company is actually a platoon of combat engineers with the task of deceiving opposing observers.

12.5.2.3.2 The data structures for this example are shown in Table 73 in five parts. Sub-table (a) records the judgement of the reporting unit about the type of object that is being reported—in this case, the type assignment is made for an enemy unit. Sub-tables (b) and (c) record the appropriate reporting data. The reporting-data-id *rd4* identifies the mechanised company as the source, and reporting-data-id *rd5* points to Division G-2. Sub-table (d) links the instances of REPORTING-DATA to CONTEXT. Sub-table (e) contains three entries. The first two concern data referred to by *rd4*. The first record enters the company's concern, and the second by Division G-2 points out that the concern is misplaced. The third record provides the reason for the judgement by the G-2.

Table 73. Typing of Hostile Units

(a) OBJECT-ITEM-TYPE

object-item-id	object-type-id	object-item-type-index	reporting-data-id
[Hostile Unit X]	[Infantry Battalion]	1	rd4
[Hostile Unit X]	[Combat Engineer Platoon]	1	rd5

(b) REPORTING-DATA

reporting-data-id	***-category-code	***-credibility-code	***-reporting-date	***-reporting-time	***-reporting-organisation-id
rd4	Reported	Trusted	[10 Aug 98]	[1515]	[Mech Coy]
rd5	Reported	Trusted	[11 Aug 98]	[1035]	[Div G-2]

Note: *** stands for "reporting-data"

(c) REPORTING-DATA-ABSOLUTE-TIMING

***–id	***–duration	***–effective-date	***–effective-time	***–effective-time-precision-code
rd4	—	[10 Aug 98]	[1435]	Minute
rd5	—	[11 Aug 98]	[1020]	Minute

Note: *** stands for "reporting-data-absolute-timing"

(d) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
c3	1	rd4
c4	1	rd5

(e) CONTEXT-ASSESSMENT

context-id	context-assessment-index	context-assessment-text	context-assessment-effective-date	context-assessment-effective-time	context-assessing-organisation-id
c3	2	This rather sizeable enemy unit is a threat to our right flank.	[10 Aug 98]	[1600]	[Mech Coy]
c4	1	The enemy unit is much smaller and is not likely to be a threat.	[11 Aug 98]	[1100]	[Div G-2]
c4	2	Our analysis of reconnaissance imagery leads to the conclusion that the enemy formation is engaged in a deception operation.	[11 Aug 98]	[1145]	[Div G-2]

12.5.2.4 Assessment of a Situation Involving Own Unit Status, Holdings, and Enemy Force Disposition

12.5.2.4.1 An Allied mechanised brigade has been involved in heavy action; it has suffered significant losses both in personnel and materiel. It is now disengaged and is in the process of reconstitution. However, there are three hostile regiments that are deployed in locations to pose a threat to the brigade, particularly in its weakened state. If the enemy forces discern the status of the brigade, they may choose to use the opportunity for an immediate attack.

12.5.2.4.2 The data for this example are displayed in Table 74. Sub-table (a) shows selected holdings of the brigade: MBTs, APCs, and personnel. Sub-table (b) presents the commander's judgement about the status of the brigade. Sub-table (c) is part of the data provided by the parent Division G-2 regarding the disposition of opposing forces. The appropriate reporting data for each of the classes of information contained in the first three Sub-tables is recorded in Sub-tables (d) and (e). Sub-table (f) shows that the three separate sets of data are combined into a single CONTEXT. The brigade commander/s assessment is shown in Sub-table (g); it references data in Sub-tables (a), (b), and (c).

Table 74. Situational Awareness

(a) HOLDING

object-item-id	object-type-id	holding-index	holding-operational-quantity	holding-total-quantity	reporting-data-id
[Mech Bde]	[MBT]	1	32	58	rd6
[Mech Bde]	[APC]	1	37	54	rd6
[Mech Bde]	[Personnel]	1	1357	1806	rd6

(b) ORGANISATION-STATUS

***-id	object-item-status-index	***-operational-status-code	***-operational-status-qualifier-code
[Mech Bde]	1	Marginally operational	Moderately damaged

OBJECT-ITEM-STATUS

reporting-data-id
rd7

Note: *** stands for "organisation-status"

(c) ORGANISATION-POINT

organisation-id	point-id	organisation-point-index	reporting-data-id
[BQ AR Regt 1]	Point 1	1	rd8
[BQ AR Regt 2]	Point 2	1	rd8
[BQ Motorised Regt]	Point 3	1	rd8

(d) REPORTING-DATA

reporting-data-id	***-category-code	***-confirmation-indicator-code	***-counting-indicator-code	***-credibility-code	***-reporting-date	***-reporting-time	***-reporting-organisation-id
rd6	Reported	—	Yes	Trusted	[16 Aug 98]	[0930]	[Mech Bde]
rd7	Reported	—	—	Trusted	[16 Aug 98]	[0940]	[Mech Bde]
rd8	Reported	Yes	—	Trusted	[16 Aug 98]	[0730]	[Div G-2]

Note: *** stands for "reporting-data"

(e) REPORTING-DATA-ABSOLUTE-TIMING

***–id	***–duration	***–effective-date	***–effective-time	***–effective-time-precision-code
rd6	—	[16 Aug 98]	[0800]	Minute
rd7	—	[16 Aug 98]	[0900]	Minute
rd8	—	[16 Aug 98]	[0600]	

Note: *** stands for "reporting-data-absolute-timing"

(f) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
c1	1	rd6
c1	2	rd7
c1	3	rd8

(g) CONTEXT-ASSESSMENT

context-id	context-assessment-index	context-assessment-text	context-assessment-effective-date	context-assessment-effective-time	context-assessing-organisation-id
c1	1	This rather sizeable enemy unit is a threat to our right flank, particularly given the operational status of the Brigade. A careful watch must be kept for any change in posture and disposition.	[16 Aug 98]	[1315]	[Mech Bde]

12.6 Business Rules

The paragraphs below record the business logic that is to be applied for creating, reading, updating, and deleting REPORTING-DATA records and related information. The reading and deletion rules are optional, and are included as suggestions.

12.6.1 Creation

12.6.1.1 In general, the business rules that govern the creation of REPORTING-DATA records are very simple. Each time a piece of dynamic information is entered, a new REPORTING-DATA record needs to be created to carry the associated reporting information.

12.6.1.2 If the dynamic information that is entered in any one table consists of more than one record and all records share the same meta information, then only a single REPORTING-DATA record need to be associated with this dynamic information. (E.g., a unit reports the counted operational holding of 20 tanks, 10 APCs, and 10 trucks).

12.6.1.3 If the dynamic information consists of more than one record but those records do not share the same meta information, multiple REPORTING-DATA records need to be created to point to the individual records of dynamic information. CONTEXT-REPORTING-DATA-ASSOCIATION records may then be created to show that these REPORTING-DATAs were derived from the same report (e.g., a unit reports the counted operational holdings as listed above and the estimated holdings of opposing forces, or that the counts were made at different times).

12.6.1.4 REPORTING-DATA records and their combinations may also be created during the correlation of REPORTING-DATAs. REPORTING-DATA records can also be created during the production of plans to show the required start states or the desired outcomes of military operations.

12.6.2 Reading

12.6.2.1 Access to the information stored in the REPORTING-DATA entity can be achieved in a number of ways. The most obvious is to request the meta information associated with a piece of dynamic information. Another approach would be to place a request for all instances of REPORTING-DATA that are relevant to a military operation. A third way would be to place a query for all instances of REPORTING-DATA that are:

(a) Generated by a specific organisation

(b) Relevant within a certain period of time

(c) Reported after a certain time

(d) Related to a specified OBJECT-ITEM.

12.6.2.2 All access patterns are equally valid. It is up to the operational user to choose a single pattern or a combination of access patterns to get the most relevant information.

12.6.3 Updating

12.6.3.1 Updates are not allowed on REPORTING-DATA records and related dynamic information: each new piece of dynamic information leads to the creation of a new REPORTING-DATA record.

12.6.3.2 If a piece of entered dynamic information proves to contain errors (e.g., 40 enemy tanks happens to be 4 enemy tanks or vice versa), then a new corrected record of dynamic data must be created along with a new REPORTING-DATA. The new REPORTING-DATA is linked to the previous REPORTING-DATA through CONTEXT-REPORTING-DATA-ASSOCIATION using the values “Is a correction of” in the category code. This would allow the recipient of the new data to make adjustments to any plans or activities that may have been based on the erroneous data.

12.6.4 Deletion

12.6.4.1 The CONTEXT and REPORTING-DATA entities prevent the loss of relevant information simply by stating that no REPORTING-DATA records can be deleted if they take part in any CONTEXT. This implies that REPORTING-DATA records can be considered for deletion only if they have been disassociated from all instances of CONTEXT. This technique forces the user to re-evaluate the data associated with specific instances of REPORTING-DATA before final deletion.

12.6.4.2 CONTEXT records can be deleted whenever they are not referenced by any associative entity.

12.6.4.3 When disassociated from all CONTEXT and CONTEXT-REPORTING-DATA-ASSOCIATION records, instances of REPORTING-DATA can be deleted without any further constraints if the dynamic data associated with the specific REPORTING-DATAs are being purged. Otherwise, normal referential integrity rules hold.

13. ACTION

13.1 Introduction

13.1.1 The entity ACTION together with its substructures specifies and describes operations planned for or carried out in the battlespace. It is also used to describe unplanned happenings which are of military interest. The underlying concept for modelling ACTIONs is based on a statement in which something carries out an activity to affect something at some time. Within the model, the "something" within the basic action statement is described by an OBJECT-TYPE or an OBJECT-ITEM. Thus, OBJECT-TYPEs and OBJECT-ITEMs are related to ACTION in two distinct ways: as resources and as objectives. There is yet a third relationship between ACTION and battlespace objects that characterises the effects of ACTIONs. The three principal relationships to battlespace objects are illustrated in Figure 69 in an entity-level presentation.

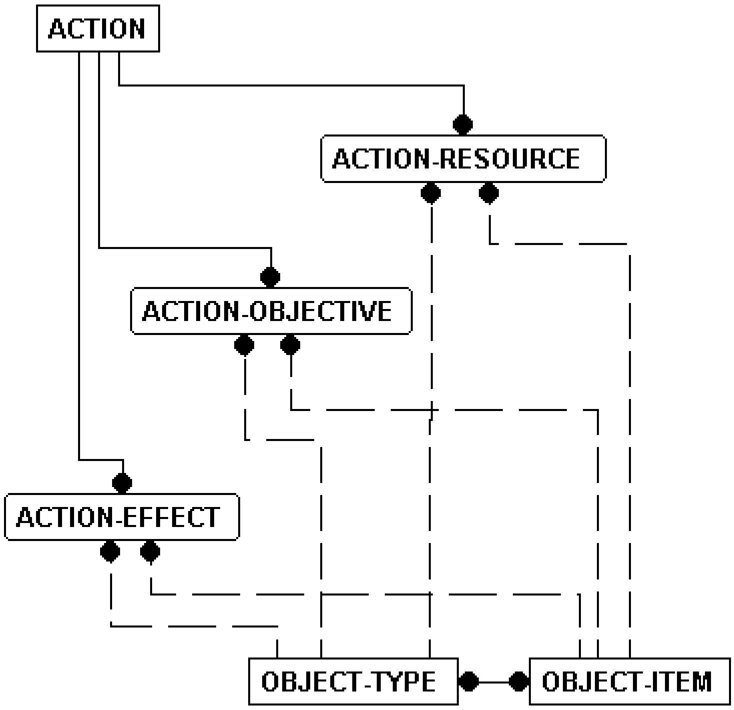


Figure 69. Primary Relationships of ACTION to Battlespace Objects

13.1.2 Resources are those OBJECT-TYPEs and OBJECT-ITEMs that carry out, or are utilised in, an ACTION, and objectives are those OBJECT-TYPEs and OBJECT-ITEMs that are the focus of the ACTION. Thus, ACTIONs can be characterised by the following statement:

RESOURCEs carry out or are utilised in **ACTION**s,
which are focused against **OBJECTIVE**s.

13.1.3 The specification of an ACTION can designate both resources and objectives, only resources, only objectives, or none of these. Some examples of the type of activity that the ACTION construct is intended to record are given in Table 75.

Table 75. Examples of Action Statements

Label	Resource	Verb Phrase	Objective
Action 1	52 Inf Div	Defend	Control Feature "Steel"
Action 2	1 (US) Corps	Destroy	6 Guards Tank Division
Action 3	1 R IRISH	Defend	Hill 126
Action 4	2 RTR	Constitute a reserve	52 Inf Div
Action 5	1 RHA	Move	Hameln, GE
Action 6	3 GE Recce Bn	Secure	Route Club

13.1.4 The linking of simple statements, such as the ones in Table 75 above, enables the construction of complex statements such as operations orders. Table 76 illustrates how the examples listed above might be related together to provide more complex statements. This table specifies that Action 2 is dependent on Action 1, which has at least three subactivities: Actions 3, 4, and 5. Further, Action 5 is time dependent on Action 6.

Table 76. Examples of Related Action Statements

Action Statement	Relationship	Related Action
52 Inf Div defend "Steel" (Action 1)	in order that	1 (US) Corps destroy 6 Guards Tank Division (Action 2)
1 R IRISH defend Hill 126 (Action 3)	is a sub-action of	Action 1
2 RTR constitute a reserve (Action 4)	is a sub-action of	Action 1
1 RHA move to Hameln (Action 5)	is a sub-action of	Action 1
1 RHA move to Hameln (Action 5)	is to start at the end of	3 GE Recce Bn secure Route Club (Action 6)

13.1.5 The specifications that are required to enable the building of complex statements by relating an ACTION to other ACTIONs are discussed in detail in the subsequent sections. The general order of presentation in this chapter is the following:

a. The specification of ACTION and its relationships to OBJECT-ITEM and OBJECT-TYPE (ACTION-RESOURCE, ACTION-OBJECTIVE, and ACTION-EFFECT) (Sections 13.2 and 13.3).

b. The subtyping of ACTION (ACTION-EVENT and ACTION-TASK) (Section 13.4).

c. The specification of the planned or actual completion status of ACTION-TASKs (Section 13.5).

d. The associations between ACTIONs that involve functional and time dependencies (Section 13.6).

e. Association of ORGANISATION with ACTIONs (Section 13.7).

f. Summary of the basic ACTION functionality listed in (a) through (d) above (Section 13.8).

g. Extensions to the basic ACTION functionality to include the addition of ACTION-RESOURCE-EMPLOYMENT as well as relationships to CAPABILITY, CONTEXT, and RULE-OF-ENGAGEMENT (Section 13.9).

h. Relationship of candidate targets to ACTION structure (Section 13.10).

13.2 Specification of ACTION

13.2.1 The entity ACTION is of prime importance to the Generic Hub since it must, together with its related entities, be capable of specifying and describing all activities, plans, events, observations, and situations that occur in the battlespace. Its attributes are defined and explained immediately below, while those of its subtypes are in the sections that follow.

13.2.2 ACTION is defined as follows: An activity, or the occurrence of an activity, that may utilise resources and may be focused against an objective. A model for the concept of ACTION is "activity type"--A succinct description of various types of activities used to facilitate reporting detected and reported events or activities (Ref. ADatP-3 FFIRN 01072). ACTIONs may include "courses of action" such as:

a. Any sequence of activities that an individual or unit may follow.

b. A possible plan open to an individual or commander that would accomplish, or is related to the accomplishment of his mission.

c. The scheme adopted to accomplish a job or mission.

d. A line of contact in an engagement.

13.2.3 The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs.

b. action-category-code—The specific value that represents or denotes the class of ACTION. It serves as a discriminator that partitions ACTION into subtypes. The domain values are: ACTION-TASK, ACTION-EVENT.

c. action-name—A designation, expressed in a word or phrase, of a specific ACTION. This may be a specific code word that is allocated to a plan, order, or operation, such as OPERATION Blue Goose.

13.2.4 The actual specification of what the ACTION is expected to accomplish is provided by a verb phrase or category code in the subtypes of ACTION in order to permit different set of choices for ACTIONs that are ACTION-TASKs versus ACTIONs that are ACTION-EVENTs. Table 77 provides example instances for ACTION. This example is developed in greater detail as additional data structure is described.

Table 77. ACTION Example Instances

ACTION

action-id	action-category-code	action-name
1	ACTION-TASK	OP GOLD
2	ACTION-TASK	OP GOLD
3	ACTION-TASK	OP LEAD
4	ACTION-TASK	OP ZINC
5	ACTION-TASK	OP GOLD
6	ACTION-TASK	OP GOLD

13.3 The Role of Objects as Resources, Objectives, and Recipients of Effects

13.3.1 Introduction

The entities ACTION-RESOURCE and ACTION-OBJECTIVE are introduced in order to relate OBJECT-ITEMs and OBJECT-TYPEs to ACTION. Since both ACTION-RESOURCE and

ACTION-OBJECTIVE can be related to either OBJECT-TYPE or OBJECT-ITEM, they are subtyped to give four additional entities: ACTION-RESOURCE-TYPE, ACTION-RESOURCE-ITEM, ACTION-OBJECTIVE-TYPE, and ACTION-OBJECTIVE-ITEM. The construct is illustrated as a view of the Generic Hub shown in Figure 70.

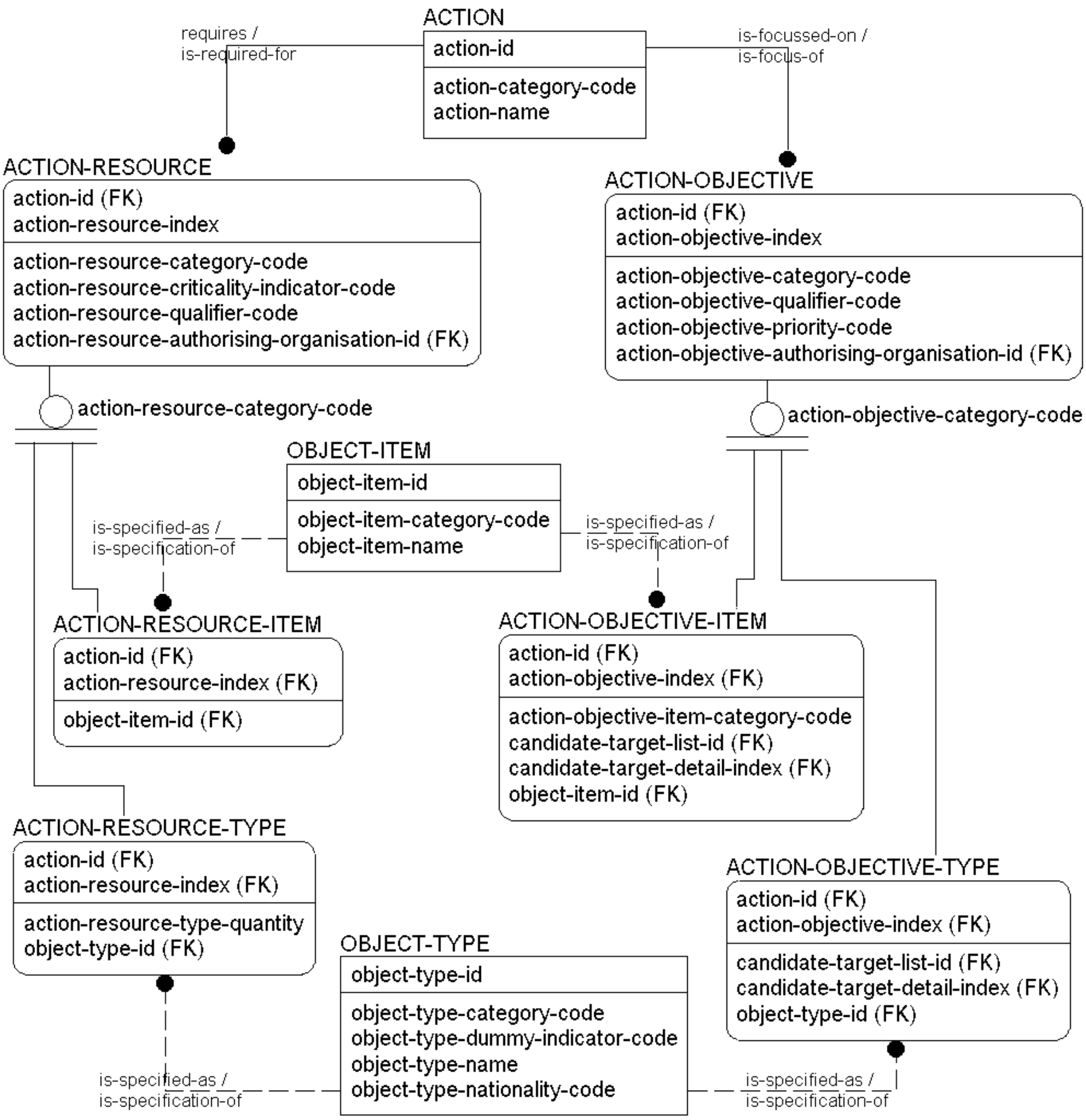


Figure 70. ACTION, ACTION-RESOURCE, and ACTION-OBJECTIVE Structure

13.3.2 ACTION-RESOURCE

The entity ACTION-RESOURCE is defined as an OBJECT-ITEM or an OBJECT-TYPE that is required, requested, allocated, or otherwise used or planned to be used in conducting a specific ACTION. ACTION-RESOURCEs are those OBJECT-ITEMs and OBJECT-TYPEs that have been specified as the things executing, things being used in or allocated to, or things whose use is qualified in some way, in carrying out a specific ACTION. The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs.

b. action-resource-index—The unique value, or set of characters, assigned to represent a specific ACTION-RESOURCE for a specific ACTION and to distinguish it from all other ACTION-RESOURCEs for that ACTION. This attribute allows more than one resource to be related to an ACTION at the same time, and the same resource to be related to the same ACTION more than once.

c. action-resource-category-code—The specific value that represents or denotes the class of ACTION-RESOURCE with respect to item or type. It serves as a discriminator that partitions ACTION-RESOURCE into subtypes. The domain values are: ACTION-RESOURCE-ITEM, ACTION-RESOURCE-TYPE.

d. action-resource-criticality-indicator-code—The specific value that denotes a judgement whether a specific resource (OBJECT-ITEM or OBJECT-TYPE) associated with a specific ACTION is essential for the effective completion of that ACTION. The domain values are: Yes, No.

e. action-resource-qualifier-code—The specific value that represents or denotes the type of restriction or other qualification applicable to a specific ACTION-RESOURCE for a specific ACTION. It lays down the type of relationship that exists between the objects and the ACTION. The domain values are: Authorised for use, Maximise use of, Minimise use of, No exploitation east of line, No exploitation north of line, No exploitation south of line, No exploitation west of line, Not authorised, Stay above area, Stay below area, Stay inside area, Stay outside area.

f. action-resource-authorising-organisation-id—The organisation-id of a specific ORGANISATION that authorises the use of a specific ACTION-RESOURCE (a role name for object-item-id).

13.3.2.1 ACTION-RESOURCE-TYPE

The entity ACTION-RESOURCE-TYPE is defined as an OBJECT-TYPE (FACILITY-TYPE, FEATURE-TYPE, MATERIEL-TYPE, ORGANISATION-TYPE, or PERSON-TYPE) to be used, excluded from use, being used, or having been used, in conducting a specific ACTION. The entity ACTION-RESOURCE-TYPE links the ACTION-RESOURCE to an OBJECT-TYPE through a non-identifying relationship. In addition, the entity contains the attribute, action-resource-type-quantity, which specifies the quantity of types to be related to the ACTION as a resource. ACTION-RESOURCE-TYPE has one native non-key attribute:

> action-resource-type-quantity—The non-monetary numeric value representing the aggregated units of a specific ACTION-RESOURCE-TYPE. In fire support, this attribute is used to specify number of fire units, number of projectiles, number of fuses, number of support weapons, number of rounds, number of propellants, number of warheads, and number of aircraft—when used to specify a resource for an ACTION.

13.3.2.2 ACTION-RESOURCE-ITEM

The entity ACTION-RESOURCE-ITEM is defined as an OBJECT-ITEM (FACILITY, FEATURE, MATERIEL, ORGANISATION, or PERSON) to be used, excluded from use, being used, or having been used, in conducting a specific ACTION. The entity ACTION-RESOURCE-ITEM links the ACTION-RESOURCE to an OBJECT-ITEM through a non-identifying relationship. Since it refers to an item rather than a type, it contains no quantity. The quantity of

OBJECT-TYPEs held by the OBJECT-ITEM identified as a resource can be found using the entity that specifies holdings.

13.3.2.3 ACTION-RESOURCE Examples

13.3.2.3.1 The next two tables illustrate the use of the entities ACTION-RESOURCE and ACTION-RESOURCE-ITEM. Table 78 shows the resource relationships that are required to link the executing units to Actions 1 through 6 that are described in Table 75. The parenthetical phrase is included as a reminder of the objective for each of the ACTIONs—a topic formally addressed in a subsequent section.

a. 52 Inf Div is allocated as an ACTION-RESOURCE to execute Action 1 (defend Control feature 'Steel') between 011200 Aug 94 and 071400 Aug 94.

b. 1 (US) Corps is allocated as an ACTION-RESOURCE to execute Action 2 (destroy 6 Guards Tank Division) between 020500 Aug 94 and 061200 Aug 94.

c. 1 R Irish is allocated as an ACTION-RESOURCE to execute Action 3 (defend Hill 126) between 020200 Aug 94 and 071400 Aug 94.

d. 2 RTR is allocated as an ACTION-RESOURCE to execute Action 4 (constitute a reserve for 52 Inf Div) between 020230 Aug 94 and 071400 Aug 94.

e. 1 RHA is allocated as an ACTION-RESOURCE to execute Action 5 (move to Hameln) between 011000 Aug 94 and 011800 Aug 94.

f. 3 GE Recce Bn is allocated as an ACTION-RESOURCE to execute Action 6 (secure Route Club) between 010300 Aug 94 and 011800 Aug 94.

Table 78. ACTION-RESOURCE Example

(a) ACTION (Repeated from Table 77)

action-id	action-category-code	action-name
1	ACTION-TASK	OP GOLD
2	ACTION-TASK	OP GOLD
3	ACTION-TASK	OP LEAD
4	ACTION-TASK	OP ZINC
5	ACTION-TASK	OP GOLD
6	ACTION-TASK	OP GOLD

(b) ACTION-TASK[47]

action-task-id	action-task-planned-start-date	action-task-planned-start-time	action-task-planned-end-date	action-task-planned-end-time	action-task-verb-phrase-code
1	[d1 01 Aug 94]	[1200]	[d2 07 Aug 94]	[1400]	Defend
2	[d3 02 Aug 94]	[0500]	[d4 06 Aug 94]	[2300]	Destroy
3	[d5 02 Aug 94]	[0200]	[d2]	[1400]	Defend
4	[d6 02 Aug 94]	[0230]	[d2]	[1400]	Constitute a reserve
5	[d7 01 Aug 94]	[1000]	[d8 01 Aug 94]	[1800]	Move to
6	[d9 01 Aug 94]	[0300]	[d8]	[1800]	Secure

(c) ACTION-RESOURCE

action-id	action-resource-index	action-resource-category-code	action-resource-criticality-indicator-code	action-resource-qualifier-code	action-resource--authorising-organisation-id

[47] Details of ACTION-TASK are presented in a subsequent section. The entity is included here to provide amplifying information in the form of the task verb phrase and the timing of the ACTIONs.

1	1	ACTION-RESOURCE-ITEM	—	Authorised for use	—
2	1	ACTION-RESOURCE-ITEM	—	Authorised for use	—
3	1	ACTION-RESOURCE-ITEM	—	Authorised for use	—
4	1	ACTION-RESOURCE-ITEM	—	Authorised for use	—
5	1	ACTION-RESOURCE-ITEM	—	Authorised for use	—
6	1	ACTION-RESOURCE-ITEM	—	Authorised for use	—

(d) ACTION-RESOURCE-ITEM

action-id	action-resource-index	object-item-id
1	1	52 [52 Inf Div]
2	1	107 [1 US Corps]
3	1	3051 [1 R IRISH]
4	1	1917 [2 RTR]
5	1	1793 [1 RHA]
6	1	1933 [3 GE Recce Bn]

13.3.2.3.2 Table 79 shows the resources allocated to a particular action (with an action-id 10) that requires an attack helicopter company to reach an area of operations using any one of four air corridors. These resources are subtypes of OBJECT-ITEM, in this case, CONTROL-FEATUREs.

Table 79. Additional ACTION-RESOURCE Example

(a) ACTION-RESOURCE

action-id	action-resource-index	action-resource-category-code	action-resource-qualifier-code
10 [Cross]	11	ACTION-RESOURCE-ITEM	Authorised for use
10 [Cross]	12	ACTION-RESOURCE-ITEM	Authorised for use
10 [Cross]	13	ACTION-RESOURCE-ITEM	Authorised for use
10 [Cross]	14	ACTION-RESOURCE-ITEM	Authorised for use

(b) ACTION-RESOURCE-ITEM

action-id	action-resource-index	object-item-id
10 [Cross]	11	Control Feature 1 [Air Corridor DELTA]
10 [Cross]	12	Control Feature 2 [Air Corridor GOLF]
10 [Cross]	13	Control Feature 3 [Air Corridor HOTEL]
10 [Cross]	14	Control Feature 4 [Air Corridor SIERRA]

13.3.3 ACTION-OBJECTIVE

The entity ACTION-OBJECTIVE is defined as the focus, in terms of an OBJECT-ITEM or OBJECT-TYPE, in conducting a specific ACTION. ACTION-OBJECTIVEs are those OBJECT-TYPEs or OBJECT-ITEMs that are specified to be (or excluded from) the focus of an ACTION. In the same way as ACTION-RESOURCE, ACTION-OBJECTIVE has been subtyped to allow links to OBJECT-TYPE and OBJECT-ITEM. In addition, ACTION-OBJECTIVE-ITEM includes a category code that allow it to be subtyped in order to cater for the requirements of different functional extensions[48]. The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs.

[48] The fire support extension, for example, treats TARGET as a subtype of ACTION-OBJECTIVE-ITEM.

b. action-objective-index—The unique value, or set of characters, assigned to represent a specific ACTION-OBJECTIVE for a specific ACTION and to distinguish it from all other ACTION-OBJECTIVEs for that ACTION. It uniquely distinguishes between different focuses of a specific ACTION.

c. action-objective-category-code—The specific value that represents or denotes the class of ACTION-OBJECTIVE with respect to item or type. It serves as a discriminator that partitions ACTION-OBJECTIVE into subtypes. The domain values are: ACTION-OBJECTIVE-TYPE, ACTION-OBJECTIVE-ITEM.

d. action-objective-qualifier-code—The specific value that represents or denotes a restriction or other qualification applicable to a specific ACTION-OBJECTIVE for a specific ACTION. The domain values are: Authorised, No exploitation east of line, No exploitation north of line, No exploitation south of line, No exploitation west of line, Not authorised, Stay above area, Stay below area, Stay inside area, Stay outside area.

e. action-objective-priority-code—The specific value that represents or denotes the rank of importance of a specific ACTION-OBJECTIVE in the view of the initiating ORGANISATION. Commanders will be required to give guidance in the classification of target and action priorities within their ORGANISATION. The domain values are: Priority 1, Priority 2, Priority 3, Priority 4, Priority 5.

f. action-objective-authorising-organisation-id—The organisation-id of a specific ORGANISATION that authorises the use of a specific ACTION-OBJECTIVE (a role name for object-item-id).

13.3.3.1 ACTION-OBJECTIVE-TYPE

The entity ACTION-OBJECTIVE-TYPE is defined as a class of battlespace object (FACILITY-TYPE, FEATURE-TYPE, MATERIEL-TYPE, ORGANISATION-TYPE, or PERSON-TYPE) as the focus of a specific ACTION.

13.3.3.2 ACTION-OBJECTIVE-ITEM

The entity ACTION-OBJECTIVE-ITEM is defined as a battlespace object (FACILITY, FEATURE, MATERIEL, ORGANISATION, or PERSON) as the focus of a specific ACTION. ACTION-OBJECTIVE-ITEM has one native non-key attribute:

action-objective-item-category-code—The specific value that represents or denotes the class of an ACTION-OBJECTIVE-ITEM. It serves as a discriminator that partitions ACTION-OBJECTIVE into subtypes. The domain values are TARGET[49], Not otherwise specified.

13.3.3.3 ACTION-OBJECTIVE Example

The following statements build on a previous example by specifying objectives for Actions 1 through 6 in Table 75:

a. Action 1 (52 Inf Div (M) defend) is focused against the River Weser (which coincides with Control Feature “Steel”). The ACTION is to ensure no enemy penetration and is to be completed by 1400 hours on 7 Aug 94.

[49] TARGET as a subtype of ACTION-OBJECTIVE-ITEM is intended to capture information that is needed to characterise an objective as the focus of hostile activity. It is described in Chapter 15.

b. Action 2 (1(US) Corps destroy) is focused against 6 Guards Tank Division. The ACTION is to achieve destruction of the enemy.

c. Action 3 (1 R IRISH defend) is focused against Hill 126. The ACTION is to be completed at the same time as Action 1.

d. Action 4 (2 RTR constitute a reserve) has as its objective 52 Inf Div (M) for which it is in reserve.

e. Action 5 (1 RHA move to) is focused against Hameln. The ACTION is to be completed by 1800 hours on 1 Aug 94.

f. Action 6 (3 GE Recce Bn secure) is focused against Route Club. The ACTION is to be completed at the same time as Action 5.

Table 80 illustrates the data required to represent the objective statements (a) through (f).

Table 80. ACTION-OBJECTIVE Example

(a) ACTION (repeated from Table 77)

action-id	action-category-code	action-name
1	ACTION-TASK	OP GOLD
2	ACTION-TASK	OP GOLD
3	ACTION-TASK	OP LEAD
4	ACTION-TASK	OP ZINC
5	ACTION-TASK	OP GOLD
6	ACTION-TASK	OP GOLD

(b) ACTION-TASK (repeated from Table 78)

action-task-id	action-task-planned-start-date	action-task-planned-start-time	action-task-planned-end-date	action-task-planned-end-time	action-task-verb-phrase-code
1	[d1 01 Aug 94]	[1200]	[d2 07 Aug 94]	[1400]	Defend
2	[d3 02 Aug 94]	[0500]	[d4 06 Aug 94]	[2300]	Destroy
3	[d5 02 Aug 94]	[0200]	[d2]	[1400]	Defend
4	[d6 02 Aug 94]	[0230]	[d2]	[1400]	Constitute a reserve
5	[d7 01 Aug 94]	[1000]	[d8 01 Aug 94]	[1800]	Move to
6	[d9 01 Aug 94]	[0300]	[d8]	[1800]	Secure

(c) ACTION-OBJECTIVE

action-id	action-objective-index	action-objective-category-code	action-objective-qualifier-code	action-objective-priority-code	action-objective-authorising-organisation-id
1	1	ACTION-OBJECTIVE-ITEM	Authorised	1	—
2	1	ACTION-OBJECTIVE-ITEM	Authorised	1	—
3	1	ACTION-OBJECTIVE-ITEM	Authorised	3	—
4	1	ACTION-OBJECTIVE-ITEM	Authorised	1	—
5	1	ACTION-OBJECTIVE-ITEM	Authorised	4	—
6	1	ACTION-OBJECTIVE-ITEM	Authorised	2	—

(d) ACTION-OBJECTIVE-ITEM

action-id	action-objective-index	action-objective-item-category-code	object-item-id
1	1	Not otherwise specified	15 [Control feature “Steel”]
2	1	TARGET	14486 [6 Guards Tank Division]
3	1	TARGET	16 [Feature—Hill 126]
4	1	TARGET	57 [52 Inf Div]
5	1	Not otherwise specified	17 [Feature—Hameln]
6	1	Not otherwise specified	18 [Control feature—Route Club]

13.3.3.4 Using ACTION-OBJECTIVEs to Specify Targeting Guidance and Complex Sets of Objectives

13.3.3.4.1 Many ACTIONs have complex sets of objectives. An enemy airfield serves as an example.

13.3.3.4.2 Initially, an airfield is to be the focus of intelligence collection. The results may include a list of OBJECT-ITEMs that include MATERIEL (specific air-defence radars), MATERIEL-TYPEs (aircraft types, vehicle types), FACILITYs (refuelling facility, rearming facility, air traffic control facility, runways, access roads), FACILITY-TYPEs (mobile air-defence control facility types, parking aprons), and ORGANISATION-TYPEs (type of air squadron, type of air-defence brigade).

13.3.3.4.3 Later, the objective changes to the destruction of the operational capability of the airfield—a large FACILITY. An ACTION-TASK would be defined having the airfield as its ACTION-OBJECTIVE. Additional subordinate ACTIONs could then be defined, specifying various elements or groups of elements of the airfield as ACTION-OBJECTIVEs as well as the means and timing of the attacks.

13.3.4 ACTION-EFFECT

13.3.4.1 Introduction

There is a need to monitor the effectiveness of actions that are executed in the battlespace as well as to estimate the potential effects of planned or pending ACTIONs. The results of applying ACTION-RESOURCEs for ACTIONs focused against certain ACTION-OBJECTIVEs are measured in terms of ACTION-EFFECT. Furthermore, ACTION-EFFECT can express intended or unintended side effects on OBJECT-ITEMs and OBJECT-TYPEs. Operational performance may be evaluated by comparing ACTION-EFFECTs with stated ACTION-OBJECTIVEs.

13.3.4.2 Specification of ACTION-EFFECT

13.3.4.2.1 The entity ACTION-EFFECT specifies the effects of the ACTION against OBJECT-TYPEs and OBJECT-ITEMs. ACTION-EFFECT is defined as a perceived effectiveness of a specific ACTION against a specific battlespace object or its class. The estimate may be for a pending ACTION or the effect that may be achieved using the specified resources, or for an ACTION that has been partially or fully completed. The data view is illustrated in Figure 71. The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs.

b. action-effect-index—The unique value, or set of characters, assigned to represent a specific ACTION-EFFECT for a specific ACTION and to distinguish it from all other ACTION-EFFECTs for that ACTION.

c. action-effect-category-code—The specific value that represents or denotes the class of an ACTION-EFFECT with respect to item or type. It serves as a discriminator that partitions ACTION-EFFECT into subtypes. The domain values are: OBJECT-ITEM-ACTION-EFFECT, OBJECT-TYPE-ACTION-EFFECT.

d. action-effect-description-code—The specific value that represents or denotes the type of outcome of a specific ACTION that is being estimated or recorded. The attribute specifies what effect the ACTION is having on the specified OBJECTs. The domain values are: Burning, Captured, Consumed, Destroyed (K-kill), Firepower kill (F-kill), Forced to flee, Identified, Illuminated, Killed, Light damage, Mobility kill (M-kill), Moderate damage, Neutralised, Non-battle casualty, Severe damage, Suppressed, Wounded, Not known, Not otherwise specified.

f. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

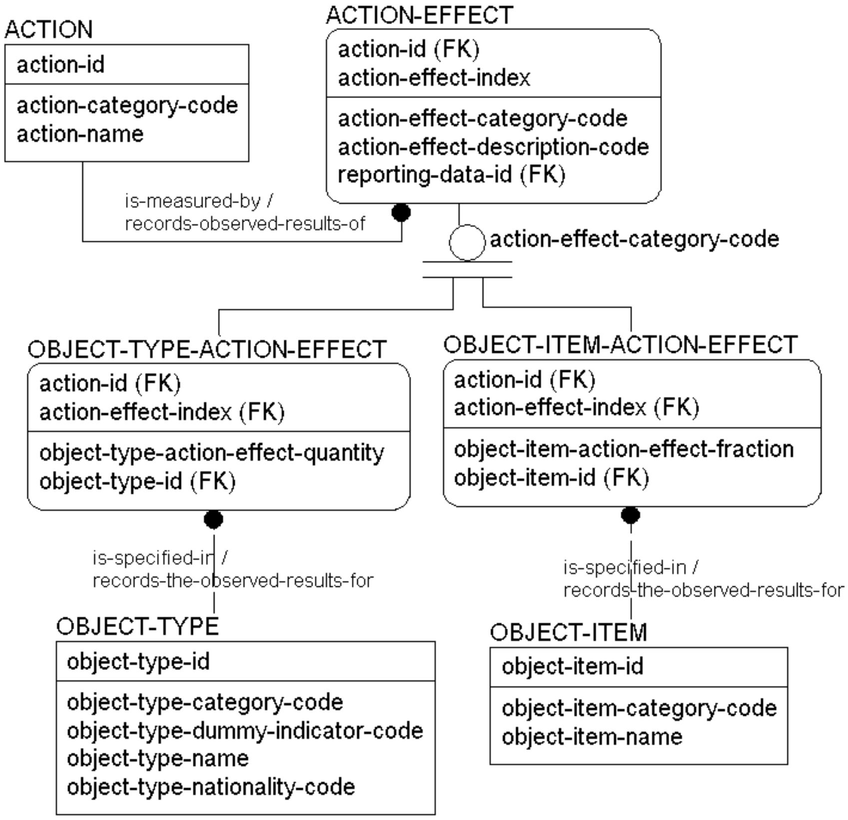


Figure 71. ACTION-EFFECT

13.3.4.2.2 It should be noted that this structure permits the capture of information about effects of ACTIONs on objects that are not necessarily the objectives of the ACTION. It also permits the effects of an ACTION to be reported in terms of OBJECT-ITEMs or OBJECT-TYPEs other than those designated as ACTION-OBJECTIVEs. For example, the task may have been specified as that of destroying enemy main battle tanks (OBJECT-TYPE) in a certain area (CONTROL-FEATURE). The reporting under ACTION-EFFECT could cite the number of main battle tanks destroyed; however, it could also say (if such information is known) that the effectiveness of a particular enemy armoured battalion (an OBJECT-ITEM that had not been specified as an objective) has been reduced to some fraction of its former battlespace capability.

13.3.4.2.3 In order to specify the OBJECT-TYPE or OBJECT-ITEM against which the ACTION has had an effect, ACTION-EFFECT is subtyped to give the entities: OBJECT-ITEM-ACTION-EFFECT and OBJECT-TYPE-ACTION-EFFECT.

13.3.4.3 OBJECT-ITEM-ACTION-EFFECT

13.3.4.3.1 The entity OBJECT-ITEM-ACTION-EFFECT is defined as an ACTION-EFFECT of a specific ACTION in accomplishing its aim in relation to a specific OBJECT-ITEM. OBJECT-ITEM-ACTION-EFFECT has one native non-key attribute:

> object-item-action-effect-fraction—The value that represents the portion of a whole OBJECT-ITEM that is estimated in a specific OBJECT-ITEM-ACTION-EFFECT to have the result specified in ACTION-EFFECT. Domain is a non-negative real number not exceeding 1.0.

13.3.4.3.2 Since it is an OBJECT-ITEM that is specified, the measure of the degree to which the action effect-description-code refers is described by a fraction. For example, if the specified OBJECT-ITEM was an enemy ORGANISATION and the estimate specified to what degree it had been destroyed by an ACTION, then the fraction of the ORGANISATION destroyed would be specified in object-item-action-effect-fraction.

13.3.4.4 OBJECT-TYPE-ACTION-EFFECT

13.3.4.4.1 The entity OBJECT-TYPE-ACTION-EFFECT is defined as the perceived effectiveness of a specific ACTION in accomplishing its aim in relation to a specified OBJECT TYPE. OBJECT-TYPE-ACTION-EFFECT has one native nonkey attribute:

> object-type-action-effect-quantity—The non-monetary numeric value representing the aggregated units of an OBJECT-TYPE that is estimated in a specific OBJECT-TYPE-ACTION-EFFECT to have the result specified in a particular ACTION-EFFECT.

13.3.4.5 An Example of ACTION-EFFECT

13.3.4.5.1 Table 81 illustrates the use of ACTION-EFFECT. It shows the situation of two friendly ORGANISATIONs making an estimate on the effect of a fire mission (Action 21). 2 RTR estimates that an enemy unit (6 Guards Tank Division) has been 70 percent destroyed. The fact that 2 RTR is the reporting organisation is not explicit in the table but would be determined through an instance of REPORTING-DATA identified as rd571. 1 R IRISH estimates the destruction in terms of T64 tanks (object-type-id = 13) and BMPs (object-type-id = 15) destroyed. The identity of the reporting organisation would be determined by reference to instances of REPORTING-DATA via identifiers rd1230 and rd35.

13.3.4.5.2 It is often necessary to detail the effects of an ACTION against an objective specified for that ACTION. This is not handled explicitly within the model because ACTION-EFFECT is specified in terms of OBJECT-TYPEs and OBJECT-ITEMs independently of ACTION-OBJECTIVE. Both sets of identifiers can be compared to determine how well the effects relate to a specified objective.

Table 81. ACTION-EFFECT Example

(a) ACTION-EFFECT

action-id	action-effect-index	action-effect-category-code	action-effect-description-code	reporting-data-id
21	1	OBJECT-ITEM-ACTION-EFFECT	Destroyed (K-kill)	rd571
21	2	OBJECT-TYPE-ACTION-EFFECT	Destroyed (K-kill)	rd1230
21	3	OBJECT-TYPE-ACTION-EFFECT	Destroyed (K-kill)	rd35

(b) OBJECT-ITEM-ACTION-EFFECT

action-id	action-effect-index	object-item-action-effect-fraction	object-item-id
21	1	0.70	14486 [6 Guards Tank Division]

(c) OBJECT-TYPE-ACTION-EFFECT

action-id	action-effect-index	object-type-action-effect-quantity	object-type-id
21	2	17	13 [EQUIPMENT TYPE—Tank]
21	3	8	15 [EQUIPMENT TYPE—BMP]

13.4 Subtypes of ACTION

13.4.1 Specification of Subtypes

The concept that is represented by the entity ACTION is intended to carry information about two kinds of actions:

a. Those that are planned or foreseen.

b. Those that occur, are of military interest, and consequently must be noted.

These actions are represented in the model as ACTION-TASK and ACTION-EVENT, respectively. The information that is to be represented in the data structure is different for these various categories of ACTION and it follows that subtyping is a suitable solution. The entity ACTION and its subtypes—ACTION-TASK and ACTION-EVENT—are shown in Figure 72.

13.4.2 ACTION-EVENT

13.4.2.1 An ACTION-EVENT is an ACTION that is an incident, phenomenon, or occasion of military significance which has occurred, or is occurring but for which planning is not known. This entity is intended to capture actions that simply occur and need to be noted because they are of military interest. The attributes are:

a. action-event-id—The action-id of a specific ACTION-EVENT (a role name for action-id).

b. action-event-category-code—The specific value that represents or denotes the general class or nature of activity prescribed by ACTION-EVENT. The domain values are Civil, Communications, Disaster, Economic, Environmental, Nuclear, Operational, Political.

c. action-event-subcategory-code—The specific value that represents or denotes the detailed class or nature of activity prescribed by ACTION-EVENT. Example domain values are: Aerial engagement, Aircraft crash, Airspace violation, Border incursion, Civil war.

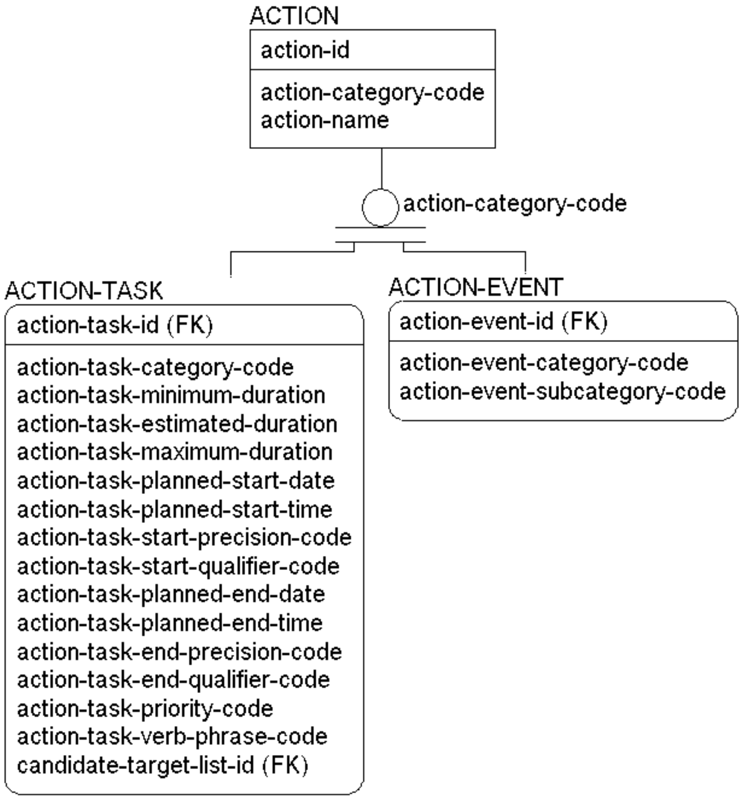


Figure 72. ACTION and Its Subtypes

13.4.2.3 Not all combinations of domain values for ACTION-EVENT attributes that specify category code and subcategory codes are meaningful. A number of constraints have been placed on the choice of domain values to limit the combinations to those that are operationally sensible. The resulting set of valid combinations is documented in Annex F, Table F-10.

13.4.3 ACTION-TASK

13.4.3.1 The entity ACTION-TASK is defined as an ACTION that is being or has been planned. It represents actions that are typically found in plans, orders, and requests. The attributes are:

a. action-task-id—The action-id of a specific ACTION-TASK (a role name for action-id).

b. action-task-category-code—The specific value that represents or denotes the class of ACTION-TASK. It serves as a category discriminator that partitions ACTION-TASK into subtypes. The domain values are: Order, Plan, REQUEST, Template.

c. action-task-minimum-duration—The non-monetary numeric value representing the aggregated units of time for the minimum permissible period of effectiveness of a specific ACTION-TASK.

d. action-task-estimated-duration—The non-monetary numeric value representing the aggregated units of time for the estimated period of effectiveness of a specific ACTION-TASK. This attribute specifies the nominal or expected duration for a given action.

e. action-task-maximum-duration—The non-monetary numeric value representing the aggregated units of time for the maximum permissible period of effectiveness of a specific ACTION-TASK.

f. action-task-planned-start-date—The date that designates the occurrence of the planned beginning of the period of effectiveness of a specific ACTION-TASK.

g. action-task-planned-start-time—The time that designates the occurrence of the planned beginning of the period of effectiveness of a specific ACTION-TASK.

h. action-task-start-precision-code—The specific value that represents the uncertainty in the estimate of the starting date and time for a specific ACTION-TASK. The domain values are: Second, Minute, Hour, Day, Week, Month, Year, Not known.

i. action-task-start-qualifier-code—The specific value that denotes the role of starting date and time with respect to the period of effectiveness of a specific ACTION-TASK. The domain values are: After, At; Before; No later than, Not before.

j. action-task-planned-end-date—The date that designates the occurrence of the planned conclusion of the period of effectiveness of a specific ACTION-TASK.

k. action-task-planned-end-time—The time that designates the occurrence of the planned conclusion of the period of effectiveness of a specific ACTION-TASK.

l. action-task-end-precision-code—The specific value that represents the uncertainty in the estimate of the ending date and time for a specific ACTION-TASK. The domain values are: Second, Minute, Hour, Day, Week, Month, Year, Not known.

m. action-task-end-qualifier-code—The specific value that denotes the role of ending date and time with respect to the period of effectiveness of a specific ACTION-TASK. The domain values are: After, At; Before; No later than, Not before.

n. action-task-priority-code—The specific value that represents or denotes the rank of importance of a specific ACTION in view of the planning organisation. Commanders will give guidance in the classification of target and action priorities for their units. The domain values are: Priority 1, Priority 2, Priority 3, Priority 4, Priority 5.

o. action-task-verb-phrase-code—The specific value that represents or denotes the nature of activity prescribed by the ACTION-TASK. Example domain values are: Block, Breach, Capture, Constitute a flank guard, Cross, Defend, Delay, Evacuate, Guard, Hold, Intercept, Interdict, Jam, Move, Neutralise, Occupy, Plan, Reconnaissance, Redeploy, Reinforce, Reorganise, Repair, Resupply, Screen, Secure, Set up, Suppress, Withdraw.

p. candidate-target-list-id—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-LIST and to distinguish it from all other CANDIDATE-TARGET-LISTs.

13.4.3.2 The attribute action-task-estimated-duration is frequently used in fire planning to denote the time interval during which a portion of the fire plan is to be executed. Absolute times are not used, except in the execution phase when an overall starting point is specified. As an example, there may be an instance of a ACTION-TASK that requires covering fire to be provided.

The time window may be 30 minutes with the stipulation that once the delivery of covering fire has begun, it must last for at least 15 minutes.

13.4.3.3 It is important to understand how the time qualifier works with respect to ACTION-TASK. The value “At” means simply the specific chronological point. The values “Before” and “After” are slightly more complex, as they impose an additional condition on the meaning of time in relation to ACTION-TASK. The values indicate that the specified chronological point is to be interpreted as a limiting time where some activity is to occur before and after, respectively. The values “No later than” and “Not before” provide additional conditions to indicate that a ACTION-TASK must be started or ended by the specified time or that it must be started or ended no earlier than the specified time.

13.4.3.4 The relationships among the timing attributes are illustrated in Figure 73. The time window is the interval that is bounded by the starting and ending times. The three specifications of duration fall within the time window. Generally, all temporal attributes (three durations, starting dates and times, ending dates and times, will be independent, except possibly in a limiting case where the duration coincides with the interval defined by the starting and ending dates and times.

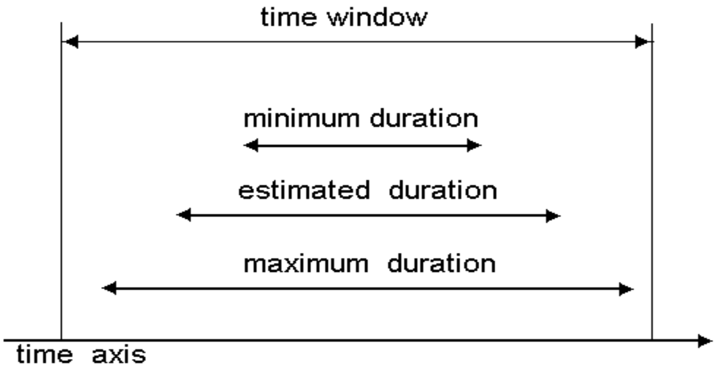


Figure 73. Timing Relationships within ACTION-TASK

13.4.3.5 The uses of the attributes in ACTION-TASK are illustrated in Table 82 which uses the ACTIONs defined previously in Table 75. The table shows the planned times for ACTIONs that are part of an operational order. The action-task-starting and ending times specify a window within which the planned action is to take place. However, its actual planned duration may well be less than this temporal window.

Table 82. Example Instances of ACTION-TASK

(a) Examples of ACTION Statements (Repeated from Table 75)

Label	Resource	ACTION	Objective
Action 1	52 Inf Div	Defend	Control Feature “Steel”
Action 2	1 (US) Corps	Destroy	6 Guards Tank Division
Action 3	1 R IRISH	Defend	Hill 126
Action 4	2 RTR	Constitute a reserve	52 Inf Div
Action 5	1 RHA	Move to	Hameln, GE
Action 6	3 GE Recce Bn	Secure	Route Club

(b) ACTION-TASK

action-task-id	***-planned-start-date	***-planned-start-time	***-start-qualifier-code	***-planned-end-date	***-planned-end-time	***-end-qualifier-code
1	[01 Aug 94]	[1200]	No later than	[07 Aug 94]	[1400]	At
2	[02 Aug 94]	[0500]	Not before	[02 Aug 94]	[0200]	No later than
3	[02 Aug 94]	[0200]	No later than	[07 Aug 94]	[1400]	At
4	[02 Aug 94]	[0230]	At	[07 Aug 94]	[1400]	At
5	[01 Aug 94]	[1000]	Not before	[01 Aug 94]	[1800]	No later than
6	[01 Aug 94]	[0300]	At	[01 Aug 94]	[1800]	No later than

Note: *** stands for "action-task."

13.5 Maintaining Status of ACTION-TASKs and ACTION-EVENTs

13.5.1 There is a need to monitor the effectiveness and progress of tasks and events in the battlespace. The model translates this requirement into two status entities as illustrated in Figure 74, which extends the previously discussed structure by adding the child entity ACTION-EVENT-STATUS to ACTION-EVENT and ACTION-TASK-STATUS to ACTION-TASK.

13.5.2 The entity ACTION-EVENT-STATUS is defined as the perceived appraisal of the actual progress of a specific ACTION-EVENT. The attributes are:

a. action-event-id—The action-id of a specific ACTION-EVENT (a role name for action-id).

b. action-event-status-index—The unique value, or set of characters, assigned to represent a specific ACTION-EVENT-STATUS for a specific ACTION-EVENT and to distinguish it from all other ACTION-EVENT-STATUSs for that ACTION-EVENT.

c. action-event-status-completion-fraction—The portion of the whole ACTION-EVENT that is estimated to have been accomplished.

d. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

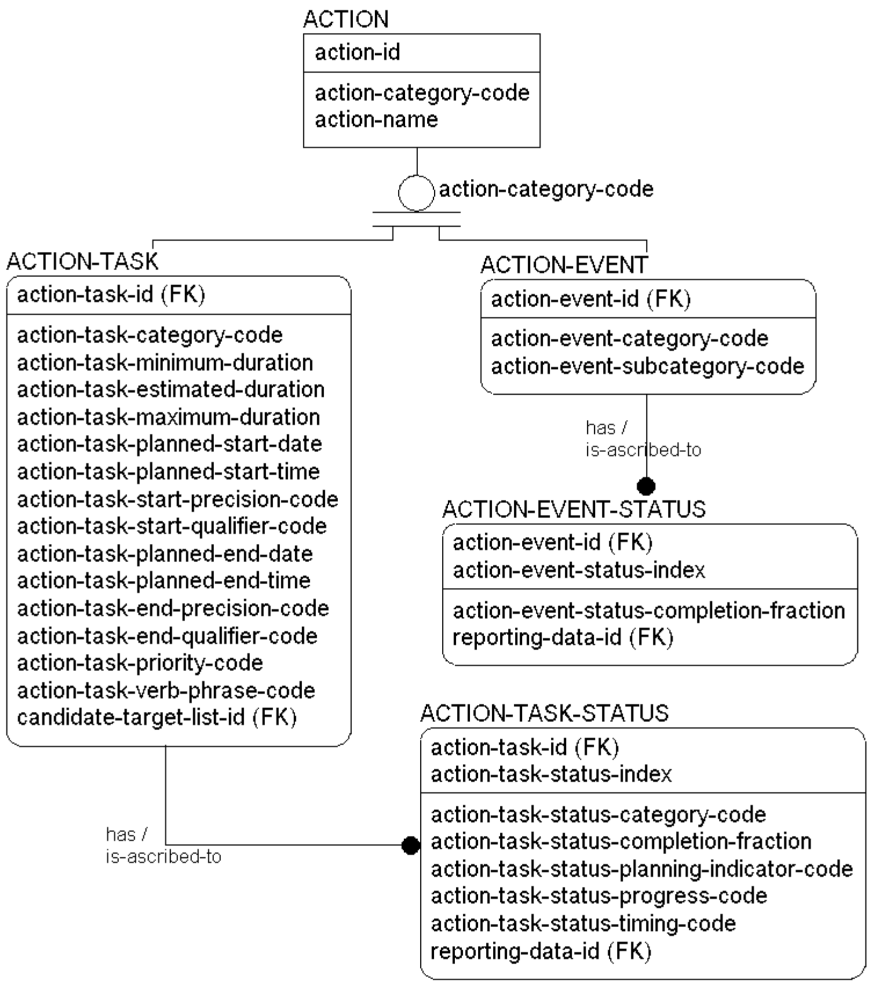


Figure 74. Maintaining Status Information for ACTION-TASKs

13.5.4 Example instances of ACTION-EVENT, their status, and associated reporting data are provided in Table 83.

Table 83. Examples of ACTION-EVENT

(a) ACTION-EVENT

action-event-id	action-event-category-code	action-event-subcategory-code
11	Civil	Religious violence
12	Communications	Communications disruption
13	Disaster	Earthquake
14	Economic	Arms trade
15	Environmental	Drought
16	Operational	Border incursion
17	Political	Coup d'etat

(b) ACTION-EVENT-STATUS

action-event-id	action-event-status-index	action-event-status-completion-fraction	reporting-data-id
11	1	1.0	rd27
12	1	1.0	rd28
13	1	1.0	rd29
14	1	—	rd30
15	1	0.6	rd31
16	1	1.0	rd32
17	1	0.9	rd33

(c) REPORTING-DATA

reporting-data-id	***-category-code	***-confirmation-indicator-code	***-credibility-code	***-reporting-date	***-reporting-time	***-reporting-organisation-id
rd27	Reported	No	Trusted	[10 Aug 96]	[0300]	7055 [CNN]
rd28	Reported	—	Trusted	[12 Sep 94]	[1145]	1917 [2 RTR]
rd29	Estimated	Yes	Trusted	[16 Jul 96]	[1232]	7055 [CNN]
rd30	Assumed	No	Trusted	[01 Nov 96]	[1200]	1122 [CIA]
rd31	Reported	Yes	Trusted	[12 Jun 94]	[1800]	793 [Reuters]
rd32	Reported	No	Trusted	[12 Aug 97]	[0312]	1793 [1 RHA]
rd33	Reported	—	Trusted	[27 May 96]	[2096]	7766 [BBC]

Note: *** stands for "reporting-data"

(d) REPORTING-DATA-ABSOLUTE-TIMING

***–id	***–duration	***–effective-date	***–effective-time	***–effective-time-precision-code
rd27	172,800 (seconds)	[09 Aug 96]	[1800]	Minute
rd28	52 (seconds)	[12 Sep 96]	[1130]	Minute
rd29	270 (seconds)	[16 Jul 95]	[1200]	—
rd30	—	[01 Oct 96]	[0001]	—
rd31	—	[09 Mar 94]	—	Day
rd32	900 (seconds)	[12 Aug 97]	[0300]	—
rd33	—	[27 May 96]	[1622]	—

Note: *** stands for "reporting-data-absolute-timing"

13.5.5 The entity ACTION-TASK-STATUS is defined as the perceived appraisal of the planning and execution progress of a particular ACTION-TASK. ACTION-TASK-STATUS specifies the progress of an ACTION-TASK toward completion without referring to the effectiveness of the ACTION-TASK against its specified objectives. The entity can be used to monitor the progress of currently occurring ACTION-TASKs, as well as to provide an estimate of expected future progress of planned, expected, or ordered ACTION-TASKs. The attributes are:

a. action-task-id—The action-id of a specific ACTION-TASK (a role name for action-id).

b. action-task-status-index—The unique value, or set of characters, assigned to represent a specific ACTION-TASK-STATUS for a specific ACTION-TASK and to distinguish it from all other ACTION-TASK-STATUSs for that ACTION-TASK.

c. action-task-status-category-code—The specific value that represents or denotes the perceived class of a specific ACTION-TASK at a given time. The domain values are: Activity, Order, Plan.

d. action-task-status-completion-fraction—The portion of the whole ACTION-TASK that is estimated to have been accomplished. The domain is non-negative real number not exceeding 1.0.

e. action-task-status-planning-indicator-code—The specific value that denotes at the reporting time whether an ACTION-TASK is completed in the planning process. A negative response implies that additional specification is intended. The domain values are: No, Yes.

f. action-task-status-progress-code—The specific value that represents or denotes the perceived appraisal of the progress of a specific ACTION-TASK. The domain values are: Aborted, Cancelled, Complete, In progress, Not known, Not started, Paused.

g. action-task-status-timing-code—The specific value that represents the timing associated with a specific ACTION-TASK-STATUS. The domain values are: Actual start time, Actual end time, Predicted start time, Predicted end time, Request start amend time, Request end amend time, Require start amend time, Require end amend time. The last four values can be used to require or request a change of planning times that are judged to be unexecutable.

h. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs. This attribute provides a link to REPORTING-DATA where amplifying data such as the identification of the organisation providing the status estimate, the effective date and time for the estimate, the reporting date and time, and credibility level are held.

13.5.7 The action-task-status-planning-indicator-code is intended to assist the recipient of a plan or order to determine whether such a plan or an order is complete from the sender's perspective. If a standard rule were to be adopted that only complete plans or orders are to be transmitted, then this attribute would be unnecessary. However, operational situations may dictate that partial plans or orders be transmitted at a given time and that the remainder would be made available later.

13.5.8 Not all combinations of domain values for ACTION-TASK-STATUS attributes that specify completion status code and the completion fraction are meaningful. A number of constraints have been placed on the choice of domain values to limit the combinations to those that are operationally sensible. The resulting set of valid combinations is documented in Annex F, Table F-11.

13.5.9 The following statements deal with the status of ongoing activity:

a. 2 RTR estimates that the enemy unit began breaching the minefield (Activity 20) at 0700, and that it will complete the breaching at 1100 on 01 Jan 93.

b. 1 R IRISH estimates that at 1000 on 1 Jan 93, the enemy unit had 70 percent (expressed as a fraction in the table) completed the ACTION-TASK of breaching the minefield.

These statements are represented as data in ACTION-TASK-STATUS as illustrated in Table 84, which shows two ORGANISATIONs estimating the degree of completion of the same task (Action 20—an enemy ORGANISATION breaching a minefield), both in absolute time and as a rate.

Table 84. ACTION-TASK Status Example

(a) ACTION-TASK-STATUS

action-task-id	*-index	*-category-code	*-completion-fraction	*-planning-indicator-code	*-progress-code	*-timing-code	reporting-data-id
20	1	Activity	0.0	—	In progress	Actual start time	101
20	2	Activity	1.0	—	Complete	Predicted end time	103
20	3	Activity	0.7	—	In progress	—	102

Note: * denotes “ action-task-status”.

(b) REPORTING-DATA

***-id	***-category-code	***-credibility-code	***-reporting-date	***-reporting-time	***-timing-category-code	***-reporting-organisation-id
101	Reported	Trusted	[01 Jan 93]	[0725]	Absolute	1917 [2 RTR]
103	Reported	Estimated	[01 Jan 93]	[0725]	Absolute	1917 [2 RTR]
102	Reported	Trusted	[01 Jan 93]	[1000]	Absolute	3051 [1 R IRISH]

Note: *** stands for “reporting-data”

(c) REPORTING-DATA-ABSOLUTE-TIMING

***_id	***_duration	***_effective-date	***_effective-time	***_effective-time-precision-code
101	—	[01 Jan 93]	[0700]	Minute
103	—	[01 Jan 93]	[1100]	Minute
102	—	[01 Jan 93]	[1000]	Minute

Note: *** stands for “reporting-data-absolute-timing”

13.6 ACTIONs in Relation to Other ACTIONs

13.6.1 ACTION Associations

13.6.1.1 ACTIONs in themselves are designed to accommodate very simple activity or operations statements. In order to create complex sets of activities, such as those represented by operational plans or orders, it is necessary to associate ACTIONs with other ACTIONs in various ways. The Generic Hub provides two mechanisms for association: ACTION-FUNCTIONAL-ASSOCIATION and ACTION-TEMPORAL-ASSOCIATION. As the names imply, one association caters to the functional relationships among ACTIONs and the other to time-specific dependencies. The model view of associations may be seen in Figure 75.

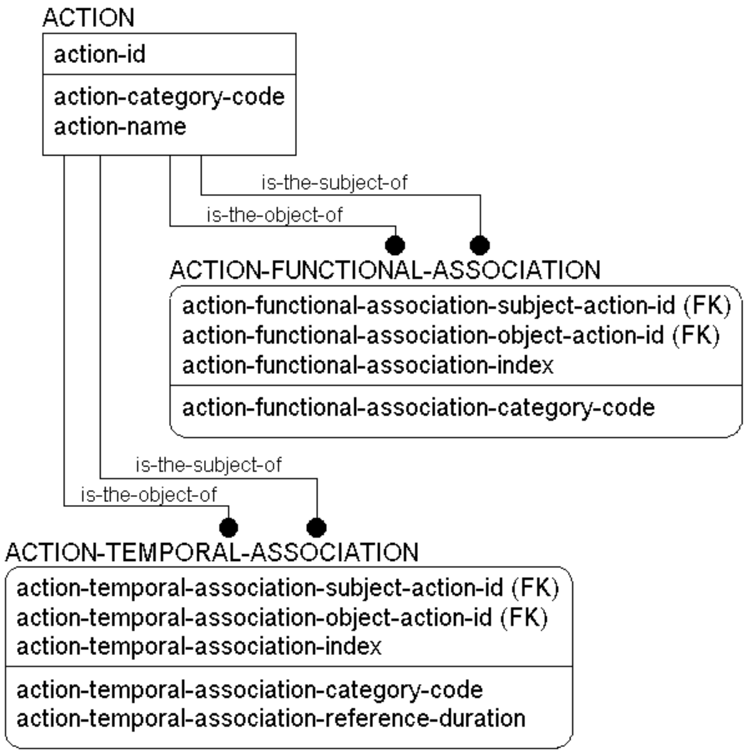


Figure 75. The Two Kinds of ACTION Association

13.6.1.2 The ACTION associations are fundamentally important in the model in building overlapping ACTIONs, and they are used to address the requirements to specify dependencies between and hierarchies among ACTIONs. The types of relationships—functional and temporal—are discussed and outlined in the subsections below.

13.6.2 Functional Association of ACTIONs

13.6.2.1 The simplest relationship is where an ACTION includes a number of other sub-ACTIONs. This is represented in the previously used set of ACTIONs shown in Table 85.

Table 85. Examples of ACTION Statements (Repeated from Table 75)

Label	Resource	ACTION	Objective
Action 1	52 Inf Div	Defend	Control Feature “Steel”
Action 2	1 (US) Corps	Destroy	6 Guards Tank Division
Action 3	1 R IRISH	Defend	Hill 126
Action 4	2 RTR	Constitute a reserve	52 Inf Div
Action 5	1 RHA	Move to	Hameln, GE
Action 6	3 GE Recce Bn	Secure	Route Club

13.6.2.2 The relationships of these ACTIONs are represented in Figure 76, where Action 2 is the major action that is supported by Action 1. Action 1 consists of four ACTIONs (Action 3 through Action 6); three of the actions are subordinated to Action 1 directly (Action 3 through Action 5), while the fourth action (Action 6) is subordinated to Action 5. In this example, the relationship hierarchy can be represented by such phrases as "is a sub-action of" and "in order that."

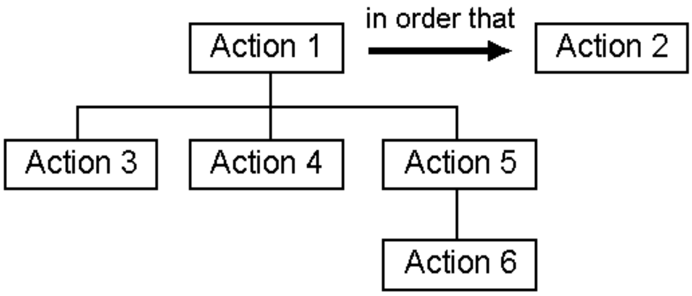


Figure 76. ACTION Hierarchy

13.6.2.3 The entity ACTION-FUNCTIONAL-ASSOCIATION is intended to accommodate the type of requirement suggested in the previous paragraph. It is defined as the relationship of a specific ACTION as a subject with another ACTION as an object in order to specify functional dependence. The attributes are:

a. action-functional-association-subject-action-id—The action-id of the subject ACTION in a specific ACTION-FUNCTIONAL-ASSOCIATION (a role name for action-id).

b. action-functional-association-object-action-id—The action-id of the object ACTION in a specific ACTION-FUNCTIONAL-ASSOCIATION (a role name for action-id).

c. action-functional-association-index—The unique value, or set of characters, assigned to represent a specific ACTION-FUNCTIONAL-ASSOCIATION for a specific subject ACTION and a specific object ACTION and to distinguish it from all other ACTION-FUNCTIONAL-ASSOCIATIONs for those ACTIONs.

d. action-functional-association-category-code—The specific value that represents or denotes the class of relationship of subject ACTION to object ACTION. The types of relationship that can exist between ACTIONs are complex and varied and are discussed in detail in subsections below. The domain values are: Has as a sub-ACTION, In order that, In response to/depending on, Is a modification of, Is an alternate to, Is a template for, Uses as a reference.

13.6.2.4 The specification of an ACTION hierarchy using ACTION-FUNCTIONAL-ASSOCIATION is illustrated in Table 86, which portrays the hierarchical relationships that exist between the ACTIONs of Figure 76.

Table 86. A Simple ACTION-FUNCTIONAL-ASSOCIATION Hierarchy

ACTION-FUNCTIONAL-ASSOCIATION

action-functional-association-subject-action-id	action-functional-association-object-action-id	action-functional-association-index	action-functional-association-category-code
1	2	1	In order that
1	3	1	Has as a sub-ACTION
1	4	1	Has as a sub-ACTION
1	5	1	Has as a sub-ACTION
5	6	1	Has as a sub-ACTION

13.6.3 Temporal Association of ACTIONs

13.6.3.1 General

13.6.3.1.1 The planning process for military operations may require a variety of timing specifications in order to address a number of different planning scenarios ranging from the creation of conceptual plans with little detail, to contingency plans with a moderate amount of detail, to highly specific daily operations orders. In order to cater to the broad requirements in planning, the model provides the functionality to specify temporal relationships in three ways:

a. Instances of ACTION are sequenced in the planning process. The specification of actual or absolute calendar times are entered for instances of ACTION-TASK. There is no need for additional data structure to enable temporal associations between ACTIONs.

b. The timing of instances of ACTION are specified as relative temporal relationships between pairs of instances of ACTION. These are statements that take the following form: Action 1 is to begin or end before or after the beginning or the end of Action 2, or put in another way, the beginning of Action 1 can be relative to either the beginning or the end of Action 2, and the end of Action 1 can be relative to either the beginning or the end of Action 2. This permits the sequencing of planned operations without any reference to calendar time.

c. Offset intervals are added to the timing specification of bullet (b) above. This takes the form of the statement that Action 1 is to start 20 minutes after the start of Action 2 (regardless of when Action 2 starts).

13.6.3.1.2 The following example is used in the subsequent sections to illustrate different ways of handling temporal relationships. It consists of a sequence of related actions in creating a minefield and is graphically presented in Figure 77. The principal action is “Create minefield” (Action 7), which includes several sub-actions: “Carry out reconnaissance” (Action 8—Do recce, for short), “Move stores” (Action 9), “Lay minefield” (Action 10), and “Mark minefield” (Action 11). Clearly, Action 9 cannot start until Action 8 is completed, Action 10 cannot start until Action 9 is at least partially completed, and so on. Although specific times are shown in the figure for purposes of illustration, there is also a need to specify temporal relationships in a relative way without recourse to a clock. In some of the subsequent examples, the reader should assume that the time scale is no longer marked.

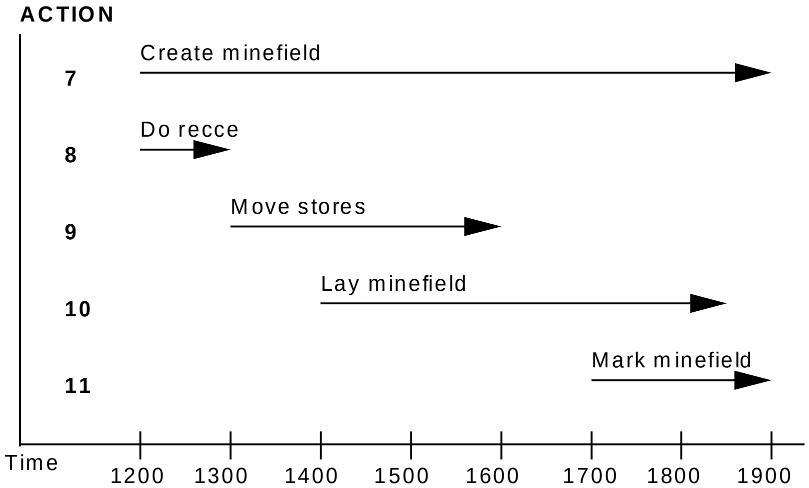


Figure 77. ACTION Temporal Dependency

13.6.3.2 Specification of Absolute Time

The simplest method of establishing temporal ACTION dependency is through the use of absolute time when such specification is appropriate. In this method, the absolute start and end times are specified in ACTION-TASK so that the subtasks are carried out in the correct sequence. Action 7 is to start at the same time as Action 8 [(011200 Jan 93)]; 9 is to start when 8 finishes [(011300 Jan 93)]; 10 is to start 1 hour after 9 starts and finish 2 hours and 30 minutes after 9 ends; and finally, 11 is to start 3 hours after 10 starts and is to end at the same time as Action 7. This is illustrated in Table 87.

Table 87. Absolute ACTION-TASK Time Relationships

ACTION-TASK

action-task-id	***-planned-start-date	***-planned-start-time	***-start-qualifier-code	***-planned-end-date	***-planned-end-time	***-end-qualifier-code
7 [Create minefield]	[01 Jan 93]	[1200]	At	[01 Jan 93]	[1900]	At
8 [Carry out reconnaissance]	[01 Jan 93]	[1200]	At	[01 Jan 93]	[1300]	At
9 [Move stores]	[01 Jan 93]	[1300]	At	[01 Jan 93]	[1600]	At
10 [Lay minefield]	[01 Jan 93]	[1400]	At	[01 Jan 93]	[1830]	At
11 [Mark minefield]	[01 Jan 93]	[1700]	At	[01 Jan 93]	[1900]	At

Note: *** stands for "action-task."

13.6.3.3 ACTION-TEMPORAL-ASSOCIATION

13.6.3.3.1 The timings of sub-actions that are part of a complex action are likely to be interdependent. The entity ACTION-TEMPORAL-ASSOCIATION is designed to handle the data requirements associated with temporal dependencies between ACTIONs. However, it can also be used to specify temporally how an ACTION-EVENT might be related to a ACTION-TASK (e.g., disaster response) and how two ACTION-EVENTs might be related (e.g., incoming round, flash-bang delay)

13.6.3.3.2 ACTION-TEMPORAL-ASSOCIATION is defined as the relationship of an ACTION as a subject to another ACTION as an object to specify time dependence. The attributes are:

a. action-temporal-association-subject-action-id—The action-id of the subject ACTION in a specific ACTION-TEMPORAL-ASSOCIATION (a role name for action-id).

b. action-temporal-association-object-action-id—The action-id of the object ACTION in a specific ACTION-TEMPORAL-ASSOCIATION (a role name for action-id).

c. action-temporal-association-index—The unique value, or set of characters, assigned to represent a specific ACTION-TEMPORAL-ASSOCIATION for a specific subject ACTION and a specific object ACTION and to distinguish it from all other ACTION-TEMPORAL-ASSOCIATIONs for those ACTIONs.

d. action-temporal-association-category-code—The specific value that represents or denotes the class of chronological relationship of a subject ACTION to an object ACTION for a specific ACTION-TEMPORAL-ASSOCIATION. Example domain values are: Ends after end of; Ends after start of; Starts and ends during; Starts after end of; Starts after start of; Starts at and ends at the same time as. The rationale for these values is developed in the following section.

e. action-temporal-association-reference-duration—The non-monetary numeric value representing the aggregated units of time that elapse after the start or end of a specific object ACTION that a subject ACTION is referenced to for its execution. It can be used, for example, to direct a subordinate task to begin a certain period of time after the start of the superior task. Values are real numbers: positive values specify time after a point in time, negative values specify time before a point in time.

13.6.3.4 Temporal Relationships

13.6.3.4.1 The concept of temporal relationships has been employed to specify relative time. Relative time is particularly relevant when the required start time of the overall action is not known, or perhaps the unit tasking the ACTION is flexible with regard to the exact time the sub-actions are to start or end *provided* they start or end at some time relative to another action. There are two related parts to the concept: one dealing with *closed intervals*, which include both start and end times, and *open-ended intervals,* which involve only the start or the end time. Both together help to define the set of domain values for the attribute action-temporal-association-category-code.

13.6.3.4.2 Closed intervals can be related temporally in 15 ways. An illustration of these relationships is presented in Table 88. The statement of a relationship is shown on the left side and a graphic depiction is shown on the right side. The last two relations (Nos. 14 and 15) implicitly include Relations 1 through 6 without specifying the explicit constraints of those relationships.

Table 88. Temporal Relationships for Closed Intervals

No	Statement of Temporal Relationship	Illustration of Temporal Relationship
1	A ends when B starts	└___A___┘ └___B___┘
2	A starts when B ends	└___A___┘ └___B___┘
3	B starts during A and A ends during B	└___A___┘ └___B___┘
4	A starts during B and B ends during A	└___A___┘ └___B___┘
5	A starts and ends before B	└___A___┘ └___B___┘
6	B starts and ends before A	└___A___┘ └___B___┘
7	A starts before B starts and ends when B ends	└______A______┘ └___B___┘
8	A starts after B starts and ends when B ends	└___A___┘ └______B______┘
9	A starts when B starts and ends after B ends	└______A______┘ └___B___┘
10	A starts when B starts and ends before B ends	└___A___┘ └______B______┘
11	A starts before B starts and ends after B ends	└______A______┘ └___B___┘
12	A starts after B starts and ends before B ends	└___A___┘ └______B______┘
13	A starts when B starts and ends when B ends	└______A______┘ └______B______┘
14	A starts before B starts and ends before B ends	└___A__ → → → └___B___┘
15	B starts before A starts and ends before A ends	└___B__ → → → └___A___┘

13.6.3.4.3 The temporal relationships listed in the previous table imply a set of candidate domain values for action-temporal-association-category-code. These values are listed below together with the identifying numbers of the relationships that they support. Since all but one of the relationships is symmetric, the resulting number of candidate domain values is eight:

a. Starts at end of (1, 2)

b. Starts during and ends after (3, 4)

c. Starts and ends before (with an offset) (5, 6)

d. Starts during and ends at the same time as (7, 8)

e. Starts at the same time and ends after (9, 10)

f. Starts and ends during (11, 12)

g. Starts at and ends at the same time as (13)

h. Starts before and ends before end of (14, 15).

13.6.3.4.4 An application of temporal relationships to the minefield example is illustrated in Table 89. It could be assumed that this situation exists at an early planning stage before specific timings had been determined. The table shows how to represent some of the key relationships between Actions 7 to 11 to assure the correct sequence. The category codes are referred to as "candidate" because they are not stated identically to the formal domain values.

Table 89. Use of Temporal Relationships in ACTION-TEMPORAL-ASSOCIATION

ACTION-TEMPORAL-ASSOCIATION

action-temporal-association-subject-action-id	**action-temporal-association-object-action-id**	**action-temporal-association-index**	**(candidate) action-temporal-association-category-code**
7 [Create minefield]	8 [Carry out reconnaissance]	1	Starts at the same time and ends after
9 [Move stores]	8 [Carry out reconnaissance]	1	Starts at end of
10 [Lay minefield]	9 [Move stores]	1	Starts during and ends after
11 [Mark minefield]	10 [Lay minefield]	1	Starts during and ends after
7 [Create minefield]	11 [Mark minefield]	1	Starts before and ends at the same time as

13.6.3.4.5 The open-ended temporal relationships specify how a single end of a relationship compares with a single end of another relationship, without regard to the other ends of those relationships. Open-ended intervals can be related temporally in 8 ways. An illustration of these relationships is presented in Table 90. The statement of a relationship is shown on the left side and a graphic depiction is shown on the right side.

Table 90. Temporal Relations for Open-Ended Intervals

No	Temporal Relationship	Illustration of Relationships
1	A starts before B starts (no statement about endings)	└ _ _ _ _ A _ _ _ _ → └ _ _ _ _ B _ _ _ _ →
2	A starts after B starts (no statement about endings)	└ _ _ _ _ A _ _ _ _ → └ _ _ _ _ B _ _ _ _ →
3	A starts before B ends (no statement about A ending or B starting)	└ _ _ _ _ A _ _ _ _ → _ _ _ _ B _ _ _ _ ┘
4	A ends after B starts (no statement about A starting or B ending)	_ _ _ _ A _ _ _ _ ┘ └ _ _ _ _ B _ _ _ _ →
5	A ends before B ends (no statement about starting)	_ _ _ _ A _ _ _ _ ┘ _ _ _ _ B _ _ _ _ ┘
6	A ends after B ends (no statement about starting)	_ _ _ _ A _ _ _ _ ┘ _ _ _ _ B _ _ _ _ ┘
7	A ends before B starts (no statement about A starting or B ending)	_ _ _ _ A _ _ _ _ ┘ └ _ _ _ _ B _ _ _ _ →
8	A starts after B ends (no statement about A ending or B starting)	└ _ _ _ _ A _ _ _ _ → _ _ _ _ B _ _ _ _ ┘

13.6.3.4.6 Because of symmetry between notional Actions A and B, the requirement to support these relationships can be met by use of the following four values as candidates for action-temporal-association-category-code, where object ACTION is the ACTION to which the subject ACTION is referenced:

a. Starts after the start of

b. Starts after the end of

c. Ends after the start of

d. Ends after the end of.

13.6.3.4.7 It is desirable to use these values not only for purely relative timing but also for designating relative timing with a specified duration for an offset. For example, Action A starts 30 minutes after the start of Action B. Operational situations may also dictate that the offset be associated with a requirement of an activity taking place at precisely, not earlier than, or not later than the specified moment. For example, Action A starts no later than 30 minutes after the start of Action B. In order to broaden the applicability of the suggested domain values in the previous paragraph, the set of values has been modified to incorporate a sense of strictness with respect to the meaning of offsets. The resultant set of values is listed below:

a. Starts after start of

b. Starts no earlier than after start of

c. Starts no later than after start of

d. Starts after end of

e. Starts no earlier than after end of

f. Starts no later than after end of

g. Ends after start of

h. Ends no earlier than after start of

i. Ends no later than after start of

j. Ends after end of

k. Ends no earlier than after end of

l. Ends no later than after end of.

13.6.3.4.8 Since two closed intervals that do not overlap can be regarded to be logically equivalent to the case of open-ended intervals, the potential domain values—*Starts at end of* and *Starts and ends before*—for closed intervals are equivalent to (d) in the previous paragraph and can be eliminated from consideration. The resultant combination of values from Paragraphs 13.6.3.4.2 and 13.6.3.4.7 provides the full set needed to specify any form of temporal relationship, whether closed or open-ended.

13.6.3.5 Temporal Relationships with Offset Intervals

13.6.3.5.1 The use of temporal relationships as described in the previous section allows specification of the relative order in which ACTIONs are to occur without specifying any actual times. It is often necessary, however, to specify relative times between related ACTIONs in addition to their imprecise temporal relationships, still without specifying actual timings. This is done using temporal relationships and adding a provision for specifying fixed offset intervals, wherein a subject ACTION is to start at some specified time interval before or after a particular reference point in the object task. This is done by using the attribute action-temporal-association-reference-duration together with an appropriate entry in action-temporal-association-category-code.

13.6.3.5.2 The previous example of creating a minefield serves again to illustrate the notion of temporal relationship with offset intervals. Table 91 lays out in graphic form selected actions and their relationships to each other. One may wish to begin the sub-ACTION “Move stores” (Action 9) 60 minutes after the start of action “Create minefield” (Action 7). “Lay minefield” (Action 10) is to start 60 minutes after “Move stores” (Action 9). The final illustrated action “Mark minefield” (Action 11) is referenced for its start to Action 10 and its conclusion to Action 7.

Table 91. Use of Temporal Relationships and Offset Intervals (Time Lines)

```
Action 9 is to start 60 minutes after start of Action 7:
        |-----------------Action 7------------------------
        o--------60--------|-----------------Action 9--------------

Action 10 is to start 60 minutes after start of Action 9:
        |------------------Action 9---------------------
        o--------60--------|-----------------Action 10------------------------

Action 11 is to start 180 minutes after start of Action 10 and end when Action 7 ends:
        |-------------------------------------------------Action 10-------------
                                                    -----------------Action 7------------------------|
        <---------------------------180--------------------------->|-------------Action 11------------------|
```

13.6.3.5.3 The equivalent information is represented in Table 92 as a formal specification using the structure provided by the data model. The time quantity of 60 minutes in the first pair of actions is specified using the attribute action-temporal-association-reference-duration, and using the value “Starts after start of object ACTION” for the action-temporal-association-category-code. The example is continued through the fourth row.

Table 92. Use of Temporal Relationships and Offset Intervals

ACTION-TEMPORAL-ASSOCIATION

action-temporal-association-subject-action-id	action-temporal-association-object-action-id	action-temporal-association-index	action-temporal-association-category-code	action-temporal-association-reference-duration
9 (move stores)	7 (create minefield)	1	Starts after start of	60 (minutes)
10 (lay minefield)	9 (move stores)	1	Starts after start of	60 (minutes)
11 (mark minefield)	10 (lay minefield)	1	Starts after start of	180 (minutes)
11 (mark minefield)	7 (create minefield)	1	Ends after end of	0 (minutes)

13.6.3.5.4 It may be necessary to specify both the start and end time of one ACTION in terms of specified time periods from some point (or points) in a superior ACTION (e.g., one may wish to specify that an ACTION is to start X minutes after the start of the superior ACTION, and end Y minutes before the end of the superior ACTION). This is done by specifying two different relationships between the two ACTIONs, one specifying the time at which the subordinate ACTION is to start, and one specifying the time it is to finish.

13.6.3.5.5 The concepts of absolute time, temporal relationships, and temporal relationships with offset intervals permit ACTIONs to be related together in very complex ways. In particular, relative times can be specified for any number of related ACTIONs without specifying a real time.

13.6.3.5.6 Use of the ACTION hierarchy and temporal relationships makes it possible to formulate plans without specifying a particular start time (or H-hour) while still being able to specify the interrelated time dependencies between its constituent sub-actions. The ACTION-TASKs can be related in time and function and only the highest level ACTION-TASK needs to specify the start time. In order to fix a start time for such a plan, it is necessary to introduce a new ACTION-TASK, with a specified planned start time, and relate it to the ACTION-TASKs to be initiated. The use of an H-Hour defined by a separate ACTION-TASK is illustrated in Table 93, wherein Action 13 has been created with a specified start time and has been related to Action 7 in order to initiate it at 1200 on 2 Jan 93.

Table 93. Use of ACTION-TEMPORAL-ASSOCIATION to Initiate Other ACTIONs

(a) ACTION-TASK

action-task-id	action-task-category-code	action-task-planned-start-date	action-task-planned-start-time	action-task-start-qualifier-code
13 [Initiate ACTION]	Order	[02 Jan 93]	[1200]	At

(b) ACTION-TEMPORAL-ASSOCIATION

action-temporal-association-subject-action-id	action-temporal-association-object-action-id	action-temporal-association-index	action-temporal-association-category-code	action-temporal-association-reference duration
7 [Create Minefield]	13 [Initiate ACTION]	1	Starts after start of	0 (minute)

13.7 Relationships of ACTION-TASK to Organisational Aspects

13.7.1 General

13.7.1.1 An ACTION-TASK can have two different types of relationships to ORGANISATION. The first type identifies the kind of responsibility that an ORGANISATION may have for any particular task—characterised by such terms as initiates, plans, disseminates, oversees the execution of, or approves. This relationship is implemented by means of ORGANISATION-ACTION-TASK-ASSOCIATION. The second type of relationship is a link to ORGANISATION-ORGANISATION-ASSOCIATION that permits the creation of task organisations or changes of command relationships to be identified explicitly with an ACTION-TASK.

13.7.1.2 The construct that relates ACTION-TASK to ORGANISATION and to ORGANISATION-ORGANISATION-ASSOCIATION is shown in Figure 78.

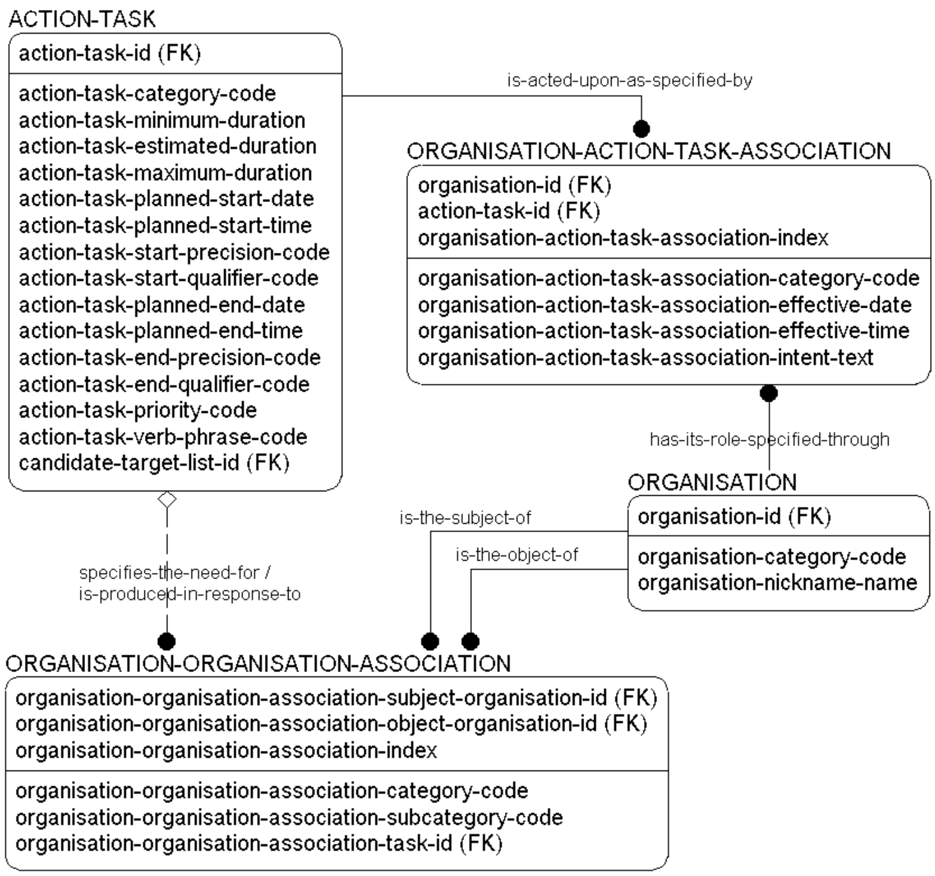


Figure 78. Relationships of ACTION-TASK to ORGANISATION

13.7.2 The Role of ORGANISATION in ACTION-TASK

13.7.2.1 The model construct that permits specification of the role of an ORGANISATION with respect to a ACTION-TASK is implemented through ORGANISATION-ACTION-TASK-ASSOCIATION. It is defined as the relationship indicating the role of a specific ORGANISATION with respect to a specific ACTION-TASK. The attributes are:

a. organisation-id—The object-item-id of a specific ORGANISATION (a role name for object-item-id).

b. action-task-id—The action-id of a specific ACTION-TASK (a role name for action-id).

c. organisation-action-task-association-index—The unique value, or set of characters assigned to represent a specific ORGANISATION-ACTION-TASK-ASSOCIATION for a subject ORGANISATION and an object ACTION-TASK and to distinguish it from all other ORGANISATION-ACTION-TASK-ASSOCIATIONs for that ORGANISATION and that ACTION-TASK.

d. organisation-action-task-association-category-code—The specific value that represents or denotes the type of relationship between a specific ORGANISATION and a specific ACTION-TASK for a specific ORGANISATION-ACTION-TASK-ASSOCIATION. The domain values are: Approves, Controls, Initiates, Is coordinating agent for, Is point of contact for, Plans, Provides direction for, Requests.

e. organisation-action-task-association-effective-date—The date that indicates the beginning of the period of effectiveness for a specific ORGANISATION-ACTION-TASK-ASSOCIATION.

f. organisation-action-task-association-effective-time—The time that indicates the beginning of the period of effectiveness for a specific ORGANISATION-ACTION-TASK-ASSOCIATION.

g. organisation-action-task-association-intent-text—A statement by a specific ORGANISATION outlining the commander's intent or the concept of operations with regard to a specific ACTION-TASK.

13.7.2.3 The attribute *organisation-action-task-association-intent-text* permits an optional text entry whenever the commander determines that there is a need for such comment. The likely use would be in connection with a top-level task that would constitute a mission statement. A series of subordinate tasks would be created to implement the mission. It is probable that subordinate tasks would not have the intent text attached; however, the structure permits the inclusion of such additional statements.

13.7.2.4 The attributes *organisation-action-task-association-effective-date* and –*effective-time* permit the use of the date and time for any type of association; however, the primary purpose is to permit a specific date and time to be entered to mark the time of the commander's decision. The explicit entry of the date is mandatory when intent text is not null.

13.7.2.5 The responsibility for the execution of a particular ACTION-TASK is implied in the specification of UNITs (ORGANISATIONs) as ACTION-RESOURCEs; however, if either additional detail and additional roles are to be specified, then the ORGANISATION-ACTION-TASK-ASSOCIATION structure permits this to be done. For example, the initiator of the ACTION-TASK is the ORGANISATION (and, by inference, its commander) who has executive responsibility for that set of orders or plans. Thus, the Division Commander is the initiating authority for the Division operations order.

13.7.3 Basic Example

Table 94 provides example instances for ORGANISATION-ACTION-TASK-ASSOCIATION. In this example, the X Corps directs its X1 Division to plan an attack for which reconnaissance support is to be provided by a brigade from X2 Division. The corps approves the plan after the X1 Division completes the planning. X1 Division is directed to act as the co-ordinating agent for assuring that such support is integrated into the attack plan.

Table 94. Example Instances of ORGANISATION-ACTION-TASK-ASSOCIATION

ORGANISATION-ACTION-TASK-ASSOCIATION

organisation-id	action-task-id	organisation-action-task-association-index	organisation-action-task-association-category-code
[X Corps]	[Attack by X1 Division]	001	Initiates
[X1 Division]	[Attack by X1 Division]	001	Plans
[X Corps]	[Attack by X1 Division]	002	Approves
[X Corps]	[Reconnaissance by X21 Brigade]	001	Initiates
[X1 Division]	[Reconnaissance by X21 Brigade]	001	Is coordinating agent for

13.7.4 Example of Commander's Intent and Concept of Operations

13.7.4.1 The Situation

13.7.4.1.1 The BRADYLAND OKIE Front, consisting of two Armies, attacked GENERICLAND on D-Day, 1 November 1995. OKIE Front employed one operational echelon as follows, from North to South: 4th and 5th (OKIE) Armies, which reached current line-of-contact on D+3 Days. The OKIE Front then halted in place, presumably to effect re–supply operations. It now appears that BRADYLAND intentions will be clarified if and when the 7th OKIE Armoured Division is committed to battle. The most likely zone of action for 7th (OKIE) AR Division is to participate in an attack on AUSTIN, the capital of GENERICLAND.

13.7.4.1.2 The in–place Multi–National Division (MND) has been activated by SACEUR. The MND is tasked with the immediate mission of protecting AUSTIN until relieved.

13.7.4.1.3 SACEUR has activated the NATO Corps in accordance with guidance contained in NATO Contingency Plans. Seven Nations have identified and allocated formations to participate in a co-ordinated counterattack against the aggressor forces. Upon deployment, NATO Corps is to prevent 5 (OKIE) Army from seizing AUSTIN. At 0700 Hours on D plus 6 Days, NATO Corps is to launch a co-ordinated counterattack on OKIE Front formations that have invaded GENERICLAND in order to restore the International Border.

13.7.4.2 Data Representation

13.7.4.2.1 Part of the situation described above may be represented in the form of ACTIONs and ACTION-TASKs. Table 95 is a composite of several tables[50]; the columns show only the relevant data. The two column heading *action-resource* and *action-objective* are not real attributes; they are used to represent the essential data that would come from the ACTION-RESOURCE and ACTION-OBJECTIVE structures.

Table 95. Representation of ACTIONs

ACTION-TASK/ACTION-RESOURCE/ACTION-OBJECTIVE (selected data)[51]

action-task-id	action-task-category-code	action-resource	action-task-verb-phrase-code	action-objective
A1	Order	ACE	Defend	Genericland
A2	Order	MND	Defend	Austin
A3	Order	MND	Hold	Pedernales Defensive Line
A4	Order	ACE	Set up	NATO Corps
A5	Order	NATO Corps	Defend	Austin
A6	Order	NATO Corps	Secure	Bradyland-Genericland Border
A7	Order	NATO Corps	Counter attack	OKIE Front

13.7.4.2.2 The relationships between instances of ACTION-TASKs are established in the table ACTION-FUNCTIONAL-ASSOCIATION, illustrated in Table 96 for this example.

[50] In this case, a full description would require the following entities (tables): ACTION, TASK, ACTION-RESOURCE, ACTION-RESOURCE-ITEM, ACTION-OBJECTIVE, ACTION-OBJECTIVE-ITEM, and OBJECT-ITEM (together with some of its subtypes). See Chapter 13.

[51] The dashed line at the right side of the table indicates that some attributes that are not relevant to the example have been omitted.

(a) The actions A1, A2, and A3 constitute a hierarchy, as specified in the first two records. ACE has the primary responsibility for defence. It assigns the mission of defending the capital city—Austin—to its only in–place force—the MND.

(b) Another relationship—the third record—indicates that Action A4 is a subordinate action in carrying out the mission specified in A1.

(c) The fourth record indicates a change of responsibility for defending Austin from MND to NATO Corps.

(d) The fifth record indicates that the NATO Corps is being set up in order for it to execute its additional mission that is stated as A6.

(e) The sixth record relates one of the many subordinate activities (A7) to the mission of the Corps (A6).

Table 96. Relationships among ACTION-TASKs

ACTION-FUNCTIONAL-ASSOCIATION

subject-action-id	object-action-id	index	category-code
A1	A2	1	Has as a sub-ACTION
A2	A3	1	Has as a sub-ACTION
A1	A4	1	Has as a sub-ACTION
A5	A2	1	Is a modification of
A4	A6	1	In order that
A6	A7	1	Has as a sub-ACTION

13.7.4.2.3 Table 97 displays two records that could be made in association with the battlespace activities of the example. In the first one, SACEUR (who is represented through ACE) initiates a chain of activities. He issues general guidance on the use of air power during the military operations in defence of Genericland. In the second one, NATO Corps commander has received a mission order from SACEUR to restore the international border; the chosen course of action is a counter–attack. His role with respect to that action is that of a planner. He issues his statement of the operational expectations.

Table 97. Examples of Intent Statements

ORGANISATION-ACTION-TASK-ASSOCIATION[52]

org-id	action-task-id	index	category-code	intent-text	effective-date	effective-time

[52] Braces are used to represent the actual data for ease of reading. In the physical implementation, the first column would contain only the identifier; the description of the organisation that the identifier refers to would be contained in other tables. The date would be expressed in the number of days since the start of the 20th century; the user's application would display the date in any desired format, one of which could be the one shown here.

[ACE]	A1	1	Provides direction for	The AIRCENT will gain and retain air superiority between the FLET and the BRADYLAND -GENERICLAND International Border with priority of effort to cover movements of the MND, then NATO Corps. AIRCENT will provide Battlefield Air Interdiction (BAI) and Close Air Support (CAS) until D+12 Days especially on any elements of BRADYLAND forces East of the International Border. Hot pursuit of OKIE forces attempting to return to BRADYLAND is authorized. Additionally, AIRCENT will control airspace, provide incidental high-to-medium air defense (HIMAD) coverage over the Corps area, as well as tactical air support to NATO Corps and its subordinate formations.	[2 Nov 95]	[0900]
[NATO Corps]	A7	1	Provides direction for	Counterattack operations will destroy the OKIE Front reconnaissance elements and forward detachments along the line-of-contact (LC) and reduce the first echelon regiments of the first echelon divisions to less than 50-percent effectiveness.	[4 Nov 95]	[1430]

13.7.5 Creating a Task Organisation

13.7.5.1 An instance of ACTION-TASK can be related to multiple instances of ORGANISATION-ORGANISATION-ASSOCIATION. The Generic Hub provides this linkage through a non-identifying relationship "specifies-the-need-for/is-produced-in-response-to" from ACTION-TASK to ORGANISATION-ORGANISATION-ASSOCIATION, as illustrated in the previous Figure 78. This enables to capture in data the requirement of commanders to reassign UNITs (ORGANISATIONs) over which they exercise control to other UNITs and to specify new command relationships.

13.7.5.2 A task organisation is usually tailored for a particular operation. The creation of a task organisation in response to an ACTION-TASK can be represented in the model by using several entities and relationships. The key entities are ACTION-TASK to specify the needed reorganisation; ACTION-FUNCTIONAL-ASSOCIATION to link the reorganisation to a master plan or action; and the ORGANISATION-ORGANISATION-ASSOCIATION in which the actual command relationships are recorded. The balance of this section consists of an example to illustrate the mechanism for creating a task organisation.

13.7.5.3 A multinational task organisation headed by 1(UK) Div is to be set up by taking on additional UNITs from several nations for the duration of defensive operations. Those UNITs that retain their existing command relationships are not shown in this example. The additions to be made to the Task Organisation of 1 (UK) Div are illustrated in the organisation chart provided in Figure 79.

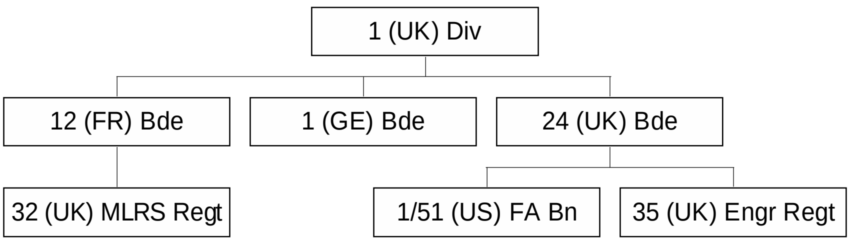


Figure 79. Task Organisation for 1 (UK) Division

13.7.5.4 1st (UK) Armoured Division (1(UK) Div) is to carry out defensive operations, although the specific actions for that defensive operation itself are not included in this example. A series of tables illustrates how a plan for a group of UNITs to be reorganised for a particular ACTION-TASK can be generated.

13.7.5.5 Table 98 sets up the individual ACTIONs. The first one is intended for the master ACTION, which is named OPERATION SHIELD. The remaining ACTIONs (out of many more potential ones) specify that the subordinate units are to be reorganised as indicated by the action-task-category-code value "Reorganise."[53] At this stage, neither ACTION linkages nor affected units are identified.[54]

Table 98. Setting Up a Task Organisation: ACTION/ACTION-TASK

(a) ACTION

action-id	action-category-code	action-name
101	ACTION-TASK	OPERATION SHIELD
111	ACTION-TASK	—
112	ACTION-TASK	—
113	ACTION-TASK	—
114	ACTION-TASK	—
115	ACTION-TASK	—
116	ACTION-TASK	—

(b) ACTION-TASK

action-task-id	action-task-verb-phrase-code
101	Defend
111	Reorganise
112	Reorganise
113	Reorganise
114	Reorganise
115	Reorganise
116	Reorganise

13.7.5.6 The ACTION-FUNCTIONAL-ASSOCIATION entity in Table 99 indicates that each instance of the action-category-code value "Reorganise" is linked to the superior action (i.e., that given to 1(UK)Div to defend) by the action-functional-association-category-code value "In order that." This means that the reorganisations are planned in order to facilitate the defensive mission given to 1(UK)Div.

Table 99. Setting Up a Task Organisation: ACTION-FUNCTIONAL-ASSOCIATION

ACTION-FUNCTIONAL-ASSOCIATION

action-functional-association-subject-action-id	action-functional-association-object-action-id	action-functional-association-index	action-functional-association-category-code
111	101	1	In order that
112	101	1	In order that
113	101	1	In order that
114	101	1	In order that
115	101	1	In order that
116	101	1	In order that

13.7.5.7 The ACTION-RESOURCE entity in Table 100 begins to specify the resources that are the subjects of each of the ACTIONs in Table 98. The table contains a pointer ACTION-RESOURCE-ITEM to a subtype structure (not shown) that would record the identifiers of the appropriate units. The first instance contains the entry "Is the responsible agent for" to indicate that

---

53 Since the descriptive phrase for a planned ACTION is contained in TASK, the appropriate columns from the TASK entity have been appended here for ease of reference.

54 In implementing this data model scheme in a real system, the use of this action-category-code could serve as an alert or trigger to the operational user and the software application that there exist related ORGANISATION-ORGANISATION-ASSOCIATIONs.

1 (UK) Division is charged with defending a given objective. The remaining entries indicate that the specified resources are "Authorised for use" in the corresponding ACTION.

Table 100. Setting Up a Task Organisation: ACTION-RESOURCE

ACTION-RESOURCE

action-id	action-resource-index	action-resource-category-code	action-resource-qualifier-code
101	1	ACTION-RESOURCE-ITEM	Is the responsible agent for
111	1	ACTION-RESOURCE-ITEM	Authorised for use
112	1	ACTION-RESOURCE-ITEM	Authorised for use
113	1	ACTION-RESOURCE-ITEM	Authorised for use
114	1	ACTION-RESOURCE-ITEM	Authorised for use
115	1	ACTION-RESOURCE-ITEM	Authorised for use
116	1	ACTION-RESOURCE-ITEM	Authorised for use

13.7.5.8 The ACTION-OBJECTIVE (Table 101) records the ACTION-OBJECTIVE-ITEM against which an ACTION is directed in a manner analogous to that described above for resources. In general, ACTION-OBJECTIVEs are recorded for all ACTIONs. The first instance points to the objective (i.e., FEATURE) that 1 (UK) Division must defend. When the action-category-code value for an instance is "Reorganise," the ACTION-OBJECTIVE is the high-level ORGANISATION whose structure is being altered, whether temporarily or permanently, in this case, 1 (UK) Div. The values of action-objective-priority-code in the ACTION-OBJECTIVE entity must be the same as in the ACTION-TASK since only a single objective is associated with each ACTION.

Table 101. Setting Up a Task Organisation: ACTION-OBJECTIVE

ACTION-OBJECTIVE

action-id	action-objective-index	action-objective-category-code	action-objective-qualifier-code	action-objective-priority-code
101	1	ACTION-OBJECTIVE-ITEM	Authorised	Priority 1
111	1	ACTION-OBJECTIVE-ITEM	Authorised	Priority 1
112	1	ACTION-OBJECTIVE-ITEM	Authorised	Priority 1
113	1	ACTION-OBJECTIVE-ITEM	Authorised	Priority 1
114	1	ACTION-OBJECTIVE-ITEM	Authorised	Priority 2
115	1	ACTION-OBJECTIVE-ITEM	Authorised	Priority 2
116	1	ACTION-OBJECTIVE-ITEM	Authorised	Priority 3

13.7.5.9 The ACTION-TASK entity (Table 102) allows the Corps commander to define the timings associated with the reorganisation, the priorities for reorganisation and to change the status of this (or any other ACTION-TASK) from a plan to an order. In this example, different priorities and timings are given to the ACTION-TASKs. It should be noted that all the UNITs used in this example are assumed to be Corps troops, and hence available to the Corps Commander to reallocate to meet his mission. In many cases, such a reorganisation will require additional ORGANISATION-ORGANISATION-ASSOCIATIONs to be set up at other echelons of the ORGANISATION, and result in the creation of additional instances.

Table 102. Setting Up a Task Organisation: Detailing ACTION-TASK

ACTION-TASK

action-task-id	***-category-code	***-planned-start-date	***-planned-start-time	***-start-precision-code	***-start-qualifier-code	***-priority-code	***-verb-phrase-code

101	Plan	[15 Aug 94]	[1030]	Minute	No later than	1	Defend
111	Plan	[15 Aug 94]	[1030]	Minute	No later than	1	Reorganise
112	Plan	[15 Aug 94]	[1030]	Minute	No later than	1	Reorganise
113	Plan	[15 Aug 94]	[1030]	Minute	No later than	1	Reorganise
114	Plan	[17 Aug 94]	[0600]	Minute	No later than	2	Reorganise
115	Plan	[17 Aug 94]	[0600]	Minute	No later than	2	Reorganise
116	Plan	[18 Aug 94]	[1500]	Minute	At	3	Reorganise

Note: *** stands for "action-task."

13.7.5.10 The ORGANISATION-ORGANISATION-ASSOCIATION entity (Table 103) captures data concerning the details about the relationship of one ORGANISATION to another, including the command status of each association.[55]

Table 103. Association Relationships in Setting Up a Task Organisation

ORGANISATION-ORGANISATION-ASSOCIATION

***-subject-org-id	*** -object-org-id	*** -index	***-subcategory-code	***-action-task-id	reporting-data-id
17 [1 (UK) Div]	55 [12 (FR) Bde]	1	OPCON	111	rd1411
17 [1 (UK) Div]	114 [1 (GE) Bde]	1	OPCON	112	rd1452
17 [1 (UK) Div]	78 [24 (UK) Bde]	1	OPCON	113	rd1797
78 [24 (UK) Bde]	534 [1/51 (US) FA Bn]	1	OPCON	114	rd1644
78 [24 (UK) Bde]	279 [35 (UK) Engr Rgt]	1	OPCON	115	rd1701
55 [12 (FR) Bde]	212 [32 (UK) MLRS Rgt]	1	TACON	116	rd2053

Note: *** denotes "organisation-organisation-association".

13.7.6 Business Rule for ORGANISATION-ACTION-TASK-ASSOCIATION

When organisation-action-task-association-intent-text is not null, then the attribute organisation-action-task-association-effective-date must not be null.

13.8 Summary of Principal ACTION Functionality

13.8.1 This section is included as an aid to the reader to recapitulate the main concepts that have been introduced so far in describing ACTION functionality. Figure 80 is a high-level diagram that illustrates these concepts.

13.8.2 The entity ACTION provides the structure for recording activities in the battlespace. These manifest themselves as either ACTION-EVENTs or ACTION-TASKs that are represented as subtypes of ACTION. The progress in performing the activities represented by these subtypes can be specified through ACTION-EVENT-STATUS and ACTION-TASK-STATUS. In

[55] A specification of reorganisation under ACTION does not assure an entry in the ORGANISATION-ORGANISATION-ASSOCIATION table. The latter table maintains part of the data that describes the battlespace situation. The former provides planning information. An automated command and control system needs some mechanism to assure that the execution of a planned ACTION that changes the battlespace situation is properly represented as changes in the part of the database that maintains status (OBJECT-ITEM-STATUS, OBJECT-ITEM associations, HOLDING, LOCATION, and so on).

addition, the several roles that an ORGANISATION may have with respect to a given ACTION-TASK can be described in ORGANISATION-ACTION-TASK-ASSOCIATION.

13.8.3 A full specification of ACTIONs entails the designation of OBJECT-ITEMs and OBJECT-TYPEs as (a) resources that either carry out activities or enable or control the prosecution of activities or (b) objectives of those activities. The model structure caters to this requirement through the entities ACTION-RESOURCE and ACTION-OBJECTIVE that provide the link to battlespace objects and their types. A similar linkage—ACTION-EFFECT—provides the means for recording the actual outcomes of ACTIONs or to specify additional detail about desired outcomes of ACTIONs.

13.8.4 The associations between ACTIONs may be temporal or functional. The ACTION-TEMPORAL-ASSOCIATION permits the sequencing of ACTIONs in several ways—in purely relative temporal relationships, relative with specified offsets, or in absolute timing, as well as combinations of these—to serve the needs that arise in different phases of planning and varying according to the echelon and the degree of detail.

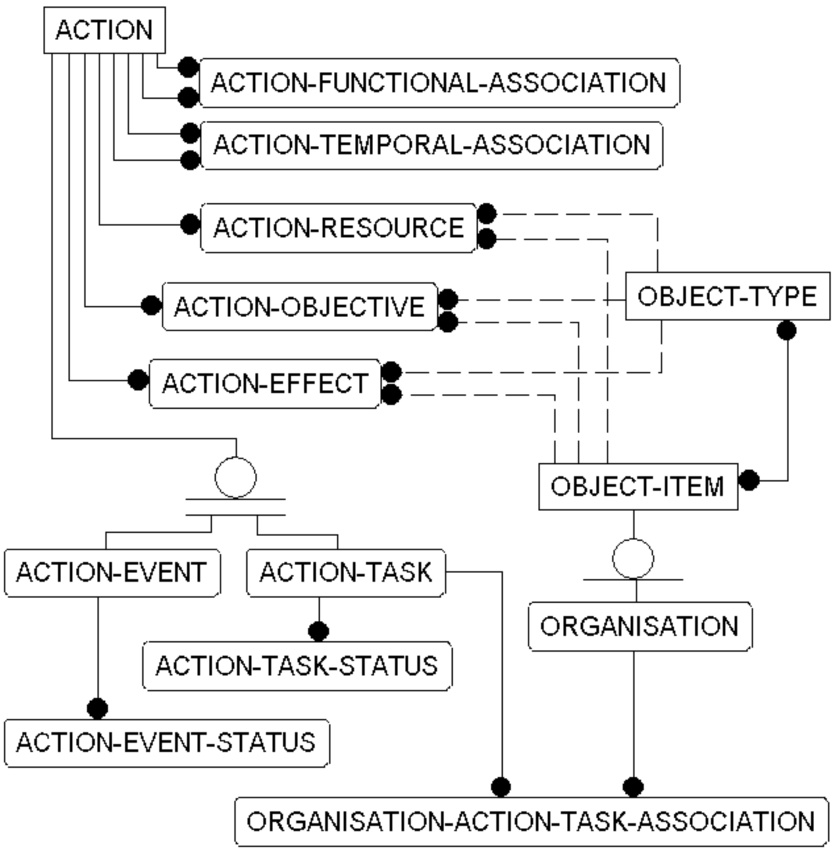


Figure 80. A Summary of Principal Functionality for ACTION

13.9 Extending ACTION Functionality

13.9.1 General

13.9.1.1 The enhancements include five concepts: ACTION-REQUIRED-CAPABILITY, ACTION-RESOURCE-EMPLOYMENT, ACTION-CONTEXT, RULE-OF-ENGAGEMENT together with ACTION-RULE-OF-ENGAGEMENT, and CANDIDATE-

TARGET-LIST with CANDIDATE-TARGET-DETAIL. The data structure for these concepts is illustrated in Figure 81 at the entity level. The concepts are presented and discussed in the succeeding sections.

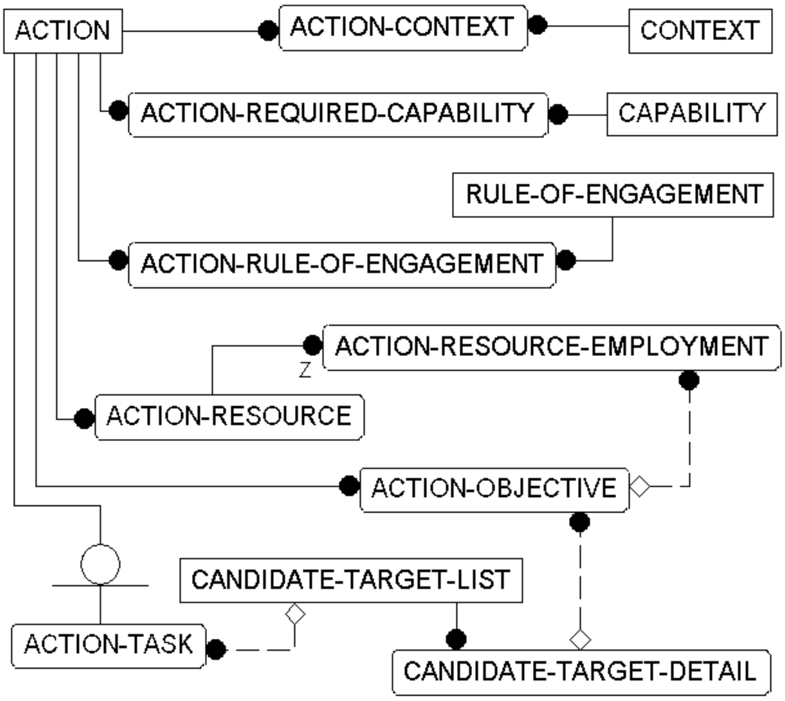


Figure 81. Enhancing the Functionality of ACTION

13.9.2 ACTION-REQUIRED-CAPABILITY

13.9.2.1 The ability to specify a required CAPABILITY for a resource of an ACTION is necessary for optimum resource employment planning and for in-progress management of resources during the life of an ACTION. The entity ACTION-REQUIRED-CAPABILITY allows the CAPABILITY required for an ACTION to be specified. The structure is illustrated in Figure 82. The independent entity CAPABILITY is described in Chapter 8. ACTION-REQUIRED-CAPABILITY is defined as the specific military quality, specified as a CAPABILITY, required to meet an agreed operational need, specified as an ACTION.

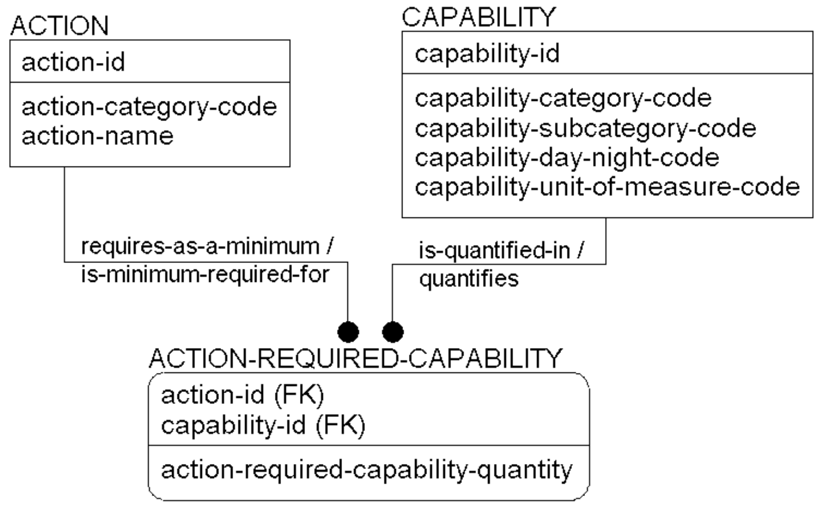


Figure 82. ACTION-REQUIRED-CAPABILITY View

13.9.2.2 A specification of the required CAPABILITYs is needed for two reasons. In the first instance, it allows the user to match OBJECT-TYPE-CAPABILITY-NORMs or OBJECT-ITEM-CAPABILITYs to the required capability in the selection of the most appropriate resource. In the second instance, if the ACTION-REQUIRED-CAPABILITY is known, and, if a resource that was selected to match a CAPABILITY is no longer available, it would be of assistance to the planner in matching replacement assets to requirements. In addition, this data can be used to assess the resulting effectiveness of a planned ACTION.

13.9.2.3 The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs.

b. capability-id—The unique value, or set of characters, assigned to represent a specific CAPABILITY and to distinguish it from all other CAPABILITYs.

c. action-required-capability-quantity—The non-monetary numeric value representing the aggregated units of a specific CAPABILITY that is needed for a specific ACTION.

13.9.2.4 The use of ACTION-REQUIRED-CAPABILITY is demonstrated by an example which requires the laydown of one square kilometre anti-tank minefield in 3 hours, and there are two candidate units capable of laying minefields. The example is illustrated in Table 104. Sub-tables (a) and (b) set up the specification of the type of capability that is of concern; in this particular case it involves a reference to ENGINEERING-CAPABILITY as well as the specification of the type of facility for which a capability is relevant. Sub-table (c) specifies the required capability for Action 27 (create minefield) as being 3 hours. Sub-table (d) shows the actual ability of two ORGANISATIONs (Units 70 and 96) to lay the specified type of minefield.

13.9.2.5 A comparison of the data in tables OBJECT-ITEM-CAPABILITY and ACTION-REQUIRED-CAPABILITY indicates that the choice of Unit 70 to carry out the ACTION is likely to be the best option based on the capability criteria described. It should be noted that in this example each unit is reporting its own capability [as shown in Sub-table (e)]. In general, such a report could be made by another ORGANISATION, particularly when enemy capabilities are assessed.

Table 104. Example of ACTION-REQUIRED-CAPABILITY

(a) CAPABILITY

capability-id	capability-category-code	capability-subcategory-code	capability-day-night-code	capability-unit-of-measure-code
677	ENGINEERING-CAPABILITY	Construction time	Day	Hour

(b) ENGINEERING-CAPABILITY

engineering-capability-id	facility-type-id	*-height-dimension	*-length-dimension	*-width-dimension
677	[Minefield, anti-tank]	—	1000 (m)	1000 (m)

Note: * denotes "engineering-capability".

(c) ACTION-REQUIRED-CAPABILITY

action-id	capability-id	action-required-capability-quantity
27 [create minefield]	677	3 [hour]

(d) OBJECT-ITEM-CAPABILITY

capability-id	object-item-id	object-item-capability-quantity	reporting-data-id
677 [lay minefield]	8021 [Unit 70]	2.5 [hour]	rd15
677 [lay minefield]	8034 [Unit 96]	3.7 [hour]	rd16

(e) REPORTING-DATA

reporting-data-id	***-category-code	***-credibility-code	***-reporting-date	***-reporting-time	***-reporting-organisation-id
rd15	Reported	Trusted	[01 Aug 98]	[0930]	8021
rd16	Reported	Trusted	[01 Aug 98]	[0940]	8034

Note: *** stands for "reporting-data"

(f) REPORTING-DATA-ABSOLUTE-TIMING

***–id	***–duration	***–effective-date	***–effective-time	***–effective-time-precision-code
rd15	—	[01 Aug 98]	[1200]	Minute
rd16	—	[01 Aug 98]	[1200]	Minute

Note: *** stands for "reporting-data-absolute-timing"

13.9.2.6 As this example indicates, the data structure provides considerable flexibility in specifying the capability of interest through the appropriate selection of capability category and subcategory codes and units of measure.

13.9.3 ACTION-RESOURCE-EMPLOYMENT

13.9.3.1 ACTION-RESOURCE-EMPLOYMENT is defined as the procedure for using a specific OBJECT-TYPE or OBJECT-ITEM against an objective in an ACTION. ACTION-RESOURCE-EMPLOYMENT is a dependent entity, derived from the relationship "is used according to/describes use of" from ACTION-RESOURCE. In addition, there is a non-identifying relationship "is the subject of/is relevant for" from ACTION-OBJECTIVE to ACTION-RESOURCE-EMPLOYMENT. These relationships are shown in Figure 83.

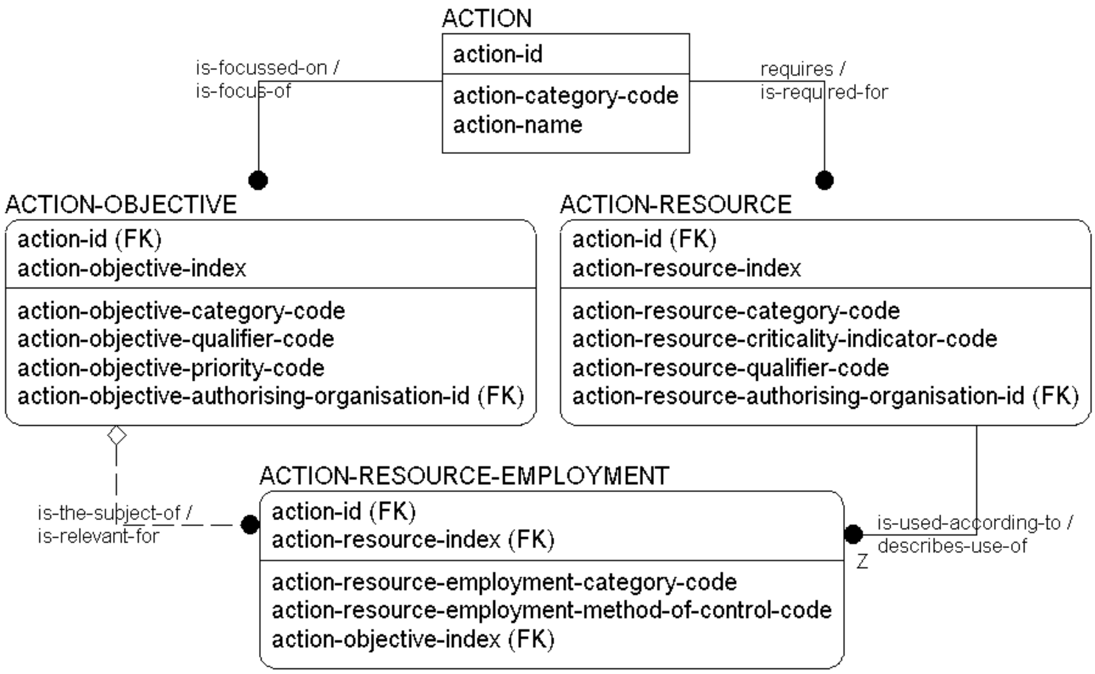


Figure 83. ACTION-RESOURCE-EMPLOYMENT View

13.9.3.2 ACTION-RESOURCE-EMPLOYMENT has two native data attributes:

a. action-resource-employment-category-code—The specific value that represents or denotes the class of ACTION-RESOURCE-EMPLOYMENT. It serves as a discriminator that partitions ACTION-RESOURCE-EMPLOYMENT into subtypes. The domain values are: ACTION-AIRCRAFT-EMPLOYMENT, Not otherwise specified.[56]

b. action-resource-employment-method-of-control-code—The specific value that represents the standard procedure to be used in controlling the employment of a specific ACTION-RESOURCE in support of a specific ACTION. The domain values are: As ordered, On orders, Not known.

13.9.3.3 Table 105 provides an example instance of ACTION-RESOURCE-EMPLOYMENT. A close air support flight has been assigned as one of the resources to be used during an attack on an enemy battalion. Its instruction are to attack "on orders," at a time to be specified by a co-ordinating authority.

Table 105. Example Instance of ACTION-RESOURCE-EMPLOYMENT

ACTION-RESOURCE-EMPLOYMENT

action-id	action-resource-index	action-resource-category-code	action-resource-employment-method-of-control-code	action-objective-index

[56] The subtype ACTION-AIRCRAFT-EMPLOYMENT is described in Chapter 15.

111 [Attack]	2 [refers to a CAS flight]	ACTION-AIRCRAFT-EMPLOYMENT	On orders	1 [refers to an enemy battalion]

13.9.4 ACTION-CONTEXT

13.9.4.1 The ACTION structure by itself may constitute a complete specification of what is to be done, but it can provide only a minimal indication of the whole situation, background, or environment relevant to a particular ACTION. The entity ACTION-CONTEXT links the two parent entities in order to state enabling, constraining or otherwise relevant conditions on an ACTION through the functionality that CONTEXT provides to point to dynamic data. It can also be used to capture pictures of a tactical situation. ACTION-CONTEXT is defined as a relationship between a specific ACTION and a specific CONTEXT. The structure is illustrated in Figure 84.

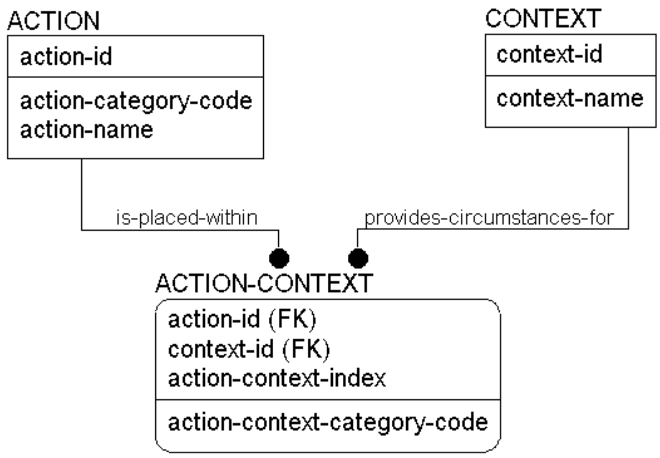


Figure 84. The ACTION-CONTEXT Structure

13.9.4.2 The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs.

b. context-id—The unique value, or set of characters, assigned to represent a specific CONTEXT and to distinguish it from all other CONTEXTs.

c. action-context-index—A unique value, or set of characters, assigned to represent a specific ACTION-CONTEXT for a specific ACTION and a specific CONTEXT and to distinguish it from all other ACTION-CONTEXTs for that ACTION and that CONTEXT.

d. action-context-category-code—The specific value that represents or denotes the nature of the ACTION-CONTEXT as it relates to a specified ACTION and a specific CONTEXT. The domain values are: Final state, actual; Final state, planning; Initial state, actual; Initial state, planning; Intermediate state, actual; Intermediate state, planning, Maximum require, Minimum required.

13.9.4.3 The CONTEXT entity is used to group instances of REPORTING-DATA (where a group could consist of a single instance). The ACTION-CONTEXT enables the linkage of CONTEXT to ACTION in order to indicate information that could apply to ACTIONs that have been executed, are being executed at some intermediate stage, are pending execution, or are planned for some future operation. Multiple CONTEXTs can be associated with an ACTION at different phases of its life cycle. The choice of domain values for *action-context-category-code* makes this clear. Thus, the linkage to CONTEXT can help to specify initial, intermediate, or final enabling or constraining conditions attendant upon an ACTION.

13.9.4.4 The planner can use CONTEXT information to judge the merits of a plan or order and make adequate changes in order to respond to a changing battlespace situation and the commander can use the CONTEXT information to choose between multiple courses of ACTION.

13.9.4.5 Amplifying ACTION Statements

13.9.4.5.1 It is evident that different ACTIONs:

a. Require different initial conditions to be fulfilled before the ACTION can start

b. Are affected differently by given constraints

c. Achieve different conditions resulting from execution.

13.9.4.5.2 As an example, an ACTION to ***move*** may require a starting point, may be degraded by severe weather conditions, and may ultimately result in reaching the desired destination. An ACTION to ***attack*** may require a positive balance between the strength of own forces compared to the enemy's strength, may be enabled by geographical conditions, and may result in withdrawal of the enemy.

13.9.4.5.3 The combination of the REPORTING-DATA and CONTEXT entities allows the user to specify complex ACTION statements in a comprehensive way. For each individual ACTION, the user has the means to specify the initial and resulting required, estimated or actual conditions in terms of data referenced by REPORTING-DATA. Furthermore, the user is able to specify additional constraints which either enable an ACTION or degrade an ACTION.

13.9.4.6 Alternative Courses of ACTION

13.9.4.6.1 The military user, who has to live with many unknowns and considerable uncertainty, needs to be able to specify different courses of ACTION that may be chosen for execution according to future conditions.

13.9.4.6.2 Use of the ACTION-FUNCTIONAL-ASSOCIATION structure permits multiple ACTIONs to be defined as alternatives; the ACTION-CONTEXT and CONTEXT entities may be used to specify a different set of initial conditions for each ACTION.

13.9.4.7 Amplifying ACTION-OBJECTIVE Statements

13.8.4.7.1 The CONTEXT entity also provides a way of amplifying ACTION-OBJECTIVE statements by specifying the desired or required data as an intended outcome for an ACTION (e.g., 1 NL Div at new location (x,y) after attack on 2nd Bradyland Division with 1 NL Div still substantially operational).

13.9.4.8 Amplifying ACTION-EFFECT Statements

13.9.4.8.1 It is possible to use CONTEXT entity to amplify the ACTION-EFFECT statements in a way similar to amplifying ACTION-OBJECTIVE statements; that is, specifying the actual outcome and/or side effects of an ACTION in terms of estimated and actual data (e.g., 1 NL Div at new location 2 miles south of (x,y) and only marginally operational).

13.9.4.8.2 The CONTEXT entity, in helping to specify the intended outcome and in describing an actual outcome of an ACTION can be useful in evaluating whether an ACTION has accomplished its stated goals.

13.9.4.9 An Example of the Use of ACTION-CONTEXT

13.9.4.9.1 The Multi National Division is planning an activity that involves two subordinate units—the 11th (NL) Battalion and the 9th (UK) Battalion. The two units are to move from their current positions, capture Hill 251, and then occupy two different positions on Hill 251, the 11th at location X and the 9th at location Y. The situation is illustrated in Figure 85. The first panel shows the current positions of the units in relation to Hill 251; the second panel shows the planned movement during the attack; and the third panel shows the desired positions of the two units at the completion of the ACTION. The example takes advantage of the ACTION-CONTEXT functionality to set up the actual initial conditions for the activity as well as the desired final conditions.

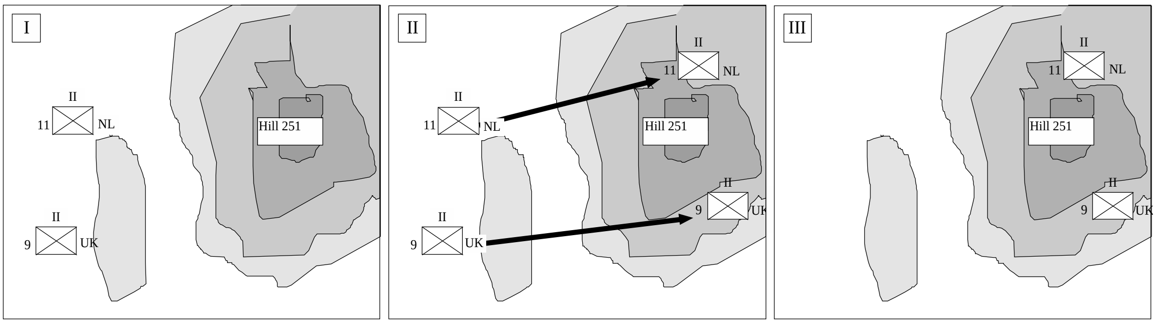


Figure 85. Planned Movement of Two Units

13.9.4.9.2 The data description of the situation is provided in the next six sets of tables. The initial data that is assumed to be in the database when the planning begins is shown in Table 106. The battlespace objects that have a role in this example are listed in Sub-table (a). The current locations for the two battalions are provided through Sub-tables (b), (c), and (d). Sub-tables (b) and (c) provide the specification of co-ordinates (here given as notional), while Sub-table (d) (ORGANISATION-POINT) specifies the units (organisations) for which the co-ordinates are valid. Sub-table (e) contains the reporting data for the position report.

Table 106. The Initial Data

(a) OBJECT-ITEM

object-item-id	object-item-category-code	object-item-name
0000001	ORGANISATION	*Multi National Division*
0000002	ORGANISATION	*11th NL Battalion*
0000003	ORGANISATION	*9th UK Battalion*
0000004	FEATURE]	*Hill 251*

(b) POINT

point-id	point-category-code
0003002	ABSOLUTE-POINT
0003003	ABSOLUTE-POINT

(c) ABSOLUTE-POINT

absolute-point-id	absolute-point-elevation-category-code	absolute-point-latitude-coordinate	absolute-point-longitude-coordinate
0003002	Local terrain	[X-latitude]	[X-longitude]
0003003	Local terrain	[Y-latitude]	[Y-longitude]

(d) ORGANISATION-POINT

organisation-id	point-id	organisation-point-index	reporting-data-id
0000002	0003002	0000001	0099001
0000003	0003003	0000001	0099002

(e) REPORTING-DATA

reporting-data-id	***-category-code	***-credibility-code	***-reporting-organisation-id
0099001	Reported	Trusted	0000002
0099002	Reported	Trusted	0000003

***-ABSOLUTE-TIMING

***–absolute-timing-effective-date	***– absolute-timing-effective-time
d1	t1
d2	t2 [(d2,t2)>(d1,t1)]

Note: *** stands for "reporting-data"

13.9.4.9.3 Staff planning sets up "Operation Hill 251" in which a specific ACTION-TASK record is created using the value "Capture" for action-task-verb-phrase-code (see Sub-tables (a) and (b) in Table 107). The resources to be used in this ACTION-TASK are specified to be the two battalions (Sub-tables (c) and (d)), and the single objective is Hill 251 (Sub-tables (e) and (f)). This type of ACTION specification represents a typical use of the ACTION structure regardless of any further conditions that may be prescribed through ACTION-CONTEXT.

Table 107. Setting Up "Operation Hill 251"

(a) ACTION

action-id	action-category-code	action-name
0077001	ACTION-TASK	Operation Hill 251

(b) ACTION-TASK

action-task-id	action-task-category-code	action-task-verb-phrase-code
0077001	Plan	Capture

(c) ACTION-RESOURCE

action-id	action-resource-index	action-resource-category-code	action-resource-criticality-indicator-code
0077001	0000001	ACTION-RESOURCE-ITEM	Yes
0077001	0000002	ACTION-RESOURCE-ITEM	Yes

(d) ACTION-RESOURCE-ITEM

action-id	action-resource-index	object-item-id
0077001	0000001	*0000002 (11th NL Bat.)*
0077001	0000002	*0000003 (9th UK Bat.)*

(e) ACTION-OBJECTIVE

action-id	action-objective-index	action-objective-category-code
0077001	0000001	ACTION-OBJECTIVE-ITEM

(f) ACTION-OBJECTIVE-ITEM

action-id	action-objective-index	object-item-id
0077001	0000001	0000004 (*Hill 251*)

13.9.4.9.4 The next step is to create records that specify the initial conditions for the planned operation. In this case, the conditions specified are actual rather than desired. The data are shown in Table 108. Sub-tables (a) and (b) specify that this instance of CONTEXT consists of two instances of REPORTING-DATA (0099001 and 0099002 from Table 106). The table states that the CONTEXT is in effect the fact that the two battalions are in position as specified in the initial table for this example. It should be noted that the CONTEXT structure uses indirect reference to the relevant data by pointing to the specific instances of REPORTING-DATA that are related to the actual data.

Table 108. An Initial CONTEXT from Two REPORTING-DATAs

(a) CONTEXT

context-id	context-name
0555001	Initial Conditions for Operation Hill 251

(b) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
0555001	1	0099001
0555001	2	0099002

13.9.4.9.5 The CONTEXT of the previous table is related to ACTION, as shown in Table 109. A meaning is given to this relationship through the action-context-category-code whose value in this case is “Initial state, actual.”

Table 109. Relating CONTEXT to ACTION

ACTION-CONTEXT-ASSOCIATION

action-id	context-id	action-context-index	action-context-category-code
0077001	0555001	0000001	Initial state, actual

13.9.4.9.6 The desired end conditions for the operation are set up by the Multi-National Division. This is done by first specifying for the two battalions the final positions on Hill 251 as being (X’-latitude, X’-longitude) and (Y’-latitude, Y’-longitude). The data are shown in Table 110, Sub-tables (a), (b), and (c). Since the metadata is identical for the two records in Sub-table (c), only a single instance of REPORTING-DATA is needed. The value for effective date and time (d4, t4) should correspond to a future time after the expected completion of the operation.

Table 110. Locations Planned for the Battalions by Multi National Division

(a) POINT

point-id	point-category-code
0003004	ABSOLUTE-POINT
0003005	ABSOLUTE-POINT

(b) ABSOLUTE-POINT

absolute-point-id	absolute-point-elevation-category-code	absolute-point-latitude-coordinate	absolute-point-longitude-coordinate
0003004	Local terrain	[X’-latitude]	[X’-longitude]
0003005	Local terrain	[Y’-latitude]	[Y’-longitude]

(c) ORGANISATION-POINT

organisation-id	point-id	organisation-point-index	reporting-data-id
0000002	0003004	0000001	0099003
0000003	0003005	0000001	0099003

(e) REPORTING-DATA

reporting-data-id	***-category-code	***-credibility-code	***-reporting-organisation-id
0099003	Planned	Trusted	0000001

***-ABSOLUTE-TIMING

***–absolute-timing-effective-date	***– absolute-timing-effective-time
d4	t4

Note: *** stands for “reporting-data”

13.9.4.9.7 The CONTEXT in this case consists of a single instance of REPORTING-DATA that references the reporting-data-id of the previous table. The construct is shown in Sub-tables (a) and (b) of Table 111. This instance of CONTEXT is linked to ACTION as shown in Sub-table (c) where the meaning given to the relationship by the value "Final state, planning" for the action-context-category-code.

Table 111. Planned Final State of the " Operation Hill 251"

(a) CONTEXT

context-id	context-name
0555004	Final State for Operation Hill 251

(b) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
0555004	1	0099003

(c) ACTION-CONTEXT-ASSOCIATION

action-id	context-id	action-context-index	action-context-category-code
0077001	0555004	0000001	Final state, planning

13.9.5 Rules of Engagement

13.9.5.1 LC2IEDM provides a simple structure for listing rules of engagement and indicating which rules apply to which ACTION. The structure consists of two entities: RULE-OF-ENGAGEMENT and ACTION-RULE-OF-ENGAGEMENT. The first is defined as a specification of a rule which governs the way a given activity is executed. The second is defined as a relationship between a specific ACTION and a specific RULE-OF-ENGAGEMENT designed to convey circumstances which are deemed normal for the ACTION concerned. The structure is illustrated in Figure 86.

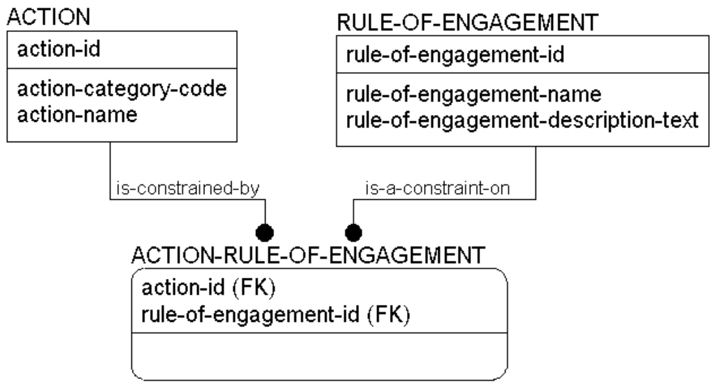


Figure 86. Specification of Rules of Engagement for ACTIONs

13.9.5.2 The entity RULE-OF-ENGAGEMENT in essence provides a list of rules. Its attributes are defined as follows:

a. rule-of-engagement-id—The unique value, or set of characters, assigned to represent a specific RULE-OF-ENGAGEMENT and to distinguish it from all other RULE-OF-ENGAGEMENTs.

b. rule-of-engagement-name—A designation, expressed in a word or phrase, of a specific RULE-OF-ENGAGEMENT.

c. rule-of-engagement-description-text—The unformatted character string assigned to represent a specific RULE-OF-ENGAGEMENT.

13.9.5.3 The entity ACTION-RULE-OF-ENGAGEMENT permits the linking of specific rules to specific ACTIONs. It has no attributes aside from the inherited foreign keys.

13.10 Identifying Candidate Targets

13.10.1 Introduction

13.10.1.1 The primary purpose of this structure is to enable the building of target lists for consideration during planning processes. The notion of a potential target is different from the notion of TARGET (a model entity) that is actually specified as an objective of activity in military planning. The structure permits the nomination of targets at any number of echelons with or without a change in target numbering. An item or type may be nominated as a target multiple times, possibly with a different activity focus in each nomination. The authorisation of candidate targets may also occur at multiple levels.

13.10.1.2 The structure for identifying potential target includes two tiers of entities: the first to create candidate target lists and the second to itemise candidate targets individually. The model contains the entities CANDIDATE-TARGET-LIST and CANDIDATE-TARGET-DETAIL for this purpose. There is also a provision to specify authorisations for lists in their entirety and individual targets separately. The data structure consists of CANDIDATE-TARGET-LIST-AUTHORISATION and CANDIDATE-TARGET-DETAIL-AUTHORISATION. Since target lists are often likely to be related to each other, such as battalion and brigade-nominated lists with division list, the model includes the CANDIDATE-TARGET-LIST-ASSOCIATION. A similar provision is made for relating individual targets, for example, the elements of a complex target such as a military airbase, a major logistics facility, or a naval port, through the entity CANDIDATE-TARGET-DETAIL-ASSOCIATION. The structure is illustrated in Figure 87.

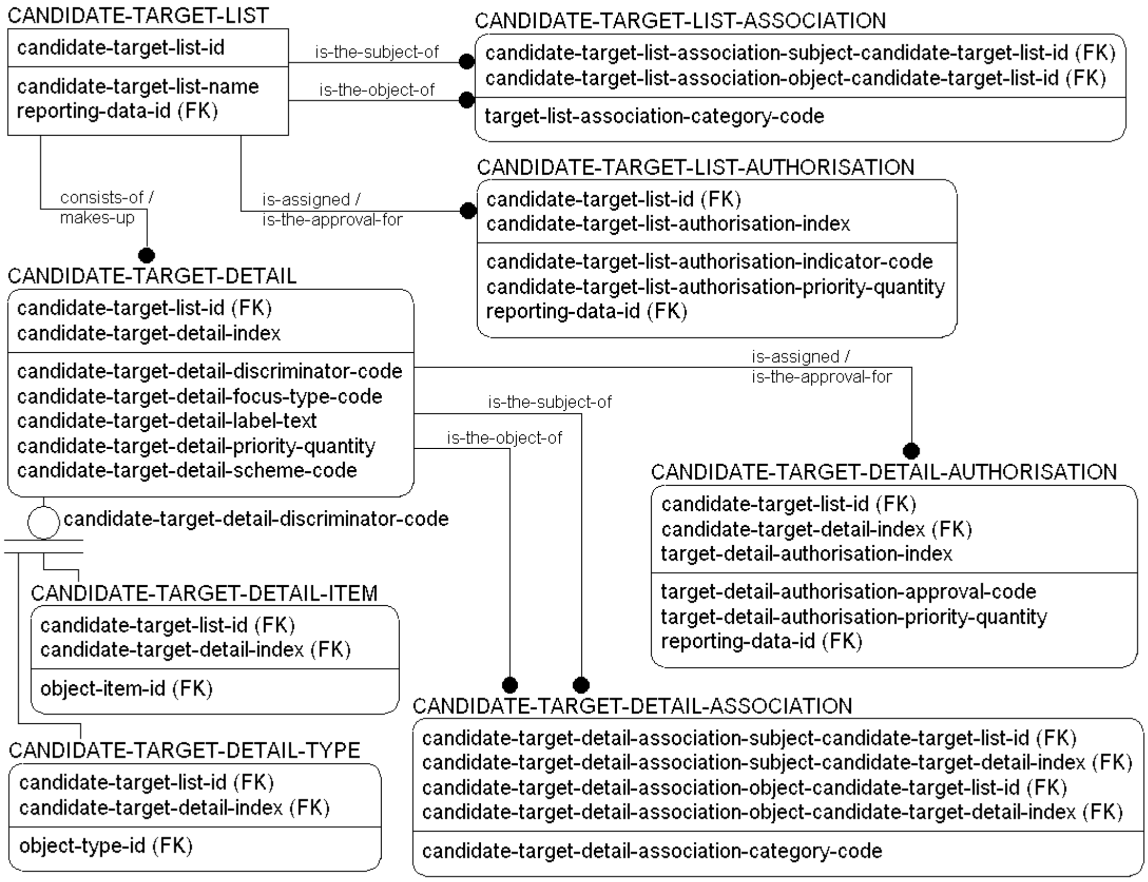


Figure 87. The Data Structure for Creating Target Lists

13.10.2 Specification of Candidate Target Lists

13.10.2.1 The top-level structure for creating lists includes the following three entities: CANDIDATE-TARGET-LIST, CANDIDATE-TARGET-LIST-ASSOCIATION, and CANDIDATE-TARGET-LIST-AUTHORISATION. The primary purpose is to permit the management of candidate target data at the list level rather than one candidate target at a time.

13.10.2.2 CANDIDATE-TARGET-LIST is defined as a list of selected battlespace objects or types that have potential value for destruction or exploitation, nominated by competent authority for consideration in planning battlespace activities. The attributes are:

a. candidate-target-list-id—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-LIST and to distinguish it from all other CANDIDATE-TARGET-LISTs.

b. candidate-target-list-name—The designation, expressed in a word or phrase, of a specific CANDIDATE-TARGET-LIST.

c. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

13.10.2.3 CANDIDATE-TARGET-LIST-ASSOCIATION is defined as a relationship of a CANDIDATE-TARGET-LIST as a subject with another CANDIDATE-TARGET-LIST as an object. The attributes are:

a. candidate-target-list-association-subject-candidate-target-list-id—The candidate-target-list-id of a specific CANDIDATE-TARGET-LIST that serves as the subject of a specific CANDIDATE-TARGET-LIST-ASSOCIATION (a role name for candidate-target-list-id).

b. candidate-target-list-association-object-candidate-target-list-id—The candidate-target-list-id of a specific CANDIDATE-TARGET-LIST that serves as the object of a specific CANDIDATE-TARGET-LIST-ASSOCIATION (a role name for candidate-target-list-id).

c. candidate-target-list-association-category-code—The specific value that represents or denotes the class of CANDIDATE-TARGET-LIST-ASSOCIATION. The domain values are: Has as a component, Incorporates parts of, Precedes, Replaces.

13.10.2.4 CANDIDATE-TARGET-LIST-AUTHORISATION is defined as the designation by competent authority of a CANDIDATE-TARGET-LIST as an approved source of objectives in planning battlespace activities. The attributes are:

a. candidate-target-list-id—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-LIST and to distinguish it from all other CANDIDATE-TARGET-LISTs.

b. candidate-target-list-authorisation-index—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-LIST-AUTHORISATION for a specific CANDIDATE-TARGET-LIST and to distinguish it from all other CANDIDATE-TARGET-LIST-AUTHORISATIONs for the same CANDIDATE-TARGET-LIST. Multiple instances of authorisation may be recorded to reflect different views of authorisers according to functional needs at various echelons.

c. candidate-target-list-authorisation-indicator-code—The specific value that denotes whether a specific CANDIDATE-TARGET-LIST is authorised further consideration in planning military operations. The domain values are: No, Yes.

d. candidate-target-list-authorisation-priority-quantity—The specific value that denotes the rank of importance of a specific CANDIDATE-TARGET-LIST in the view of authorising authority. Any number of priority levels may be assigned.

e. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

13.10.2.5 An example of CANDIDATE-TARGET-LIST is provided in Table 112. The scenario for the instance tables envisions the following situation: a US division and a Spanish brigade under the operational control of a NATO corps are engaged in operations against PURPLE enemy forces. The US division has two armoured brigades and a Military Intelligence Battalion (MI Bn) nominating targets. The Spanish brigade has two battalions that are nominating targets. The NATO Corps itself nominates a target. In all, seven different units are contributing lists. The only data shown from REPORTING-DATA is the identity of the reporting organisation. The data from this table is used in subsequent examples of candidate target details.

Table 112. Example Instances of CANDIDATE-TARGET-LIST

(a) CANDIDATE-TARGET-LIST

candidate-target-list-id	candidate-target-list-name	reporting-data-id
241011	1 (US) Bde for D+3	241911

(b) REPORTING-DATA

reporting-data-reporting-organisation-id
[1 (US) Bde]

241012	2 (US) Bde for D+3	241912	[2 (US) Bde]
241013	4 (US) MI Bn for D+3	241913	[4 (US) MI Bn]
241101	1 (US) Armored Div for D+3	241191	[1 (US) Armored Div]
272001	7 (SP) Bn for D+3	272901	[7 (SP) Bn]
272002	8 (SP) Bn for D+3	272902	[8 (SP) Bn]
435001	NATO Corps for D+3	435901	[NATO Corps]

13.10.3 Specification of Candidate Target Detail

13.10.3.1 The structure for specifying the details of candidate targets includes five entities: CANDIDATE-TARGET-DETAIL, CANDIDATE-TARGET-DETAIL-ITEM, CANDIDATE-TARGET-DETAIL-TYPE, CANDIDATE-TARGET-DETAIL-ASSOCIATION, and CANDIDATE-TARGET-DETAIL-AUTHORISATION.

13.10.3.2 CANDIDATE-TARGET-DETAIL is defined as an element of CANDIDATE-TARGET-LIST. The notion of a target as used here envisages the designation of a facility, feature, materiel, organisation, or person or the corresponding type to be the focus of specified activity such as capture, destruction, or information collection. The attributes are:

a. candidate-target-list-id—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-LIST and to distinguish it from all other CANDIDATE-TARGET-LISTs.

b. candidate-target-detail-index—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-DETAIL for a specific CANDIDATE-TARGET-LIST and to distinguish it from all other CANDIDATE-TARGET-DETAILs for that CANDIDATE-TARGET-LIST.

c. candidate-target-detail-discriminator-code—The specific value that denotes a CANDIDATE-TARGET-DETAIL as being an item or a type. The domain values are: CANDIDATE-TARGET-DETAIL-ITEM, CANDIDATE-TARGET-DETAIL-TYPE.

d. candidate-target-detail-focus-type-code—The specific value that denotes a general class of actions intended by the nominating authority for a specific CANDIDATE-TARGET-DETAIL. The domain values are: Attack, Capture, Defeat, Destroy, Illuminate, Infiltrate, Intercept, Jam, Locate, Mark, Neutralise, Observe, Occupy, Reconnoitre, Suppress, Not known, Not otherwise specified.

e. candidate-target-detail-label-text—A character string that identifies a specific CANDIDATE-TARGET-DETAIL in accordance with a specific scheme.

f. candidate-target-detail-priority-quantity—The non-monetary numeric value that denotes the rank of importance of a specific CANDIDATE-TARGET-DETAIL in the view of nominating authority. Any number of priority levels may be assigned.

g. candidate-target-detail-scheme-code—The specific value that denotes an identification scheme used for recording a CANDIDATE-TARGET-DETAIL. The domain values are: ABCA (Australian, British, Canadian and American target numbering scheme), BE (Basic Encyclopaedia), FIBE (Field Initiated Basic Encyclopaedia Numbering System), Organisational, Site number.

13.10.3.3 CANDIDATE-TARGET-DETAIL-ITEM is defined as an instance of CANDIDATE-TARGET-DETAIL that is an OBJECT-ITEM. The entity enables a specific candidate target to be identified as an instance of OBJECT-ITEM. The entity has no native attributes.

13.10.3.4 CANDIDATE-TARGET-DETAIL-TYPE is defined as an instance of CANDIDATE-TARGET-DETAIL that is an OBJECT-TYPE. The entity enables a specific candidate target to be identified as an instance of OBJECT-TYPE. The entity has no native attributes.

13.10.3.5 CANDIDATE-TARGET-DETAIL-ASSOCIATION is defined as a relationship of a CANDIDATE-TARGET-DETAIL as a subject with another CANDIDATE-TARGET-DETAIL as an object. The attributes are:

a. candidate-target-detail-association-subject-candidate-target-list-id—The candidate-target-list-id of a specific CANDIDATE-TARGET-DETAIL that serves as the subject of a specific CANDIDATE-TARGET-DETAIL-ASSOCIATION (a role name for candidate-target-list-id).

b. candidate-target-detail-association-subject-candidate-target-detail-index—The candidate-target-detail-index of a specific CANDIDATE-TARGET-DETAIL that serves as the subject of a specific CANDIDATE-TARGET-DETAIL-ASSOCIATION (a role name for candidate-target-detail-index).

c. candidate-target-detail-association-object-candidate-target-list-id—The candidate-target-list-id of a specific CANDIDATE-TARGET-DETAIL that serves as the object of a specific CANDIDATE-TARGET-DETAIL-ASSOCIATION (a role name for candidate-target-list-id).

d. candidate-target-detail-association-object-candidate-target-detail-index—The candidate-target-detail-index of a specific CANDIDATE-TARGET-DETAIL that serves as the object of a specific CANDIDATE-TARGET-DETAIL-ASSOCIATION (a role name for candidate-target-detail-index).

e. candidate-target-detail-association-category-code—The specific value that represents or denotes the class of CANDIDATE-TARGET-DETAIL-ASSOCIATION. The domain values are: Has as a component, Is co-located with.

13.10.3.6 CANDIDATE-TARGET-DETAIL-AUTHORISATION is defined as the designation by competent authority of an instance of CANDIDATE-TARGET-DETAIL as an approved objective in planning battlespace activities. Multiple instances of authorisation may be recorded to reflect different views of desired outcome by the nominators. For example, one echelon may wish to see a certain facility (e.g., air-defence site) destroyed, while the next higher echelon may think that it is more important to spare the site in order to gather electronic intelligence. The attributes are:

a. candidate-target-list-id—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-LIST and to distinguish it from all other CANDIDATE-TARGET-LISTs.

b. candidate-target-detail-index—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-DETAIL for a specific CANDIDATE-TARGET-LIST and to distinguish it from all other CANDIDATE-TARGET-DETAILs for that CANDIDATE-TARGET-LIST.

c. candidate-target-detail-authorisation-index—The unique value, or set of characters, assigned to represent a specific CANDIDATE-TARGET-DETAIL-

AUTHORISATION for a specific CANDIDATE-TARGET-DETAIL and to distinguish it from all other CANDIDATE-TARGET-DETAIL-AUTHORISATIONs for the same CANDIDATE-TARGET-DETAIL.

d. candidate-target-detail-authorisation-approval-code—The specific value that represents or denotes the type of approval that a specific CANDIDATE-TARGET-DETAIL is authorised for further consideration in planning military operations. The domain values are: Approved and available, Approved and excluded, Not approved.

e. candidate-target-detail-authorisation-priority-quantity—The non-monetary numeric value that denotes the rank of importance of a specific CANDIDATE-TARGET-DETAIL in the view of authorising authority.

f. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

13.10.4 Example of Candidate Target Nomination and Authorisation

13.10.4.1 The example introduced in the previous table is continued to show candidate target nominations as illustrated by the following statements:

a. The two US brigades, the US MI Bn, and the US division submit candidate targets: three from 1 US Bde, two from 2 US Bde, three from 4 US MIBn, and two from 1 US AR Div.

b. Both of the division nominations have been submitted by subordinate units, but the division attaches its own target numbers.

c. The two SP battalions submit candidate targets: three from 7 SP Bn and two from 8 SP Bn.

d. The staff of the NATO Corps submits a single target nomination: to attack 78P Div headquarters.

The results of the nomination process are represented as data in Table 113. Sub-tables (a) and (b) are repeated from the previous table for ease of reference.

Table 113. Example Instances of CANDIDATE-TARGET-DETAIL

(a) CANDIDATE-TARGET-LIST

candidate-target-list-id	candidate-target-list-name	reporting-data-id
241011	1 (US) Bde for D+3	241911
241012	2 (US) Bde for D+3	241912
241013	4 (US) MI Bn for D+3	241913
241101	1 (US) Armored Div for D+3	241191
272001	7 (SP) Bn for D+3	272901
272002	8 (SP) Bn for D+3	272902
435001	NATO Corps for D+3	435901

(b) REPORTING-DATA

reporting-data-reporting-organisation-id
[1 (US) Bde]
[2 (US) Bde]
[4 (US) MI Bn]
[1 (US) Armored Div]
[7 (SP) Bn]
[8 (SP) Bn]
[NATO Corps]

(c) CANDIDATE-TARGET-DETAIL

cand.-target-list-id	**-index	**-discr.-code	**-focus-type-code	**-label-text	**-priority-code	**-scheme-code

(d) ITEM

object-item-id[57]

[57] For ease of reading, the actual description of the candidate target is shown in brackets rather than the arbitrary identifier that would normally be held in the database.

241011	1	ITEM	Attack	1B0072	1	ABCA	[22P[58] Armoured Bde]
241011	2	ITEM	Attack	1B0042	2	ABCA	[21P SAM Bty]
241011	3	ITEM	Attack	1B0027	3	ABCA	[1P Target Acquisition Radar]
241012	1	ITEM	Attack	2B0008	1	ABCA	[17P Armoured Battalion]
241012	2	ITEM	Attack	2B0013	2	ABCA	[12P Assembly Area]
241013	1	ITEM	Observe	1M0035	1	ABCA	[1P Target Acquisition Radar]
241013	2	ITEM	Observe	1M0002	1	ABCA	[8P Communications Site]
241013	3	ITEM	Attack	1M0061	2	ABCA	[32P SCUD TEL]
241101	1	ITEM	Attack	1D0072	1	ABCA	[22P Armoured Bde]
241101	2	ITEM	Attack	1D0061	3	ABCA	[32P SCUD TEL]
272001	1	ITEM	Suppress	7BN00011	3	Not specified	[12P Assembly Area]
272001	2	ITEM	Attack	7BN00021	2	Not specified	[8P Communications Site]
272001	3	ITEM	Attack	7BN00003	1	Not specified	[5P FA Battery]
272002	1	ITEM	Jam	8BN00117	2	BE	[8P Communications Site]
272002	2	ITEM	Attack	8BN00088	1	BE	[13P Ammo Storage Facility]
435001	1	ITEM	Attack	XCV223A	1	Not specified	[78P Division Headquarters]

Note: ** denotes “candidate-target-detail” and ITEM denotes CANDIDATE-TARGET-DETAIL-ITEM.

13.10.4.3 The data resulting from the authorisation process is contained in Table 114. The column *reporting-data-id* is filled with reporting unit identification rather than the identifier. Sub-table (b) is included for ease of reference. The table specifies the following details:

a. The US division operations officer authorises 4 of the 10 targets for which it has responsibility, including both of its own nominations.

b. The division explicitly does not authorise one target (21P SAM Bty) nominated by a subordinate brigade.

c. The Spanish brigade acts upon two target lists submitted by its two subordinate battalions without adding any of its own or changing any target numbers.

d. The Spanish brigade authorises two targets, and does not authorise another (8P Communications Site) that is nominated by both battalions—one requesting attack and the other preferring jamming.

e. The NATO Corps enters two authorisations: one for its own nomination and the second reaffirming the US division attack against 22P Armoured Brigade.

f. The NATO Corps denies authorisation to two targets: the first (8P Communications Site) is a reaffirmation of a lower echelon decision and the second (1P Target Acquisition Radar) involves a reversal of the US division authorisation to attack.

Table 114. Example Instances of CANDIDATE-TARGET-AUTHORISATION

(a) CANDIDATE-TARGET-DETAIL-AUTHORISATION (b) ITEM

cand.-target-list-id	**-index	**-auth.-index	**-auth.-approval-code	**-auth.-priority-code	reporting-data-id	object-item-id

58 Here P stands for PURPLE, the colour of the assumed foe.

241011	2	1	Not authorised	—	[1 US AR Div]	[21P SAM Bty]
241011	3	1	Authorised	4	[1 US AR Div]	[1P Target Acquisition Radar]
241011	3	2	Not authorised	—	[NATO Corps]	[1P Target Acquisition Radar]
241012	1	1	Authorised	3	[1 US AR Div]	[17P Armoured Battalion]
241101	1	1	Authorised	1	[1 US AR Div]	[22P Armoured Bde]
241101	2	1	Authorised	2	[1 US AR Div]	[32P SCUD TEL]
241101	2	2	Authorised	2	[NATO Corps]	[32P SCUD TEL]
272001	1	1	Authorised	2	[1 SP Bde]	[12P Assembly Area]
272001	2	1	Not authorised	—	[1 SP Bde]	[8P Communications Site]
272002	1	1	Not authorised	—	[1 SP Bde]	[8P Communications Site]
272001	2	2	Not authorised	—	[NATO Corps]	[8P Communications Site]
272001	3	1	Authorised	1	[1 SP Bde]	[5P FA Battery]
435001	1	1	Authorised	1	[NATO Corps]	[78P Division Headquarters]

Note: ** denotes "candidate-target-detail"

13.10.5 Linking Candidate Targets to Operations Planning

13.10.5.1 The nomination and authorisation of candidate targets is intended to be used in the operational planning process. The model structure that permits candidate target lists and individual candidate targets to be associated with the ACTION structure is illustrated in Figure 88. The primary connection is from CANDIDATE-TARGET-LIST to ACTION-TASK. The migration of the foreign key *candidate-target-list-id* to ACTION-TASK through the non-identifying relationship "may be used in planning" allows a direct reference to be made to any specific CANDIDATE-TARGET-LIST.

13.10.5.2 The connection also exists for individual candidate targets through the relationships "may be specified as" from CANDIDATE-TARGET-DETAIL-ITEM and CANDIDATE-TARGET-DETAIL-TYPE to ACTION-OBJECTIVE-ITEM and ACTION-OBJECTIVE-TYPE. These relationships permit an explicit association between a target nomination and the designation of any item or type as a planned objective of a specific ACTION.

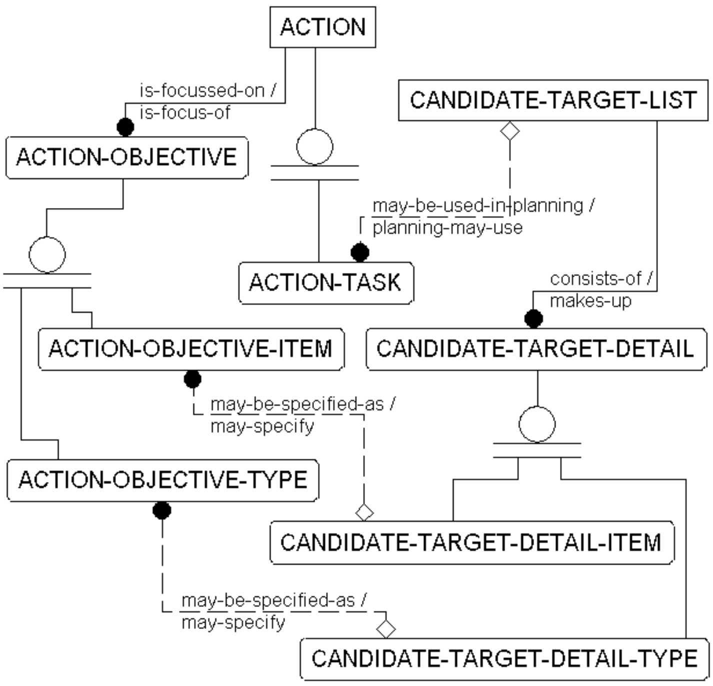


Figure 88. Linking Candidate Targets to Operations Planning

13.10.6 Business Rules for Candidate Targets

13.10.6.1 Unless explicitly prohibited by a higher echelon, a lower-echelon target is a legitimate objective for planning at the lower echelon.

13.10.6.2 Normally, a higher echelon should base its decisions on the authorisation lists of the next lower echelon; however, there is no modelling structure to prevent a higher echelon from considering target nominations or authorisations from any lower echelon or sub-echelon. This should be a local operating procedure imposed by each commander.

(This page intentionally left blank)

14. INTELLIGENCE EXTENSION

14.1 Introduction

14.1.1 The purpose of this chapter is to document the extension of the model specification to include selected information exchange requirements which originate from the intelligence subfunctional area but have general applicability within the Generic Hub. The intelligence information in this paper is based on the following sources:

a. DFD (Data Fusion Demonstrator NATO Project).

b. BIO V4 (Base d'Informations Opérationnelles) [Ref. BIO V4 1995].

c. MCDE V2.0 (Modèle Conceptuel des Données Echangées).

14.1.2 The aims of intelligence in a tactical context are:

a. Obtain the data that are needed for planning or executing military operations.

b. Identify the degree of certainty of all the data contained in the database.

14.1.3 In the model, these objectives are partially satisfied via four primary entities: REPORTING-DATA, CONTEXT-REPORTING-DATA-ASSOCIATION, OBJECT-ITEM-TYPE, and ACTION-TASK.

14.1.4 REPORTING-DATA allows the user to describe the origin (i.e., organisation-id) and validity (i.e., credibility-code) of data. However, this approach suffers from some limitations.

a. It is only available for dynamic data and hence not for semi-permanent ones (i.e., object types).

b. There is no consistent way to distinguish observed data from data that are produced by intelligence processing (fusion, aggregation or classification by type) unless explicit data are entered in CONTEXT and CONTEXT-REPORTING-DATA-ASSOCIATION.

14.1.5 ACTION-TASK allows the user to describe orders, plans or requests as specified in the action-task-category-code. The activity of the request is described by an attribute (action-task-verb-phrase-code) that can take on values such as “identify,” “locate,” and “observe” as part of the specification of a request for intelligence information. The battlespace object or type about which information is requested or an area in which information is to be gathered is described by the entity ACTION-OBJECTIVE. However, there are several shortcomings to this approach:

a. There are categories of requested information in categories such as ACTION, CAPABILITY, and LOCATION that are neither OBJECT-TYPEs nor OBJECT-ITEMs, the only entities whose instances can be specified in ACTION-OBJECTIVE.

b. A request for intelligence can be either permanent or not, can be of immediate interest or not, and these functionalities must be explicitly described.

c. It is necessary to distinguish between spontaneously arising and requested information, and, most importantly, to identify if missing information is not present because it is not available or because it was simply never requested.

14.2 Requirements

A list of fundamental intelligence requirements is presented below, with some indication of how they are, in some cases, satisfied in the data model.

a. *R1: The degree of certainty of the data represented by each record must be modelled.* This very general requirement is due to the fact that meta-information is important in intelligence. The only way to support this requirement would be to introduce a metamodel of the logical data model. To avoid this, the requirement can be restricted to dynamic entities, and this is already done with the entity REPORTING-DATA.

b. *R2: An observation must be accompanied by information about the observer, the activity observed, the period of validity, the observation date, and a confidence factor.* Much of this requirement is captured through the entity REPORTING-DATA.

c. *R3: A request for intelligence information must be modelled.* A request for intelligence information identifies data that are currently not contained in the database. Such a request must be part of the replicatable data so that some intelligence collecting organisation might be able to respond, collect the required information, update the database, and replicate the data to the requester.

d. *R4: The subject of a request for intelligence information may include any of the following topics: ACTION, CAPABILITY, LOCATION, OBJECT-TYPE, or OBJECT-ITEM.* Such a request encompasses the identification of enemy's actions, capabilities, and locations, as well as the identification of battlespace objects or their types belonging to the opposing forces.

e. *R5: A request for intelligence information has a required delivery date.* Requests for intelligence information are, in general, submitted in response to the temporal constraints of a planning process and hence have operationally significant deadlines.

f. *R6: A request for intelligence information can be permanent.* Such requests (e.g., a standing request for information) always specify critical information needs.

g. *R7: A standing request for intelligence information can have an immediate impact.* An example of such a request is the enemy's use of chemical, biological, or nuclear weapons.

h. *R8: A request for intelligence information can be linked to a resource cited in an operational plan.* Such a request can be useful in validating a hypothesis but can also be necessary for an operational plan. For example, an attack in a given area can be executed under assurance that no friendly forces are present in this area.

i. *R9: A response to a request for intelligence information must be accompanied by metadata.* As explained in the introduction of this chapter, it is necessary to know, to the degree possible, sources of the data in the database, and more importantly, the reasons for missing data.

j. *R10: A response to a request for intelligence information is characterised by the identification of the submitter, the date and time of collection, and the identification of related observations.* In other words, the information required for a query must be as precise as possible.

k. *R11: It is highly desirable that a response to a request for intelligence information be explicitly positive or negative.* This requirement is related to the "closed world" assumption, which states that, if data are missing in the database, then the data must also be missing in "reality". This assumption is not realistic from the intelligence point of view. Specifically, if the database indicates that no enemy forces are located in a given area, it must be ascertained that this is also true in "reality." An explicit negative response means that the given area was reconnoitred and no enemy forces were detected.

l. *R12: The fusion, aggregation, and type classification operations must be modelled.* This requirement is related to the general need to identify the source of the data. In particular, a fusion of two sets of objects induces a local update of the database in order to keep it consistent. This update would be difficult to accomplish if the collected individual source information is lost.

14.3 Design considerations

14.3.1 The general design of the intelligence extension is the following:

a. A request for intelligence information is modelled as a subtype of ACTION-TASK

b. A response to a request for intelligence information is modelled as a specific entity, similar to the ACTION-TASK-STATUS entity

c. A response to a request for intelligence information must be related to REPORTING-DATA

d. The objectives of requests for intelligence information are those of ACTION (i.e., ACTION-OBJECTIVE-TYPE and ACTION-OBJECTIVE-ITEM)

e. The data that result from a fusion or an aggregation operation are modelled via the CONTEXT-REPORTING-DATA-ASSOCIATION entity

f. An ACTION, a CAPABILITY or a LOCATION may be specified in a request for intelligence information.

14.3.2 These design considerations lead to the need for extending the model structure by adding two main entities: REQUEST and REQUEST-ANSWER. The idea of fusion or aggregation is based on the CONTEXT-REPORTING-DATA-ASSOCIATION entity. The ACTION-EVENT entity provides a link between ACTION and REPORTING-DATA for the information related to ACTION, CAPABILITY or LOCATION. The OBJECT-ITEM-CAPABILITY entity provides a link between CAPABILITY and REPORTING-DATA. The FEATURE-LOCATION entity is used as a link between LOCATION and REPORTING-DATA.

14.4 Specification of REQUEST

14.4.1 REQUEST is defined as an ACTION-TASK that states a requirement[59]. It is a subtype of ACTION-TASK and has available to it all the attributes and relationships of ACTION-TASK and ACTION. A request for intelligence information is an instance of REQUEST. The links with ACTION-RESOURCE, ACTION-REQUIRED-CAPABILITY, and ACTION-TEMPORAL-ASSOCIATION allow the user to specify temporal constraints between actions and requests. The subtyping of ACTION-TASK is incomplete. The two other categories: *plan* and *order* are not explicitly subtyped. REQUEST may have other uses in a future version of the model; however, the current attributes cater to intelligence and reconnaissance requirements. The structure of REQUEST and its place in the ACTION hierarchy is illustrated in Figure 89.

[59] In normal military parlance, a request goes to a higher or adjacent headquarters (‘Please!”), while a task comes down to a lower headquarters from a superior headquarters (“Do it!). The data structure is the same for any planned, ordered, or requested activity. The distinction about authority is made through the choice of values in the attribute task-category-code, and the linkage of tasks, e.g. Division X directs Brigade Y to attack Objective Z.

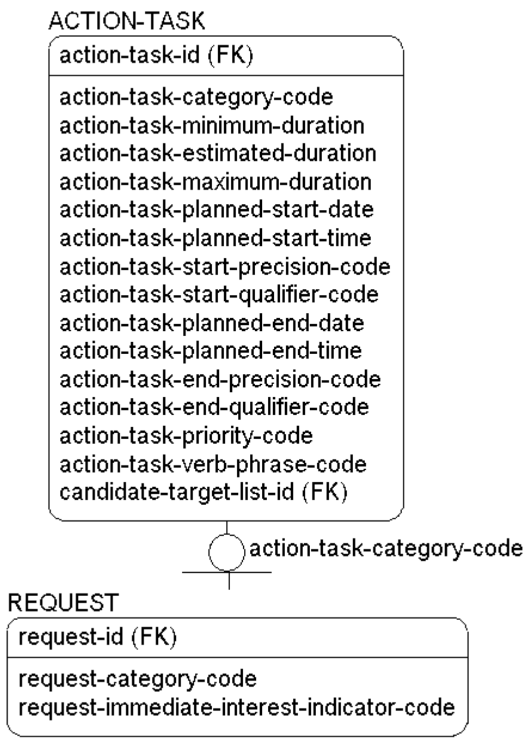


Figure 89. ACTION/TASK/REQUEST View

14.4.2 The start date, time, and qualifier attributes in ACTION-TASK allow the user to specify the period of validity of the request. Omission of an entry corresponding to the ending date and time or the entry of a suitably large number permits the specification of permanent requests.

14.4.3 The attributes are:

a. request-id—The action-task-id of a specific REQUEST (a role name for action-id).

b. request-category-code—The specific value that represents or denotes the type classification of a specific REQUEST. The domain values are: Action, Association, Capability, Holding, Hostility, Location, Presence, Status, Type, Not otherwise specified.

c. request-immediate-interest-indicator-code—The specific value that indicates whether a request is of immediate interest. The domain values are: No, Yes.

14.5 Specification of REQUEST-ANSWER and REQUEST-ANSWER-ELEMENT

14.5.1 Structure

14.5.1.1 A response to a request is described via the entity REQUEST-ANSWER. Since an instance of a REQUEST-ANSWER is itself an item of dynamic data, it is linked to REPORTING-DATA. Furthermore, a response to a REQUEST may consist of multiple items of data; therefore, it is linked to REPORTING-DATA through an associative entity REQUEST-ANSWER-ELEMENT that can identify which items of information actually constitute a response to an instance of REQUEST. The data structure for this concept is shown in Figure 90.

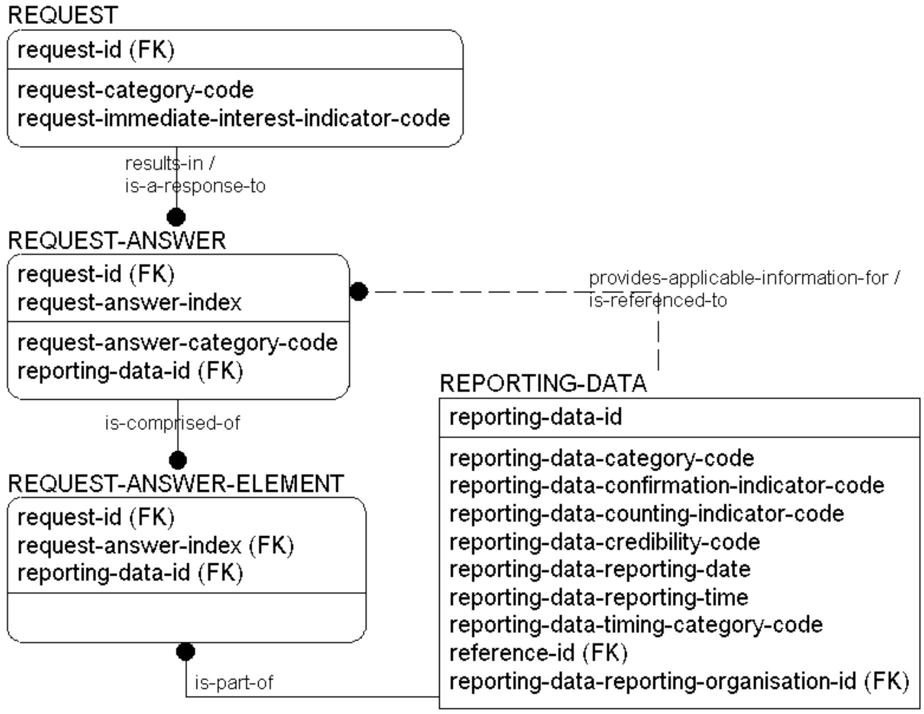


Figure 90. The REQUEST-ANSWER Construct

14.5.1.2 REQUEST-ANSWER is defined as an indication of the nature of a response to a specific REQUEST of information. Its attributes are:

a. request-id—The action-task-id of a specific REQUEST (a role name for action-id).

b. request-answer-index—The unique value, or set of characters, assigned to represent a specific REQUEST-ANSWER for a specific REQUEST and to distinguish it from all other ANSWERs for that REQUEST.

c. request-answer-category-code—The specific value that represents or denotes the class of REQUEST-ANSWER. The domain values are: No; Yes; Unanswerable; Unknown.

d. reporting-data-id—The unique value, or set of characters, assigned to represent a specific REPORTING-DATA and to distinguish it from all other REPORTING-DATAs.

14.5.1.3 The request-answer-category-code value "Yes" is set if at least one requested element has been detected. In that case, an instance of the entity REQUEST-ANSWER-ELEMENT provides the link to the response. The request-answer-category-code value "No" is set if no requested element has been detected. This in itself is positive information that can be referred through REPORTING-DATA. The request-answer-category-code value "Unanswerable" specifies that the request is illogical. The request-answer-category-code value "Unknown" specifies that the answer cannot be formulated due to the absence of information.

14.5.1.4 The REQUEST-ANSWER-ELEMENT entity allows the user to link to a response all the related basic observations. It is defined as a relationship between a specific REQUEST-ANSWER and a specific REPORTING-DATA that provides linkage to amplifying information for a REQUEST-ANSWER. The only attributes that REQUEST-ANSWER-ELEMENT has are the foreign keys inherited from its two parents.

14.5.2 Relationship between Domain Values

The precise meaning of the values "No" and "Unknown" for the *request-answer-category-code* in REQUEST-ANSWER depends on the specific value of the *request-category-code* in REQUEST. The relationships are detailed in Table 115.

Table 115. Domain Values of *request-answer-category-code*

request-category-code	request-answer-category-code	Meaning
Action	No	No action element of the specified OBJECT-ITEM has been detected.
	Unknown	The potential action elements of the specified OBJECT-ITEM could not be identified.
Association	No	No element of association between the specified OBJECT-ITEMs has been detected.
	Unknown	The potential elements of association between the specified OBJECT-ITEMs could not be identified.
Capability	No	—
	Unknown	The potential capability elements of the specified OBJECT-ITEM could not be identified.
Holding	No	No holding element for the specified OBJECT-ITEM has been detected.
	Unknown	No potential holding element for the specified OBJECT-ITEM could be identified.
Hostility	No	—
	Unknown	The potential hostility element of the specified OBJECT-ITEM could not be identified.
Location	No	—
	Unknown	The position of the specified OBJECT-ITEM could not be determined.
Presence	No	No instance of the specified OBJECT-TYPE has been detected.
	Unknown	The potential presence of the specified OBJECT-TYPE could not be identified.
Status	No	—
	Unknown	The status of the specified OBJECT-ITEM could not be identified.
Type	No	—
	Unknown	The type of the specified OBJECT-ITEM could not be identified.

14.6 Formulation of a Request

14.6.1 An intelligence request can be formulated by specifying either one or two objective elements, and a request-category-code. The objective element is either an OBJECT-TYPE or an OBJECT-ITEM. This allows the user to specify *unitary* requests in which only a single objective element is specified, or *binary* requests in which two objective elements are specified.

14.6.2 The type of information product that is sought through an intelligence request is specified by the request-category-code. The domain values that have been selected bear a close relationship to type of data that is represented in entities related to REPORTING-DATA (for example, see Chapter 12, Figure 61).

14.6.3 There are categories of data that have been omitted from the list of allowable types for requests. An example is the value *establishment*. Establishment data tends to be static or "permanent;" it is reference data that may be part of the initial system load and is less likely to be exchanged between nations. Furthermore, it is not associated to REPORTING-DATA. Furthermore, it is not the kind of information that is likely to be collected on a tactical battlespace.

14.7 Specification of Requests

14.7.1 Unitary Requests

A unitary request details a single OBJECT-ITEM. In this case, the possible request-category-code values are: A*ction, Association, Capability, Holding, Hostility, Location, Status, Type*. It should be noted that the value of "Presence" for the request-category-code cannot be specified by a unitary request. Table 116 indicates the available request-code values and the associated entities related to the answer. For example, a request involving an ORGANISATION with the request-category-code *Capability* may be answered with an instance of OBJECT-ITEM-CAPABILITY.

Table 116. Unitary Request for OBJECT-ITEM and the Attribute *request-category-code*

OBJECT-ITEM	request-category-code	Entities Related to the Answer
Any OBJECT-ITEM	Action	ACTION-EFFECT ACTION-EVENT
ORGANISATION	Association	ORGANISATION-CONTROL-FEATURE-ASSOCIATION ORGANISATION-FACILITY-ASSOCIATION ORGANISATION-MATERIEL-ASSOCIATION ORGANISATION-ORGANISATION-ASSOCIATION ORGANISATION-PERSON-ASSOCIATION and corresponding status entities
Any OBJECT-ITEM	Capability	OBJECT-ITEM-CAPABILITY
Any OBJECT-ITEM	Holding	HOLDING
Any OBJECT-ITEM	Hostility	OBJECT-ITEM-STATUS
FACILITY FEATURE MATERIEL ORGANISATION PERSON	Location	FACILITY-LOCATION FEATURE-LOCATION MATERIEL-POINT ORGANISATION-POINT PERSON-POINT
Any OBJECT-ITEM	Status	OBJECT-ITEM-STATUS CONTROL-FEATURE-STATUS FACILITY-STATUS GEOGRAPHIC-FEATURE-STATUS MATERIEL-STATUS ORGANISATION-STATUS PERSON-STATUS
Any OBJECT-ITEM	Type	OBJECT-ITEM-TYPE

14.7.2 Binary Requests

14.7.2.1 Introduction

There are two types of binary requests:

a. A request that addresses one OBJECT-TYPE and one OBJECT-ITEM

b. A request that addresses two OBJECT-ITEMs.

14.7.2.2 Requests That Involve One OBJECT-ITEM and One OBJECT-TYPE

14.7.2.2.1 Three values of *request-category-code* are possible in this case: *Holding, Presence,* and *Type*. Table 117 indicates, for a given OBJECT-ITEM and a given OBJECT-TYPE, the available request-category-code values, and for each, an arrow points to the dynamic entities related to the potential response. The general scheme for the *Holding* value is that militarily meaningful combinations of OBJECT-ITEMs and OBJECT-TYPEs have been listed. *Presence* can be determined only for a combination of FEATURE (geographic or control) and an OBJECT-TYPE. The response may be a specific LOCATION or a positive or negative answer in REQUEST-ANSWER. *Type* request could be the desire to confirm or to obtain more detailed type information. For example, is a specific armoured vehicle actually a T-72 tank? Thus, there is a "Type" entry for corresponding pairs of items and types.

14.7.2.2.2 The following is an example of a request to confirm presence. The request involves a MATERIEL-TYPE and a FEATURE. The response may be an instance of MATERIEL-POINT; the very fact of being able to provide a location confirms presence. On the other hand, the response may be simply a "Yes" value in the request-answer-category-code. If presence is cannot be confirmed, then the only available response within the data structure is a "No" in the REQUEST-ANSWER.

Table 117. Potential Binary Requests Involving OBJECT-ITEM and OBJECT-TYPE

	FACILITY	FEATURE	MATERIEL	ORGANISATION	PERSON

FACILITY-TYPE	**Holding** ↓ HOLDING ----- **Type** ↓ OBJECT- ITEM-TYPE	**Holding** ↓ HOLDING ----- **Presence** ↓ FACILITY-LOCATION or REQUEST-ANSWER		**Holding** ↓ HOLDING	
FEATURE-TYPE	**Holding** ↓ HOLDING	**Holding** ↓ HOLDING ----- **Presence** ↓ FEATURE-LOCATION or REQUEST-ANSWER ----- **Type** ↓ OBJECT-ITEM-TYPE		**Holding** ↓ HOLDING	
MATERIEL-TYPE	**Holding** ↓ HOLDING	**Holding** ↓ HOLDING ----- **Presence** ↓ MATERIEL-POINT or REQUEST-ANSWER	**Holding** ↓ HOLDING ----- **Type** ↓ OBJECT- ITEM-TYPE	**Holding** ↓ HOLDING	**Holding** ↓ HOLDING
ORGANISATION- TYPE		**Holding** ↓ HOLDING ----- **Presence** ↓ ORGANISATION-POINT or REQUEST-ANSWER		**Holding** ↓ HOLDING ----- **Type** ↓ OBJECT-ITEM- TYPE	
PERSON-TYPE		**Holding** ↓ HOLDING ----- **Presence** ↓ PERSON-POINT or REQUEST-ANSWER		**Holding** ↓ HOLDING	**Type** ↓ OBJECT-ITEM- TYPE

14.7.2.3 Requests Involving Two OBJECT-ITEMs

14.7.2.3.1 If two OBJECT-ITEMs are specified in a request, then the only possible values for the request-category-code are *Association* and *Presence*. Table 118 indicates the available values of request-category-code for pairs of OBJECT-ITEMS; for each value of request-category-code an arrow points to the dynamic entities related to the answer. The item associations correspond to those specified in Chapter 7. For example, a request involving FACILITY and FEATURE with the request-code *Association* may be answered with an instance of FACILITY-FEATURE-ASSOCIATION. *Presence* can be determined only for a combination of FEATURE (geographic or control) and an OBJECT-ITEM. The response may be a specific LOCATION or a positive or negative answer in REQUEST-ANSWER.

Table 118. Potential Binary Requests Involving a Pair of OBJECT-ITEMs

	FACILITY	FEATURE	MATERIEL	ORGANISATION	PERSON

FACILITY	**Association** ↓ FACILITY-FACILITY-ASSOCIATION	**Association** ↓ FACILITY-FEATURE-ASSOCIATION **Presence** ↓ FACILITY-LOCATION or REQUEST-ANSWER		**Association** ↓ ORGANISATION-FACILITY-ASSOCIATION	
FEATURE CONTROL-FEATURE GEOGRAPHIC-FEATURE		**Association** (control-feature) ↓ CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION **Association** (control-feature) ↓ CONTROL-FEATURE-GEOGRAPHIC-FEATURE-ASSOCIATION **Presence** ↓ FEATURE-LOCATION or REQUEST-ANSWER		**Association** ↓ ORGANISATION-CONTROL-FEATURE-ASSOCIATION	
MATERIEL		**Presence** ↓ MATERIEL-POINT or REQUEST-ANSWER		**Association** ↓ ORGANISATION-MATERIEL-ASSOCIATION	
ORGANISATION		**Presence** ↓ ORGANISATION-POINT or REQUEST-ANSWER		**Association** ↓ ORGANISATION-ORGANISATION-ASSOCIATION	
PERSON		**Presence** ↓ PERSON-POINT or REQUEST-ANSWER		**Association** ↓ ORGANISATION-PERSON-ASSOCIATION	

14.7.2.4 Examples

14.7.2.4.1 Examples of intelligence requests are listed in Table 119. The examples are then translated in a subsequent table into formats dictated by the data model structures.

Table 119. Examples of Requests

request-id	Requests for:
10001, 10002, 10003	Actions, capacities and location of the unit U1 (the request is valid between T1 and T2 and is of immediate interest)
10004	Hostility of unit U2 (the request is valid between T3 and T4 and has no immediate interest)
10005	Holding of unit U3 with materiel type: “ MLRS, Multiple Rocket Launcher ” (the request is valid between T1 and T5 and has no immediate interest)
10006	Association of unit U1 with materiel M1 (the request is valid between T1 and T2 and if of immediate interest)
10007	Presence of unit U1 in area Z1 (feature-location) (the request is valid between T3 and T6 and is of immediate interest)
10008	Presence of unit type: “ FIRE-SUPPORT-UNIT-TYPE ” in area Z2 (feature-location) (the request is permanent and is of immediate interest)
10009	Presence of person type “ Officer ” in area Z3 (feature-location) (the request is permanent and has no immediate interest)

14.7.2.4.2 The requests are expressed using the ACTION structure. The specific data are illustrated in Table 120 that consists of eight Sub-tables. The first three Sub-tables [Sub-tables (a) through (c)] set up the subtype hierarchy from ACTION to ACTION-TASK to REQUEST.

ACTION-TASK is only partially filled; some columns have been omitted. The specification of instances of REQUEST is completed by adding ACTION-OBJECTIVE, ACTION-OBJECTIVE-TYPE, and ACTION-OBJECTIVE-ITEM (Sub-tables (d), (e), and (f)) to designate the specific OBJECT-ITEMs or OBJECT-TYPEs that are the objectives about which intelligence information is to be collected. It should be kept in mind that a specification of a REQUEST does not necessarily assure a response to it. Some responses may result coincidentally from other battlespace activities. For example, a combat patrol may be able to determine the current position and activity of Unit U1. Similar information may be forthcoming from a scout helicopter. In general, it must be assumed that specific ACTIONs must be planned in response to the intelligence requests.

14.7.2.4.3 Sub-tables (g) and (h) illustrate how responses to the intelligence requests would be recorded if every request had been acted upon. Sub-table (g) lists instances of REQUEST-ANSWER in which the category code denotes the nature of the answer. The details of the response are indicated by the data contained in Sub-table (h)—REQUEST-ANSWER-ELEMENT—which references instances of REPORTING-DATA that point to the relevant dynamic data.

Table 120. Example of Generating an Intelligence Request

(a) ACTION

action-id	action-category-code	action-name
10001	ACTION-TASK	Action-of-unit-U1
10002	ACTION-TASK	Capability-of-unit-U1
10003	ACTION-TASK	Location-of-unit-U1
10004	ACTION-TASK	Hostility-of-unit-U2
10005	ACTION-TASK	Unit-U3-mat-type-MLRS-holding
10006	ACTION-TASK	Unit-U1-mat-M1-association
10007	ACTION-TASK	Unit-U1-in-zone-Z1
10008	ACTION-TASK	Fire-support-unit-type-in-zone-Z2
10009	ACTION-TASK	Officer-in-zone-Z3

(b) ACTION-TASK

action-task-id	action-task-category-code	action-task-priority-code	action-task-verb-phrase-code
10001	REQUEST	1	Observe
10002	REQUEST	2	Identify
10003	REQUEST	3	Locate
10004	REQUEST	1	Identify
10005	REQUEST	5	Identify
10006	REQUEST	4	Identify
10007	REQUEST	3	Identify
10008	REQUEST	2	Identify
10009	REQUEST	1	Identify

(Table continued on the next page)

Table 120. Example of Generating an Intelligence Request (Continued)

(c) REQUEST

request-id	request-category-code	request-immediate-interest-indicator-code
10001	Action	Yes
10002	Capability	Yes
10003	Location	Yes
10004	Hostility	No
10005	Holding	No
10006	Association	Yes
10007	Presence	No
10008	Presence	Yes
10009	Presence	No

(d) ACTION-OBJECTIVE

action-id	action-objective-index	action-objective-category-code	action-objective-qualifier-code
10001	1	ACTION-OBJECTIVE-ITEM	Authorised
10002	1	ACTION-OBJECTIVE-ITEM	Authorised
10003	1	ACTION-OBJECTIVE-ITEM	Authorised
10004	1	ACTION-OBJECTIVE-ITEM	Authorised
10005	1	ACTION-OBJECTIVE-TYPE	Authorised
10005	2	ACTION-OBJECTIVE-ITEM	Authorised
10006	1	ACTION-OBJECTIVE-ITEM	Authorised
10006	2	ACTION-OBJECTIVE-ITEM	Authorised
10007	1	ACTION-OBJECTIVE-ITEM	Authorised
10007	2	ACTION-OBJECTIVE-ITEM	Authorised
10008	1	ACTION-OBJECTIVE-TYPE	Authorised
10008	2	ACTION-OBJECTIVE-ITEM	Authorised
10009	1	ACTION-OBJECTIVE-TYPE	Authorised
10009	2	ACTION-OBJECTIVE-ITEM	Authorised

(e) ACTION-OBJECTIVE-TYPE

action-id	action-objective-index	object-type-id
10005	1	80001 [MLRS]
10008	1	70001 [FIRE-SUPPORT-UNIT-TYPE]
10009	1	90001 [Officer]

(f) ACTION-OBJECTIVE-ITEM

action-id	action-objective-index	object-item-id
10001	1	20001 [U1]
10002	1	20001 [U1]
10003	1	20001 [U1]
10004	1	20002 [U2]
10005	2	20003 [U3]
10006	1	20001 [U1]
10006	2	30001 [M1]
10007	1	20001 [U1]
10007	2	40001 [Z1]
10008	2	40002 [Z2]
10009	2	40003 [Z3]

(Table continued on the next page)

Table 120. Example of Generating an Intelligence Request (Continued)

(g) REQUEST-ANSWER

request-id	request-answer-index	request-answer-category-code	reporting-data-id
10001	20001	Yes	rd1 [org1—d1]
10002	20002	Unknown	rd2 [org1—d2]
10003	20003	Unknown	rd3 [org1—d3]
10004	20004	Yes	rd4 [org1—d4]
10005	20005	Yes	rd5 [org2—d5]
10006	20006	Yes	rd6 [org2—d6]
10007	20007	No	rd7 [org3—d7]
10008	20008	No	rd8 [org4—d10]
10009	20009	No	rd20 [org5—d20]
10009	20010	Yes	rd21 [org6—d21]

Note: The essential reporting data is shown in brackets. It points to organisation and a time.

(h) REQUEST-ANSWER-ELEMENT[60]

request-id	request-answer-index	reporting-data-id[61]
10001	20001	rd11 [org1—d1]
10002	20002	rd21 [org1—d2]
10003	20003	rd31 [org1—d3]
10004	20004	rd41 [org1—d4]
10005	20005	rd51 [org2—d5]
10006	20006	rd61 [org2—d6]
10007	20007	rd71 [org3—d7]
10008	20008	rd81 [org4—d8]
10008	20008	rd91 [org4—d9]
10009	20009	rd201 [org5—d20]
10009	20010	rd211 [org6—d21]

14.7.2.4.4 It is interesting to examine the different kinds of negative answers in the preceding example.

a. For request 10007 that asks that the presence of unit U1 in area Z1 be determined, the organisation (org3) reported a "No" (rd7 at time d7).

b. For request 10008 (presence of unit type "FIRE-SUPPORT-UNIT-TYPE" in area Z2), unit org4 reported a "No" (rd8 at time d10). In fact, no unit of type FIRE-SUPPORT-UNIT-TYPE was seen in the area z2, but, instead, two units of type MANOEUVRE-UNIT-TYPE were detected. Although this is pointed to by the rd8 and rd9 at times d8 and d9, respectively, in the REQUEST-ANSWER-ELEMENT table above, the fact of manoeuvre units being in area z2 is not explicitly shown in additional tables, but merely asserted in the text for purposes of illustration. In order to complete the answer, one instance of the ORGANISATION and at least one instance of the ORGANISATION-POINT were created in conjunction with rd8 and rd9.

60 All the attributes of this entity are primary key attributes, as indicated by the double line on the right side.

61 Each instance of REPORTING-DATA in REQUEST-ANSWER-ELEMENT has the same metadata for the corresponding request-id as the instances of REPORTING-DATA for REQUEST-ANSWER, but the identifiers for instances of REPORTING-DATA must be different to satisfy the creation rules adopted for the specification.

c. For the request 10009 (a standing request to uncover the presence of person type "Officer" in area Z3), an initial "No" was given by the organisation org5 at time d20, but later a "Yes" was reported by organisation org6 at time d21).

14.8 Intelligence Information

14.8.1 The essence of intelligence processes is creating intelligence appreciation from multiple and sometimes seemingly unrelated observations—that is, the intelligence analyst creates a new item of information that is derived from other items of information. Such a process is generally referred to as *fusion, aggregation,* or *correlation*. The data model has structures that supports the fusion or aggregation of data. This may be done by using the REPORTING-DATA and CONTEXT structure that is described in Chapter 12 to record the results of fusion activities as well as identify the sources for data that are derived through the fusion process.

14.8.2 The CONTEXT structure enables the identification of data that are referenced by several REPORTING-DATA instances as contributing to the derivation of new data. The new data is recorded in the appropriate entities together with a new instance of REPORTING-DATA that identifies the originator, date, and time of the derived data. The entity CONTEXT-REPORTING-DATA-ASSOCIATION provides the means for linking the observations that contributed to the fusion process with the results of that process. The nature of the linkage is described by a value of the *context-reporting-data-association-category-code* attribute.

14.8.3 The concepts are illustrated by an example. The scenario is as follows. Two distinct Mechanised Regiments MR1 and MR2 have been observed by two different organisations (these observations are to be associated with specific REPORTING-DATAs identified by reporting-data-id 80 and reporting-data-id 90). Later, a third organisation decides, after some analysis, that these two units are in fact the same, and name the resultant unit MR3 (this determination is to be associated with a specific REPORTING-DATA identified by reporting-data-id 100). The example of linking the information derived through some fusion process to the sources is illustrated in Table 121.

Table 121. Example of Fusion-Derived Information

(a) REPORTING-DATA

***-id	***-category-code	***-credibility-code	***-reporting-date	***-reporting-time	***-timing-category-code	***-reporting-organisation-id
080	Reported	Trusted	d15		[Absolute]	[14-1 Recce Sqn]
090	Reported	Trusted	d25		[Absolute]	[14-2 Recce Sqn]
100	Estimated	Trusted	d35		[Absolute]	[Div Tps]

Note: *** stands for "reporting-data"

(b) REPORTING-DATA-ABSOLUTE-TIMING

***_id	***_duration	***_effective-date	***_effective-time	***_effective-time-precision-code
01		d10 [<d15]		
011		d20 [<d25]		
02		d30 [<d35]		

Note: *** stands for "reporting-data-absolute-timing"

(Table continued on the next page)

(c) CONTEXT

context-id	context-name
040	Analysis BC2

(d) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
040	1	080
040	2	090

(e) CONTEXT-REPORTING-DATA-ASSOCIATION

context-id	reporting-data-id	context-reporting-data-association-index	context-reporting-data-association-category-code
040	100	01	Implies

14.8.4 Sub-tables (a) and (b) above contain instances of REPORTING-DATA and REPORTING-DATA-ABSOLUTE-TIMING that point to the dynamic data recorded in other tables. In order to establish that data identified by reporting-data-ids 080 and 090 are the sources for data identified by reporting-data-id 100, the following must be specified:

a. One instance of CONTEXT (Sub-table (c)).

b. Two instances of CONTEXT-ELEMENT (Sub-table (d)) that specify the instances of REPORTING-DATA that constitute the instance of CONTEXT.

c. An instance of CONTEXT-REPORTING-DATA-ASSOCIATION (Sub-table (e)) in which the instance of CONTEXT is said to imply the derived data identified by reporting-data-id 100.

14.8.5 A second example illustrates the derivation of information through aggregation. The scenario for the example is as follows. Two distinct Armoured Squadrons AS1, AS2 have been observed by two different organisations (reporting-data-ids 110 and 120). Later, a third organisation decided that in fact these two units are sub-units of a third one, which is a Mechanised Regiment named MR4; the latter fact is recorded with the reporting-data-id 200. The data for this example are contained in Table 122.

Table 122. Example of Derived Information through Aggregation

(a) REPORTING-DATA

***-id	***-category-code	***-credibility-code	***-reporting-date	***-reporting-time	***-timing-category-code	***-reporting-organisation-id
110	Reported	Trusted	d17		[Absolute]	[14-1 Recce Sqn]
120	Reported	Trusted	d27		[Absolute]	[14-2 Recce Sqn]
200	Estimated	Trusted	d37		[Absolute]	[Div Tps]

Note: *** stands for “reporting-data”

(Table continued on the next page)

(b) REPORTING-DATA-ABSOLUTE-TIMING

***–id	***–duration	***–effective-date	***–effective-time	***–effective-time-precision-code
01		d16 [<d17]		
011		d26 [<d27]		
02		d36 [<d37]		

Note: *** stands for “reporting-data-absolute-timing”

(c) CONTEXT

context-id	context-name
061	Analysis BC14

(d) CONTEXT-ELEMENT

context-id	context-element-index	reporting-data-id
061	1	110
061	2	120

(e) CONTEXT-REPORTING-DATA-ASSOCIATION

context-id	reporting-data-id	context-reporting-data-association-index	context-reporting-data-association-category-code
061	200	01	Is defined to be

14.8.6 The details of the structure are nearly identical to that of the previous example and are not repeated for this example. The main point is that the value of the context-reporting-data-association-category code is "Is defined to be" rather than "Implies." Such a distinction may be important for management of data, particularly in purging databases. In case of fusion, it is permissible to delete the source data if it serves no other purpose; in the case of aggregated information, the source data is still valid but there is additional information that has been derived through an analysis or estimation process. In the example of the table, the added information is the relationship that the two armoured squadrons have to a mechanised regiment.

14.9 Business (CRUD) Rules

The paragraphs below record the business logic that is to be applied for creation of, access to, update of, and deletion of REQUEST, REQUEST-ANSWER, REQUEST-ANSWER-ELEMENT records and related dynamic information. The reading and deletion rules are optional, and are included as suggestions.

14.9.1 Creation

14.9.1.1 For a REQUEST record creation, the system generates a new request-id key value, and the chain up to the root of the sub-tree hierarchy : ACTION-TASK and ACTION is populated with records which carry this same key value. *When an ACTION record is created related to a REQUEST, an ACTION-OBJECTIVE record must be created and related to either one ACTION-OBJECTIVE-TYPE and one ACTION-OBJECTIVE-ITEM, or to two ACTION-OBJECTIVE-ITEMs records.*

14.9.1.2 For a REQUEST-ANSWER record creation, the user will have to specify the REQUEST for which the record is an answer. The system will copy from it the foreign key value: request-id. The request-answer-index is automatically computed by the system.

14.9.1.3 For a REQUEST-ANSWER-ELEMENT record creation, the user will have to specify the associated REQUEST-ANSWER and REPORTING-DATA. The system will copy from these records the appropriate foreign key values: request-id, request-answer-index, reporting-data-id.

14.9.2 Reading

14.9.2.1 Access to a REQUEST, REQUEST-ANSWER, or REQUEST-ANSWER-ELEMENT record can be achieved in a number of ways. All access patterns are equally valid; only the most natural are described below.

14.9.2.2 The natural access to a REQUEST record is to submit a query for all REQUESTs which are relevant in the ACTION-CONTEXT of an ACTION.

14.9.2.3 The natural access to a REQUEST-ANSWER record is to submit a query for all REQUEST-ANSWERs associated to a given REQUEST.

14.9.2.4 A REQUEST-ANSWER-ELEMENT record is indirectly requested in order to get all the REPORTING-DATAs records associated to a given REQUEST.

14.9.3 Updating

14.9.3.1 REQUEST is a non-loggable entity; however, the key attribute—request-id—is not permitted to be changed. The other attributes can be changed.

14.9.3.2 REQUEST-ANSWER is a loggable entity; consequently, an update operation is not allowed. Instead of changing the existing REQUEST-ANSWER record, the user must create a new one that contains the updated information..

14.9.3.3 REQUEST-ANSWER-ELEMENT is a non-loggable entity; however, its the key attributes—request-id, request-answer-index, and reporting-data-id—are not permitted to be changed.

14.9.4 Deletion

14.9.4.1 A REQUEST entity can be deleted. All related REQUEST-ANSWERs and REQUEST-ANSWER-ELEMENTs entities are then automatically deleted by the system, as they no longer have any meaning. The REPORTING-DATA entities related to the deleted REQUEST-ANSWERs are also automatically deleted. The REPORTING-DATA entities related to the deleted REQUEST-ANSWER-ELEMENTs are not automatically deleted as they can still be meaningful.

14.9.4.2 A REQUEST-ANSWER entity can be deleted. The above rules apply: all related REQUEST-ANSWER-ELEMENTs entities and the related REPORTING-DATA entities are automatically deleted by the system.

14.9.4.3 A REQUEST-ANSWER-ELEMENT can be deleted. No automatic deletion of related entities occurs as they can still be meaningful.

15. FIRE SUPPORT EXTENSION

15.1 Introduction

15.1.1 The purpose of this chapter is to document extension of the model specification to capture selected fire support information exchange requirements that have general applicability within the Generic Hub. The chapter addresses conventional fire support that includes the employment of field artillery, mortars, naval gunfire (NGF), close-in fire support (employment of rotary wing aircraft in a fire support role), and close air support (employment of fixed wing aircraft in a fire support role).[62]

15.1.2 The fire support information is based on the following sources (a list of references is provided at the end of this document):

a. Allied Technical Publication (ATP)-35A, *Land Force Tactical Doctrine*

b. STANAG 3736 (ATP-27B), *Offensive Air Support Operations*

c. STANAG 5620, *Standards for the Interoperability of Fire Support ADP Systems,* Appendix E, *ADatP-3 Formats*

g. AAP-6, *NATO Glossary of Terms*

h. IADB, *Dictionary of Terms,* Inter-American Defence Board

k. US Army FM 6-20, *Fire Support in Combined Arms Operations*

15.2 Definition and Scope of Fire Support

15.2.1 Fire support is the collective and co-ordinated use of indirect fire weapons, armed aircraft, and other lethal and non-lethal means in support of a battle plan.

15.2.2 Fire support responds to the needs of land, maritime, or air forces engaged with the enemy and has either an immediate or near-term effect on operations. The force commander employs fire support to carry out and sustain a scheme of manoeuvre; to mass firepower; and to delay, disrupt, or destroy enemy forces in depth. Fire support planning and co-ordination exist at all echelons of command. Fire support destroys, neutralises, and suppresses enemy personnel, weapons, formations, facilities, and fires from the enemy rear area.

15.2.3 Fire support consists of three essential parts: command and control, target acquisition for intelligence use, and employment of attack resources.

a. Command and control. A large part of C2 activity consists of synchronisation, which is defined as the arrangement of military actions in time, space, and purpose to produce maximum relative combat power at a decisive point.

b. Target acquisition for intelligence use. Target acquisition allows the joint or combined force to detect, identify, and locate targets with sufficient accuracy and timeliness to permit their attack. It is a product of intelligence derived from comparison, corroboration, integration, analysis, and evaluation of information collected by any of the intelligence disciplines such as signals intelligence (SIGINT), human intelligence (HUMINT), and imagery intelligence (IMINT).

---

[62] This scope is consistent with Section IV, Combat Support, ATP-35A [Ref. ATP-35A 1984].

c. Employment of attack resources. The following attack resources may be employed in fire support: mortars, cannon (howitzers and guns), rocket and missile launchers, fixed wing aircraft, rotary wing aircraft, naval gunfire, and electronic warfare. The attack resources can be characterised as lethal or non-lethal. Lethal fire support resources include field artillery and mortars, naval gunfire, and air support. Non-lethal fire support resources include offensive electronic warfare (EW), reflected energy emitters, and smoke and illumination munitions and their delivery systems.

15.3 Specification of General Requirements for Artillery and Missile Employment

15.3.1 Fire support co-ordination and direction requires intensive C3 activity. Two interrelated functions account for the complexity and intensity of C3 activities. The first involves technical fire direction. The second function is the overall C2 process for employing fire support assets in joint or combined operations.

15.3.2 Technical fire direction provides the requisite technical parameters from weather data (e.g., wind conditions, atmospheric pressure), terrain, target location data (impact points), and weapon system data (e.g., weapon calibre, ballistics trajectory data) to allow the weapon to deliver fire accurately. The analogous data in air delivery of fire support is obtained from the platform avionics systems and weapons payload technical characteristics to determine the optimum release points for weapon impact.

15.3.3 The second major function, termed tactical fire control, includes fire support co-ordination; tactical fire direction; and tactical air operations control, direction, and supervision.

15.3.4 In the face of varied threats posed by potential adversaries, NATO is moving toward increased use of multinational and joint forces with their inherent mix of combat capabilities and the integration of attack means, both lethal and non-lethal, provided by air, naval, and artillery fire support. Increased joint employment of forces has fostered the development of joint tactics, techniques, and procedures. The impact on fire support C3 and the attendant needs for information exchange have been substantial.

15.3.5 The types of information to be exchanged in multinational and joint fire support operations are exemplified by the following categories:

a. Joint and combined fire support planning, allocation of resources, and commanders' guidance.

b. Enemy and situation data including target identification and location information.

c. Fire support requests, both pre-planned and immediate, and schedule of fires.

d. Friendly force location and scheme of manoeuvre information.

e. Joint terminal control actions as provided by a forward air controller, forward observer, gunfire spot team, or laser designation team.

f. Co-ordination and integration of joint use of lethal and non-lethal assets.

g. Battle damage assessment information of friendly and enemy fires.

h. Ammunition status.

15.4 Additions to the Model Specification

15.4.1 Overview

The Fire Support Extension consists of adding a subtype to ACTION-RESOURCE-EMPLOYMENT and a TARGET subtype to ACTION OBJECTIVE-ITEM with a child entity TARGET-MARKING. The fire support additions are shown in the entity-level diagram of Figure 91. The new entities are shaded grey.

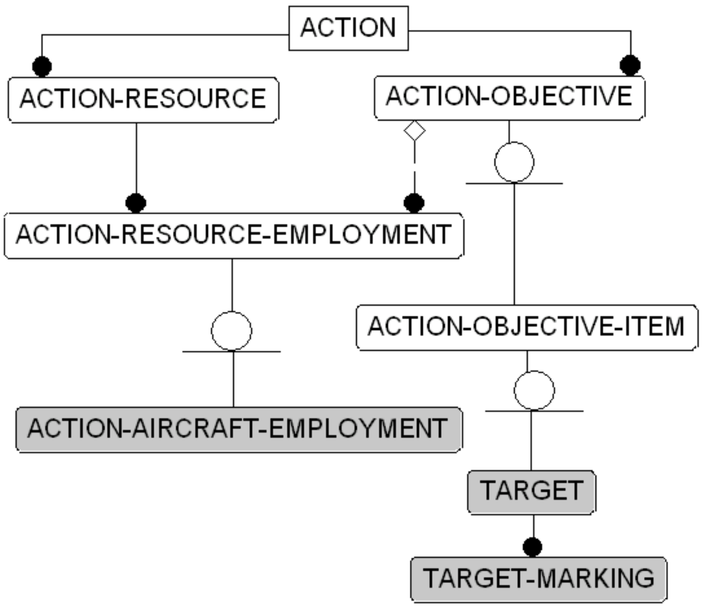


Figure 91. The Fire Support Extension to the Data Model

15.4.2 ACTION-RESOURCE-EMPLOYMENT and Subtypes

15.4.2.1 The data model defines a single subtype of ACTION-RESOURCE-EMPLOYMENT: ACTION-AIRCRAFT-EMPLOYMENT. The data structure is illustrated in Figure 92.

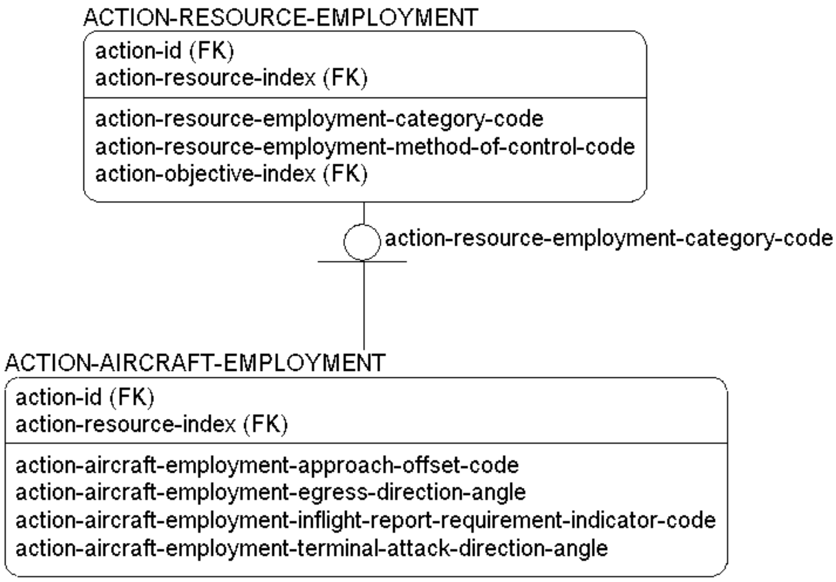


Figure 92. Subtypes of ACTION-RESOURCE-EMPLOYMENT

15.4.2.2 ACTION-AIRCRAFT-EMPLOYMENT

15.4.2.2.1 ACTION-AIRCRAFT-EMPLOYMENT is a subtype of ACTION-RESOURCE-EMPLOYMENT. ACTION-AIRCRAFT-EMPLOYMENT is defined as the procedures which guide the utilisation of an ACTION-RESOURCE that is capable of atmospheric flight. The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs. It is the action-id of the specific ACTION in which the aircraft is employed as a resource.

b. action-resource-index—The unique value, or set of characters, assigned to represent a specific ACTION-RESOURCE for a specific ACTION and to distinguish it from all other ACTION-RESOURCEs for that ACTION.

c. action-aircraft-employment-approach-offset-code—The code that denotes the side of the initial point-to-target line that the attack aircraft is cleared to manoeuvre in during the target run. The domain values are: Left; Right; Right or left.

d. action-aircraft-employment-egress-direction-angle—The angle of the rotational measurement clockwise from the line of true north to the direction to be used by an aircraft when departing an ACTION-OBJECTIVE. Comment: Cardinal directions may be derived from this angle.

e. action-aircraft-employment-inflight-report-requirement-indicator-code—The code that denotes whether there is a requirement for the flight leader to provide a report of mission accomplishments. The domain values are: No, Yes.

f. action-aircraft-employment-terminal-attack-direction-angle—The angle of the rotational measurement clockwise from the line of true north to the direction at which an aircraft is planned to attack an ACTION-OBJECTIVE.

15.4.2.2.2 Table 123 provides example instances for ACTION-AIRCRAFT-EMPLOYMENT.

Table 123. ACTION-AIRCRAFT-EMPLOYMENT Example

ACTION-AIRCRAFT-EMPLOYMENT

action-id	action-resource-index	**-approach-offset-code	**-egress-direction-angle [deg]	**-inflight-report-requirement-indicator-code	**-terminal-attack-direction-angle
Action 105	Action Resource 1	Right	35	Yes	—
Action 106	Action Resource 1	Right	182	Yes	—
Action 107	Action Resource 2	Left	233	No	—
Action 108	Action Resource 3	Right or Left	77	Yes	—

Note: ** denotes “action-aircraft-employment”.

15.4.3 TARGET and Related Concepts

15.4.3.1 Figure 93 shows the entities TARGET and TARGET-MARKING, together with their relationships to each other and their identifying and non-identifying relationships from ACTION-OBJECTIVE-ITEM, OBJECT-ITEM, and ORGANISATION.

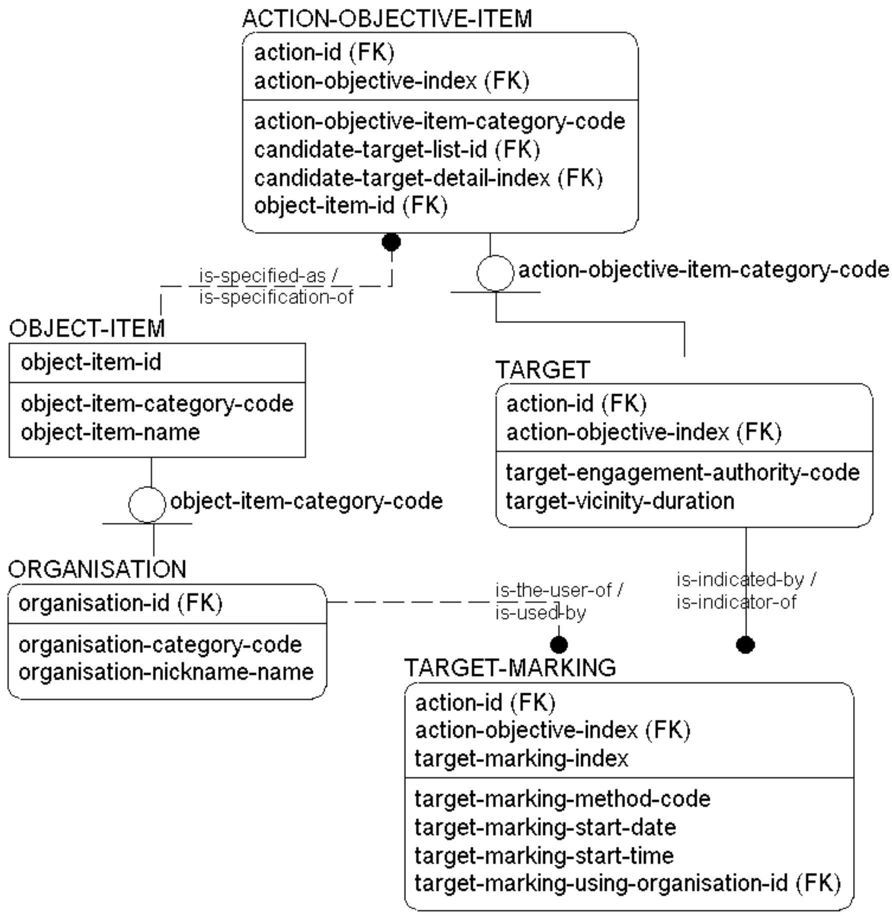


Figure 93. TARGET and TARGET-MARKING

15.4.3.2 TARGET

15.4.3.2.1 TARGET is a subtype of ACTION-OBJECTIVE-ITEM. TARGET is defined as an ACTION-OBJECTIVE-ITEM that is subject to capture or destruction by military forces or against which military intelligence operations are directed.

15.4.3.2.2 The definition of TARGET is based on the following:

a. The (U.S. DoD, IADB) term "target" is defined as—(1) A geographical area, complex, or installation planned for capture or destruction by military forces. (2) An area designated and numbered for future firing. (3) In gunfire support usage, an impact burst which hits the target.

b. The (NATO, DoD, IADB) term "target" is defined as—(4) In intelligence usage, a country, area, installation, agency, or person against which intelligence activities are directed. (5) In radar, (a) generally, any discrete object which reflects or re-transmits energy back to radar equipment; (b) specifically, an object of radar search or surveillance.

15.4.3.2.3 The concept of TARGET is not unique to fire support. Since ACTION-OBJECTIVE-ITEM is the focus of an ACTION against a specific OBJECT-ITEM, TARGET may be an entity used to specify the focus of air-defence, direct fire support, reconnaissance, and other functional areas. The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs.

b. action-objective-index—The unique value, or set of characters, assigned to represent a specific ACTION-OBJECTIVE for a specific ACTION and to distinguish it from all other ACTION-OBJECTIVEs for that ACTION.

c. target-engagement-authority-code—The code that denotes the type of employment restriction that has been authorised for a specific TARGET. The domain values are Available (non high payoff target), Excluded (do not engage), High payoff target, Not known.

d. target-vicinity-duration—The non-monetary numeric value representing the aggregated units of time that a specific TARGET is expected to remain in the vicinity of its observed location. This attribute is used to specify target permanence, target presence, target decay time, and maximum age of target.

15.4.3.2.5 Table 124 provides an example instance table for TARGET.

Table 124. Example Instances for TARGET

TARGET

action-id	action-objective-index	target-engagement-authority-code	target-vicinity-duration
[Action 112]	[Action Objective 1]	Available	[4 hr]
[Action 112]	[Action Objective 2]	High payoff target	[1 hr]
[Action 112]	[Action Objective 3]	Excluded	[12 hr]
[Action 111]	[Action Objective 1]	Available	[3 min]

15.4.4 TARGET-MARKING

15.4.4.1 TARGET-MARKING is defined as the technique of indicating the position of a TARGET at a given time for the benefit of the using ORGANISATION.

15.4.4.2 TARGET-MARKING is used to specify requirements, plans, and results of marking a TARGET position or an associated reference position. Distinction among these uses of TARGET-MARKING is identified by the action-task-category-code of the ACTION-TASK (a subtype of ACTION) specific to the TARGET-MARKING. The procedure used in support of TARGET-MARKING is specified by the target-marking-method-code. It should be noted that the assignment of the resource that provides target marking services is specified in TASK. TARGET-MARKING provides an opportunity to add co-ordinating details for the user of the marking services. The attributes are:

a. action-id—The unique value, or set of characters, assigned to represent a specific ACTION and to distinguish it from all other ACTIONs.

b. action-objective-index—The unique value, or set of characters, assigned to represent a specific ACTION-OBJECTIVE for a specific ACTION and to distinguish it from all other ACTION-OBJECTIVEs for that ACTION.

c. target-marking-index—The unique value, or set of characters, assigned to represent a specific TARGET-MARKING for a specific TARGET and to distinguish it from all other TARGET-MARKINGs for that TARGET.

d. target-marking-method-code—The specific value that represents or denotes the method of marking a position. The domain values are: Flare, Illumination, Laser, Light, Marker panel, Radio beacon, Smoke, Not known, Not otherwise specified. In fire support, this attribute is used to specify friendly position marking, target position marking, friendly unit marking, and target marking.

e. target-marking-start-date—The date that designates the start of a specific TARGET-MARKING.

f target-marking-start-time—The time that designates the start of a specific TARGET-MARKING.

g. target-marking-using-organisation-id—The organisation-id of a specific ORGANISATION that makes use of marking services (a role name for organisation-id).

15.4.4.4 Table 125 provides an example instance table for TARGET-MARKING.

Table 125. Example Instances of TARGET-MARKING

TARGET-MARKING

action-id	action-objective-index	target-marking-index	target-marking-method-code	target-marking-start-date	target-marking-start-time	target-marking-using-organisation-id
Action 112	Action Objective 1	1	Smoke	d1	t1	Unit 1
Action 112	Action Objective 2	2	Flare	d1	t1	Unit 2
Action 112	Action Objective 2	3	Flare	d2	t2	Unit 2
Action 112	Action Objective 3	4	Laser	d3	t3	Unit 3

(This page intentionally left blank)

16. COMMUNICATIONS-ELECTRONICS EXTENSION

16.1 Introduction

16.1.1 This chapter addresses the Communications Electronics (CE) extension to the battlespace tactical functional area. Communications electronics embraces design, development, installation, operations, and maintenance of electronics and electromechanical systems associated with collecting, transmitting, storing, processing, recording and displaying data and information with all forms of military communications, excluding the responsibility for information and data systems and equipment which has been otherwise assigned. CE is more than communications networks alone; it also embraces C2IS.

16.1.2 The scope of this work is limited to communications networks or, in other words, the architecture. Two different types of architecture are distinguished within communications networks: logical and physical. The main concern of the logical architecture is the identification of subscribers and the type of networks that they use. The main concern of the physical architecture is the identification of the materiel assets that are used to establish the connections. Of these two, only the logical architecture is accepted as being of primary interest in support of G-3 planning processes.

16.1.3 The Communications Electronics extension allows:

a. The modelling of tactical communications systems;

b. The modelling of networks, subscribers and connections between subscribers;

c. The planning of tactical communications systems (subscribers, nodes, and materiel).

16.1.4 In practice, the employment of tactical communications in the battlespace is focused on providing battlespace commanders with a set of communications services to support C2IS networks in a potentially hostile environment. Crisis management and peacekeeping scenarios show that inclusion of commercial and strategic communications systems within a tactical environment is relevant. Future deployments are likely to include heavy use of satellite communications.

16.1.1.5 The balance of this chapter describes the architecture of tactical communications systems and highlights the planning process for tactical communications systems.

16.2 The Network Architecture

16.2.1 Introduction

This network architecture for tactical communications systems can be described from either logical or physical viewpoint. Only the logical architecture is addressed in this chapter because there is no requirement to model the physical architecture. However, the model includes considerable structure for representing materiel and facilities and their status that could permit a degree of description of a physical architecture.

16.2.2 The Logical Architecture

16.2.2.1 The following questions need to be addressed in the logical architecture view of a communications network:

a. What are the characteristics of the network, to include:

(1) The kind of service provided (e.g., voice, facsimile, Morse, telex);

(2) The intended use of the network (e.g., fire-support, C2);

(3) The network controls elements;

b. Who are the subscribers of the network (e.g., which organisations, persons)?

c. Which subscribers can be connected?

d. What are the characteristics of the connections; such as the maximum security classification of messages which may be transmitted?

This and the following sections provide answers to these questions.

16.2.2.2 The main characteristic of a logical network is that subscribers can be connected via the same kind of communications service(s). The services of logical networks include *voice, facsimile, telex, data, graphics,* and *video*. It is possible that a network (for example, digital network) supports more than one service. The term network is also used to distinguish radio nets by referencing them to the purpose that they serve. Examples are communications-centre-net and exploration-net. Generally, the purpose of a net can be derived from the name of the network.

16.2.2.3 In general, communications can be established between every pair of subscribers of the same communications network. Subscribers are able to transmit, receive (monitor) or transmit and receive messages, data or whatever type of communications the network is used for. A subscriber participating in a particular network has the same characteristics for every connection that it can establish. If a subscriber has, for example, a monitoring status in a network, this subscriber is able to monitor information from all transmitting subscribers (whenever a connection is established). Connections can only be established between a subscriber who can receive and a subscriber who can transmit.

16.2.2.4 Organisations are considered to be subscribers of a network. An organisation can subscribe to different networks as different subscribers. For example, a commander of a unit can have equipment with which to switch between different networks (and even have different abilities in transmitting and receiving information). Subscription to a network need not be limited solely by the capabilities of equipment. It can be defined by operational requirements that are dictated by commanders and result in specified permissions to participate in networks, such as command net or a fire support net.

16.2.2.5 Other aspects of interest regarding communications networks are requirements for minimum network capacity, expressed in number of baud, and the security classification of a network.

16.2.3 CE Additions to the Model

16.2.3.1 The model has been extended to accommodate the logical architecture of Communications-Electronics by adding the entities LOGICAL-NETWORK, LOGICAL-NETWORK-SERVICE, and LOGICAL-NODE. The resultant structure is shown graphically in Figure 94:

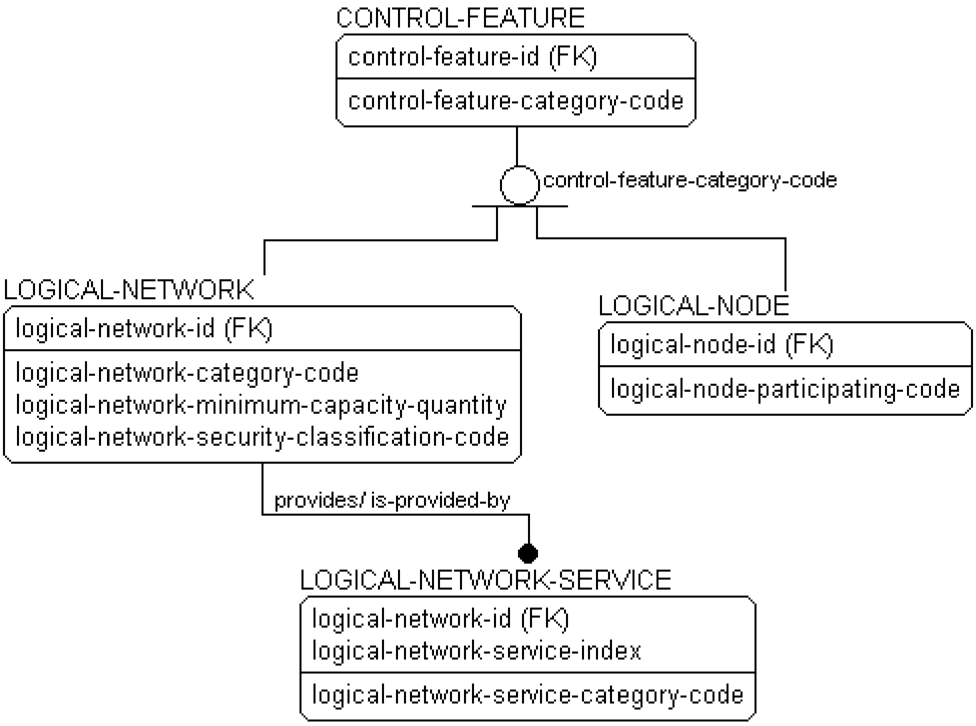


Figure 94. Entities Added for Communications-Electronics

16.2.3.2 The entities LOGICAL-NETWORK and LOGICAL-NODE are modelled as subtypes of CONTROL-FEATURE and, as such, are OBJECT-ITEMs. This way instances of both entities can be assigned a status via instances of OBJECT-ITEM-STATUS.

16.2.4 Specification of LOGICAL-NETWORK

A LOGICAL-NETWORK is defined as a CONTROL-FEATURE that is a chain of interconnecting communications elements logically designed to function in a specified manner. The attributes are:

a. logical-network-id—The control-feature-id of a specific LOGICAL-NETWORK (a role name for object-item-id).

b. logical-network-category-code—The specific value that represents or denotes a specific type of service that a LOGICAL-NETWORK is intended to provide. The domain values are: Common user network, Compound network, Sole user network.

c. logical-network-minimum-capacity-quantity—The non-monetary numeric value representing the minimum number of bauds that a specific LOGICAL-NETWORK can process.

d. logical-network-security-classification-code—The specific value that represents the security classification of a specific LOGICAL-NETWORK. The domain values are:

NATO CONFIDENTIAL, NATO RESTRICTED, NATO SECRET, NATO TOP-SECRET, NATO UNCLASSIFIED.

16.2.5 Specification of LOGICAL-NETWORK-SERVICE

LOGICAL-NETWORK-SERVICE is defined as an identification of the specific type of communications service provided by a specific LOGICAL-NETWORK. The attributes are:

a. logical-network-id—The control-feature-id of a specific LOGICAL-NETWORK (a role name of the object-item-id).

b. logical-network-service-index—The unique value, or set of characters, assigned to represent a specific LOGICAL-NETWORK-SERVICE for a specific LOGICAL-NETWORK and to distinguish it from all other LOGICAL-NETWORK-SERVICEs for that LOGICAL-NETWORK.

c. logical-network-service-category-code—The specific value that represents or denotes a specific type of service that a specific LOGICAL-NETWORK is intended to provide. The domain values are: Data, Facsimile, Graphics, Telex, Video, Voice.

16.2.6 Specification of LOGICAL-NODE

LOGICAL-NODE is defined as a CONTROL-FEATURE that participates as a logical element in a communications network. This may be a role for an ORGANISATION specified through ORGANISATION-CONTROL-FEATURE-ASSOCIATION. The attributes are:

a. logical-node-id—The control-feature-id of a specific LOGICAL-NODE (a role name for object-item-id).

b. logical-node-participating-code—The specific value which reflects the method of operation of a LOGICAL-NODE. The domain values are: Receiving; Transmitting; Transmitting/receiving.

16.2.7 Relationships to Other Parts of the Model

16.2.7.1 Some aspects of the network extension are specified through associations with other parts of the model. Figure 95 shows at entity level the associations that extend the functionality of the logical architecture of communications electronics. The principal entities are ORGANISATION-CONTROL-FEATURE-ASSOCIATION and CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION.

16.2.7.3 A logical network contains logical nodes, or in other words, a logical node is part of a logical network. This relation can be modelled by using the association CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION and the value *Is part of* for the *control-feature-control-feature-association-category-code.*

16.2.7.4 A logical network may a sub-network of another logical network, e.g., a fire-net and a C2-net which are sub-networks of a tactical communications system. This relation can be modelled by using the association CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION and the value *Is part of* for the *control-feature-control-feature-association-category-code.*

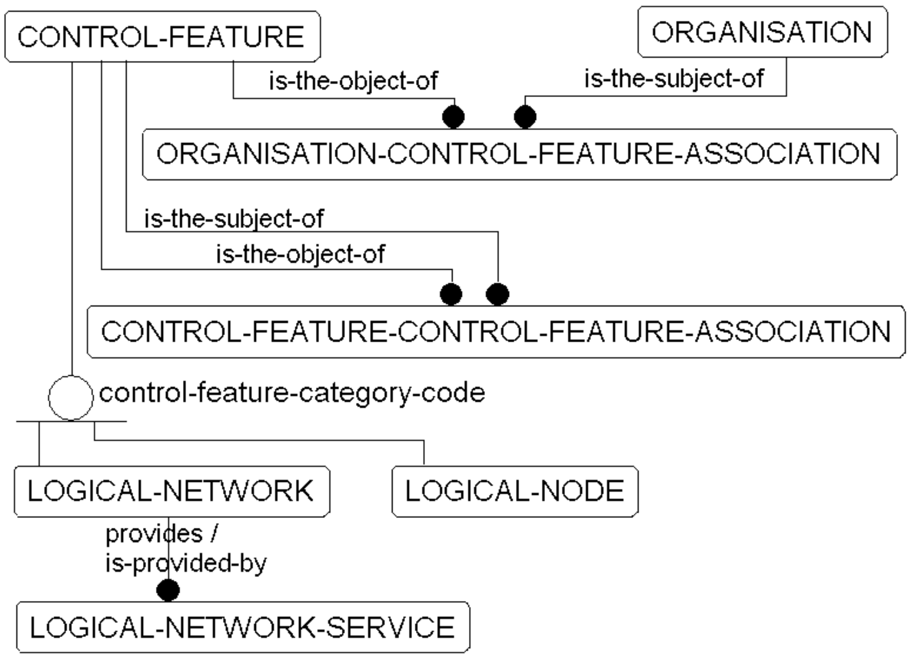


Figure 95. Associations Applicable to the Communications-Electronics Extension

16.2.7.5 An organisation that acts as a logical node can be modelled via the ORGANISATION-CONTROL-FEATURE-ASSOCIATION, only here the value is specified as *Is user of* for the *organisation-control-feature-association-category-code.* An organisation that controls a logical-network can also be modelled the same way except the value *Controls* is used for *organisation-control-feature-association-category-code.*

16.2.7.6 If a specific person is to act as a "logical node" (a subscriber of a logical network), then this person has to be associated with a post or an organisation (via ORGANISATION-PERSON-ASSOCIATION), and then this post must be designated as a logical node (via ORGANISATION-CONTROL-FEATURE-ASSOCIATION).

16.2.8 Examples

The subsequent sections present examples to illustrate the way logical networks are modelled. The first three examples are shown graphically in Figure 96. The first is a simple two-node network; the next is a network of four nodes; and the third is a network of six nodes. These three examples are supplemented with two others in which the networks are a complete network and a star network, respectively.

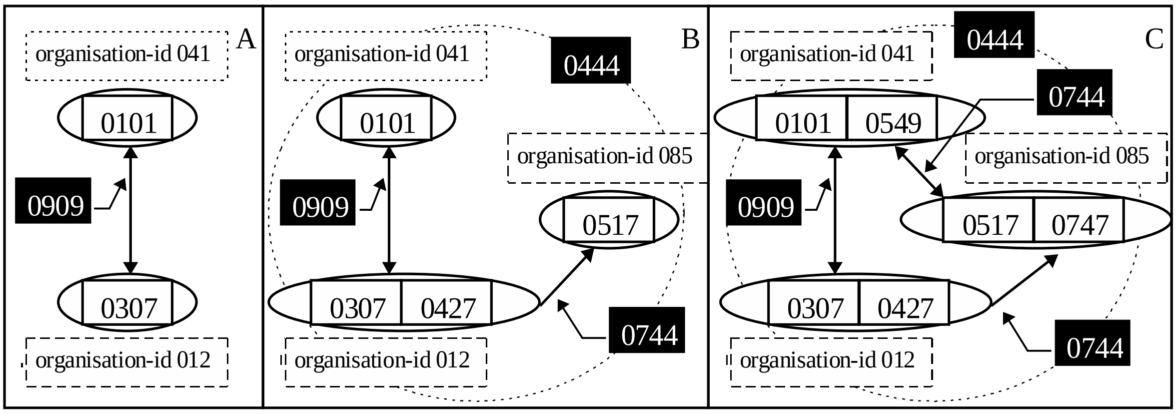


Figure 96. Three Examples of Logical Networks

16.2.8.1 Two-Node Network (Example A)

16.2.8.1.1 The first example, shown in Figure 96(A), is a logical network that represents a single connection between two subscribing organisations. The example instances of the relevant records are shown in Table 126.

Table 126. Instances for Example A

(a) LOGICAL-NODE

logical-node-id	logical-node-participating-code
0101	Transmitting/receiving
0307	Transmitting/receiving

(b) ORGANISATION-CONTROL-FEATURE-ASSOCIATION

***-subject-organisation-id	***-object-control-feature-id	***-index	***-category-code
012	0307	1	Is user of
041	0101	1	Is user of

Note: *** = organisation-control-feature-association

(c) LOGICAL-NETWORK

***-id	***-category-code	***-minimum-capacity-quantity	***-security-classification-code
0909	Sole user network	28,800	NATO SECRET

Note: *** = logical-network

(d) CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION

***-subject-control-feature-id	***-object-control-feature-id	***-index	***-category-code
0307	0909	1	Is part of
0101	0909	1	Is part of

Note: *** = control-feature-control-feature-association

16.2.8.1.2 This network is modelled by creating two LOGICAL-NODEs, both with the *participating-code* set to *Transmit/receive* [Sub-table (a)], assuming that both LOGICAL-NODEs can transmit and receive. Next, the ORGANISATIONs are identified with the LOGICAL-NODEs [Sub-table (b)], a LOGICAL-NETWORK is created, in this case a *Sole user network* with a minimum capacity of 28,800 baud [Sub-table (c)], and, finally, the LOGICAL-NODEs are associated with the LOGICAL-NETWORK [Sub-table (d)].

16.2.8.2 Four-Node Network (Example B)

16.2.8.2.1 The second example, illustrated in Figure 96(B), is similar to Example A but it adds a third receive-only organisation that subscribes to the network. The network contains two connections, each modelled as a LOGICAL-NETWORK. The overall network consists of two LOGICAL-NETWORKs that represent the two connections and one LOGICAL-NETWORK that represents the compound network. The data instances for this example are presented in Table 127.

Table 127. Instances for Example B

(a) LOGICAL-NODEs

logical-node-id	logical-node-participating-code
0101	Transmitting/receiving
0307	Transmitting/receiving
0427	Transmitting
0517	Receiving

(b) ORGANISATION-CONTROL-FEATURE-ASSOCIATION

***-subject-organisation-id	***-object-control-feature-id	***-index	***-category-code
012	0307	1	Is user of
012	0427	1	Is user of
041	0101	1	Is user of
085	0517	1	Is user of

Note: *** denotes “organisation-control-feature-association”.

(c) LOGICAL-NETWORK

***-id	***-category-code	***-minimum-capacity-quantity	***-security-classification-code
0909	Sole user network	28,800	NATO SECRET
0744	Sole user network	14.400	NATO SECRET
0444	Compound network	14.400	—

Note: *** = logical-network

(d) CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION

***-subject-control-feature-id	***-object-control-feature-id	***-index	***-category-code
0307	0909	1	Is part of
0101	0909	1	Is part of
0307	0744	1	Is part of
0507	0744	1	Is part of
0909	0444	1	Is part of
0744	0444	1	Is part of

Note: *** denotes “control-feature-control-feature-association”.

16.2.8.2.2 The first connection, between the ORGANISATIONs with *organisation-id*s *012* and *041*, is modelled in the same way as in Example A. The ORGANISATION with *organisation-id 012* is assigned a second logical node. This is done because this ORGANISATION has two connections each with slightly different characteristics. The new connection between the ORGANISATIONs with *organisation-id*s *012* and *085* is modelled in a similar way as in Example A [see instances in Sub-tables (a) through (d)]. The compound network is specified via CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION as consisting of two point-to-point LOGICAL-NETWORKs [see Sub-tables (c) and (d)].

16.2.8.3 Six-Node Network (Example C)

The third example, as illustrated in Figure 96(C), is a continuation of the previous two. It builds on the previous set of tables by showing the additional data in Table 128. As in Example B, the compound network consists of different connections but now includes three instead of two. The new connection is between ORGANISATIONs with *organisation-id*s *085* and *041*. This connection is modelled by defining two new LOGICAL-NODEs, both transmitting and receiving [see Sub-table (a)], associating the former mentioned ORGANISATIONs with them [see Sub-table (b)], defining a new LOGICAL-NETWORK [see Sub-table (c)], and by associating the LOGICAL-NODEs to be part of this LOGICAL-NETWORK [see the first two records of Sub-table (d)]. Finally, the new LOGICAL-NETWORK is made part of the compound network via the CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION [see the last record of Sub-table (d)].

Table 128. Additional Instances for Example C

(a) LOGICAL-NODE

logical-node-id	logical-node-participating-code
0517	Transmitting/receiving
0549	Transmitting/receiving

(b) ORGANISATION-CONTROL-FEATURE-ASSOCIATION

***-subject-organisation-id	***-object-control-feature-id	***-index	***-category-code
085	0517	1	Is user of
041	0549	1	Is user of

Note: *** denotes “organisation-control-feature-association”.

(c) LOGICAL-NETWORK

logical-network -id	logical-network -category-code	logical-network -minimum-capacity-quantity	logical-network -security-classification-code
0744	Common user network	28.800	NATO UNCLASSIFIED

(d) CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION

***-subject-control-feature-id	***-object-control-feature-id	***-index	***-category-code
0517	0744	1	Is part of
0549	0744	1	Is part of
0744	0444	1	Is part of

Note: *** denotes “control-feature-control-feature-association”.

16.2.8.4 A Compound Network (Example D)

16.2.8.4.1 Example D shows how to model a network in which six organisations participate. The example is shown graphically in Figure 97. The network consists of three sole-user circuits and twelve common-user lines which all are modelled as separate networks.

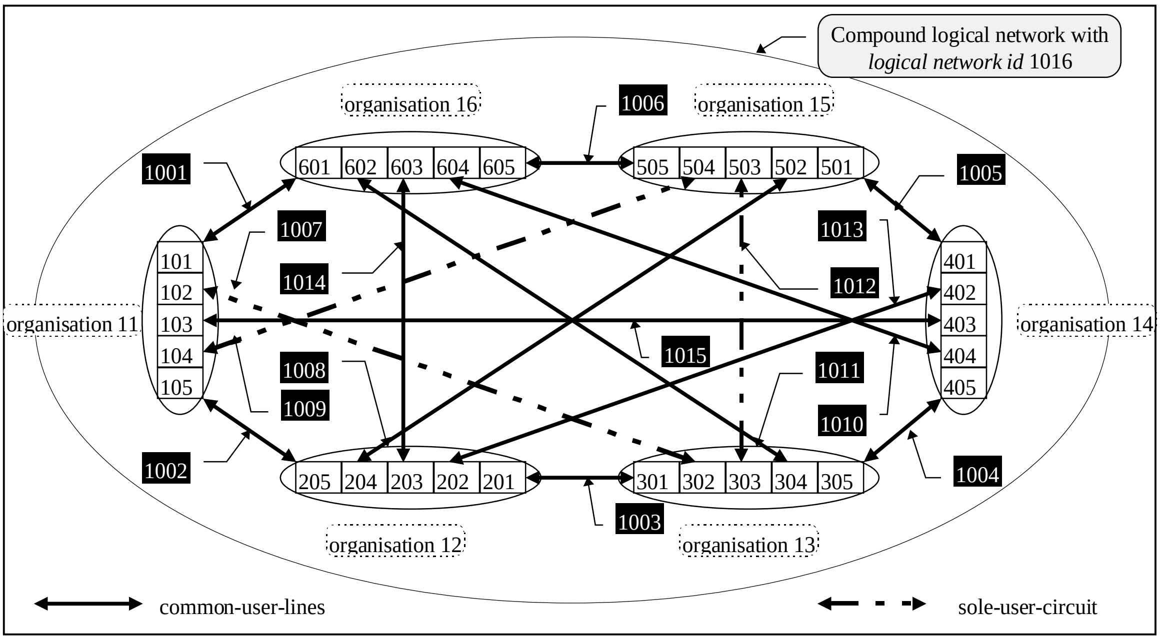


Figure 97. Example D—A Compound Network with Three Sole-User Circuits and Twelve Common-User Lines

16.2.8.4.2 In order to represent each connection as a separate network, each ORGANISATION is specified to have five LOGICAL-NODEs. The association of ORGANISATIONs with LOGICAL-NODEs is modelled in the ORGANISATION-CONTROL-FEATURE table. All instances are listed in Table 129. For example, ORGANISATION with *organisation id* 11 is identified with the five LOGICAL-NODEs having the *logical node id's* 101 through 105. The records for organisation 41 associated with logical nodes 401 through 405 and organisation 51 associated with logical nodes 501 through 505 have been omitted for brevity.

Table 129. Specifying LOGICAL-NODEs for ORGANISATIONs

ORGANISATION-CONTROL-FEATURE-ASSOCIATION

***-subject-organisation-id	***-object-control-feature-id	***-index	***-category-code
11 (organisation 11)	101 (logical node 101)	1	Is user of
11 (organisation 11)	102 (logical node 102)	1	Is user of
11 (organisation 11)	103 (logical node 103)	1	Is user of
11 (organisation 11)	104 (logical node 104)	1	Is user of
11 (organisation 11)	105 (logical node 105)	1	Is user of
21 (organisation 21)	201 (logical node 201)	1	Is user of
21 (organisation 21)	202 (logical node 202)	1	Is user of
21 (organisation 21)	203 (logical node 203)	1	Is user of
21 (organisation 21)	204 (logical node 204)	1	Is user of
21 (organisation 21)	205 (logical node 205)	1	Is user of
31 (organisation 31)	301 (logical node 301)	1	Is user of
31 (organisation 31)	302 (logical node 302)	1	Is user of
31 (organisation 31)	303 (logical node 303)	1	Is user of
31 (organisation 31)	304 (logical node 304)	1	Is user of
31 (organisation 31)	305 (logical node 305)	1	Is user of

Note: *** = organisation-control-feature-association

16.2.8.4.3 The LOGICAL-NODEs are specified to be both transmitting and receiving (no table included), and then each common-user and sole-user connection is represented as a

LOGICAL-NETWORK. These networks are listed as the first fifteen instances in Table 130. The last instance in the table identifies the compound network that will encompass all individual networks.

Table 130. Assignment of *logical-network-category-code*

LOGICAL-NETWORK

logical-network-id	logical-network-category-code
1001	Common user network
1002	Common user network
1003	Common user network
1004	Common user network
1005	Common user network
1006	Common user network
1007	Sole user network
1008	Common user network
1009	Sole user network
1010	Common user network
1011	Common user network
1012	Sole user network
1013	Common user network
1014	Common user network
1015	Common user network
1016	Compound network

16.2.8.4.4 Each connection between two LOGICAL-NODEs (associated with different ORGANISATIONs) is specified as part of a LOGICAL-NETWORK. Each network is associated with exactly two nodes. Each connection is modelled separately. Table 131 lists the LOGICAL-NODEs (as subject-control-features) and indicates the LOGICAL-NETWORK (as object-control-feature) of which each is a part. For example, *logical network id* 1001 has *logical-node-ids* 101 and 601 associated with it.

Table 131. Association of LOGICAL-NODEs with LOGICAL-NETWORKs

CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION

***-subject-control-feature-id	***-object-control-feature-id	***-index	***-category-code
101	1001	1	Is part of
601	1001	1	Is part of
105	1002	1	Is part of
205	1002	1	Is part of
201	1003	1	Is part of
301	1003	1	Is part of
305	1004	1	Is part of
405	1004	1	Is part of
401	1005	1	Is part of
501	1005	1	Is part of
504	1006	1	Is part of
604	1006	1	Is part of
102	1007	1	Is part of
302	1007	1	Is part of
204	1008	1	Is part of
502	1008	1	Is part of
104	1009	1	Is part of
504	1009	1	Is part of
404	1010	1	Is part of
604	1010	1	Is part of
304	1011	1	Is part of
602	1011	1	Is part of
303	1012	1	Is part of
503	1012	1	Is part of
202	1013	1	Is part of
402	1013	1	Is part of
203	1014	1	Is part of
603	1014	1	Is part of
103	1015	1	Is part of
403	1015	1	Is part of

Note: *** denotes “control-feature-control-feature-association”.

16.2.8.4.5 Table 132 is another instance table for CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION (which is an extension of the previous table, but is shown separately for purposes of exposition). It shows the instances of LOGICAL-NETWORKs that represent individual connections making up the compound network. The table specifies that the LOGICAL-NETWORKs with *logical network id*s 1001 through 1015 are part of the compound network with *logical network id* 1016.

Table 132. LOGICAL-NETWORK Instances for Compound Network

CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION

***-subject-control-feature-id	***-object-control-feature-id	***-index	***-category-code
1001	1016	1	Is part of
1002	1016	1	Is part of
1003	1016	1	Is part of
1004	1016	1	Is part of
1005	1016	1	Is part of
1006	1016	1	Is part of
1007	1016	1	Is part of
1008	1016	1	Is part of
1009	1016	1	Is part of
1010	1016	1	Is part of
1011	1016	1	Is part of
1012	1016	1	Is part of
1013	1016	1	Is part of
1014	1016	1	Is part of
1015	1016	1	Is part of

Note: *** denotes "control-feature-control-feature-association".

16.2.8.5 A Network with Star Topology (Example E)

16.2.8.5.1 The subject of this example is a network that is configured with star-topology having one centre and five arms. The example is graphically illustrated in Figure 98. The figure lists the identifiers for organisations, nodes, and networks that are used to specify the details in subsequent tables.

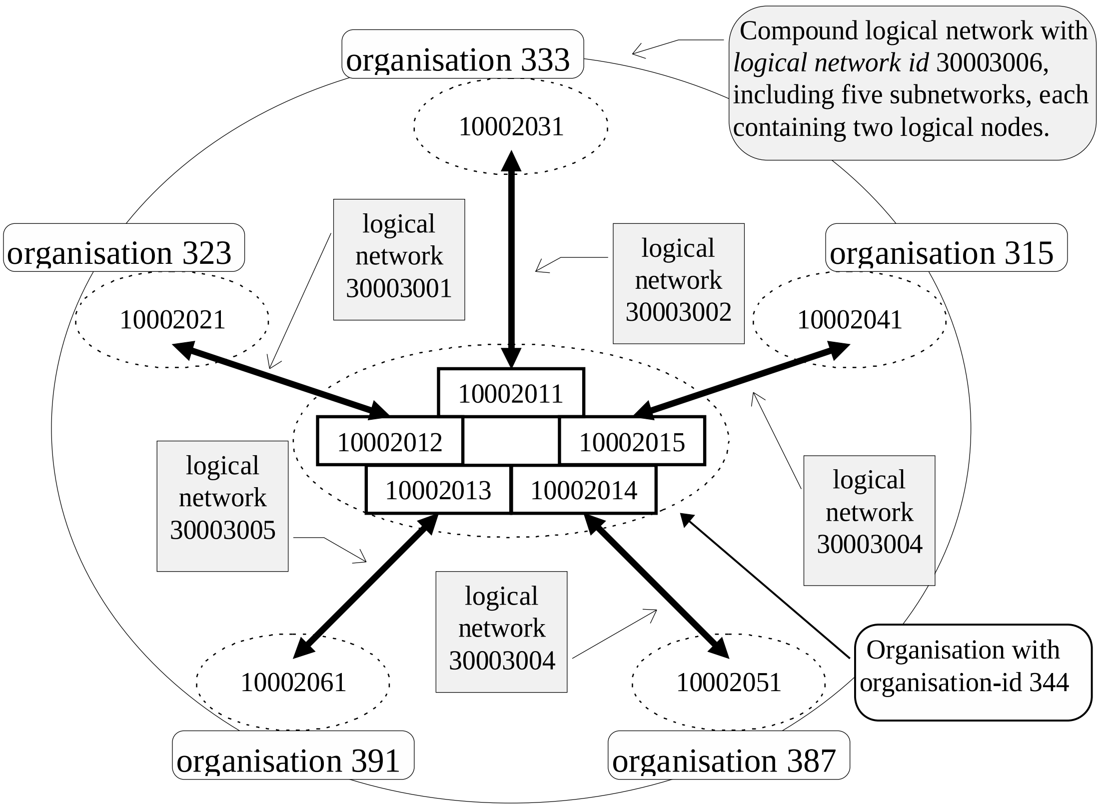


Figure 98. Example E—A Compound Network with Five Sub-networks in a Star Topology

16.2.8.5.2 The network specification requires that the five ORGANISATIONs with *organisation ids* 315, 333, 323, 391 and 387 be associated with the LOGICAL-NODEs with *logical node ids* 10002041, 10002031, 10002021, 10002061, and 10002051, respectively, and the ORGANISATION with *organisation id* 344 be associated with five LOGICAL NODEs with *logical node id*s 10002011 through 10002015. The data representation of this specification is shown in Table 133.

Table 133. Specifying LOGICAL-NODEs for ORGANISATION

ORGANISATION-CONTROL-FEATURE-ASSOCIATION

***- -subject-organisation-id	***-object-control-feature-id	***-index	***-category-code
315	10002041	1	Is user of
333	10002031	1	Is user of
323	10002021	1	Is user of
391	10002061	1	Is user of
387	10002051	1	Is user of
344	10002011	1	Is user of
344	10002012	1	Is user of
344	10002013	1	Is user of
344	10002014	1	Is user of
344	10002015	1	Is user of

Note: *** denotes “organisation-control-feature-association”.

16.2.8.5.3 Next, the LOGICAL-NODEs are associated with the instances of LOGICAL-NETWORK representing the arms of the star. The data are listed in Table 134.

Table 134. Specifying LOGICAL-NODEs in LOGICAL-NETWORKs

CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION

***-subject-control-feature-id	***-object-control-feature-id	***-index	***-category-code
10002021	30003001	1	Is part of
10002012	30003001	1	Is part of
10002061	30003005	1	Is part of
10002013	30003005	1	Is part of
10002051	30003004	1	Is part of
10002014	30003004	1	Is part of
10002041	30003003	1	Is part of
10002015	30003003	1	Is part of
10002031	30003002	1	Is part of
10002011	30003002	1	Is part of

Note: *** denotes “control-feature-control-feature-association”.

16.2.8.5.4 The final step is to specify the sub-networks with *logical network ids* 30003001 through 30003005 as being part of the compound LOGICAL-NETWORK with *logical network id* 30003006. This linkage of sub-networks to make up the entire star topology is given in data form in Table 135.

Table 135. Associations Between LOGICAL-NETWORKs

CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION

***-subject-control-feature-id	***-object-control-feature-id	***-index	***-category-code
30003001	30003006	1	Is part of
30003002	30003006	1	Is part of
30003003	30003006	1	Is part of
30003004	30003006	1	Is part of
30003005	30003006	1	Is part of

Note: *** denotes “control-feature-control-feature-association”.

16.2.9 Role of LOGICAL-NETWORK-SERVICE

16.2.9.1 The use of the entity LOGICAL-NETWORK-SERVICE is relatively simple. For every service that a LOGICAL-NETWORK provides, a separate LOGICAL-NETWORK-SERVICE record is created. If a LOGICAL-NETWORK provides more than one service, the associated LOGICAL-NETWORK-SERVICE records have key-attributes with identical values of the *logical-network-id* attribute but with distinct values for the *logical-network-service-index* attribute.

16.2.9.2 Table 136 describes an unclassified common-user network with a minimum capacity of 28,800 baud that provides both data and graphics services.

Table 136. Use of LOGICAL-NETWORK-SERVICE

(a) LOGICAL-NETWORK

logical-network -id	logical-network -category-code	logical-network -minimum-capacity-quantity	logical-network -security-classification-code
0987	Common user network	28.800	NATO UNCLASSIFIED

(b) LOGICAL-NETWORK-SERVICE

logical-network-service-id	logical-network-service-index	logical-network-service-category-code
0987	1	Data
0987	2	Graphics

16.3 Network and Materiel Planning

16.3.1 Introduction

16.3.1.1 A major aspect of communications management is network planning. The network planning process itself is concerned with the following:

a. Planning communications nodes in time and different locations

b. Planning for logical connectivity between current and future logical nodes.

16.3.1.2 The planning of logical connections is relatively simple. Logical network, subscribers and logical connections should be identified (see Section 16.2.2) and it should be determined when they will have to be operational (at what time connections should be established).

16.3.2 Mapping to the Model

16.3.2.1 An organisation that is planning a logical network can be modelling by associating the planning ORGANISATION via ORGANISATION-TASK-ASSOCIATION with an

ACTION-TASK. The objective and resources of the plan/order/request can be specified via ACTION-OBJECTIVE and ACTION-RESOURCE. The specified objective is the logical network and the specified resources are the CE-units and equipment types that will be used for implementation. In addition, subscribers and connections need to be identified.

16.3.2.2 CONTROL-FEATURE-STATUS and REPORTING-DATA can be used to keep track of the current status of an established network. The same entities can also be used to indicate future activation of networks and their elements.

(This page intentionally left blank)

17. PHYSICAL DATA SCHEMA

17.1 Introduction

17.1.1 The balance of this chapter aims to document the physical schema for information exchange and implementation of GH-conformant databases in order to provide the following:

a. Configuration control of the data specifications.

b. The physical data model specified in accordance with the Integrated Definition (IDEF) for Information Modelling [Ref. FIPS PUB 184 1993].

c. Metadata for the physical schemata, which include for each attribute:

(1) Generic data types: integer or real numeric (NUMBER), fixed-length alphanumeric (CHAR), and variable-length alphanumeric (VARCHAR)

(2) Number of positions (i.e., length of each valid domain value) and, in the case of a real numeric data type, the number of decimal places

(3) Whether a null value is permitted (NULL) or not (NOT NULL).

d. Domain values (including physical abbreviations) for all coded (enumerated) domains.

e. Rules and guidance for physical schemata to support consistent meaning of data.

f. Traceability of the physical schemata to the baseline data model.

17.1.2 This chapter constitutes a general introduction to the relevant concepts. Chapter 18 presents the transformation rules for physical schemata. Chapter 19 contains a set of create, read, update, and delete (CRUD) rules for database operations.

17.2 Schema Level

17.2.1 *Physical data schemata* are derived from their corresponding *logical data schemata*. They define the database structure for the implementation of a database, on which various applications may be run.

17.2.2 Physical data schemata describe physical views of the data, which are specifications of physical properties (e.g., data types) of data that are necessary to implement databases. They typically define tables and columns in a relational database. Physical data schemata can be characterised, for instance, by scripts of SQL statements defining database tables. Like the logical schema, physical data schemata can also be specified by means of IDEF1X diagrams, which represent tables, columns, and references among these elements.

17.3 The Data Exchange Schema (DES)

17.3.1 The Data Exchange Schema (DES) is partly used as the common reference for the data exchange using a replication mechanism (in combination with the logical Generic Hub Data Model). The DES is attached to this document as Annex I. It is directly derived from the logical Generic Hub Data Model and specifies all physical properties for the data to be exchanged.

17.3.2 Interoperability of GH-conformant systems is based on the DES being the common reference data model for data exchanged between such systems.

17.3.3 The relational structures and the attribute sequences defined in the DES are identical with those in the Logical Generic Hub Data Model. However, the (logical) entity and attribute names have been converted to physical table and column names. In addition, some physical parameters such as data types or digits and decimals for numeric values are specified. The common "data exchange format" used by replication mechanisms is based directly on the DES.

17.4 Physical Application Schemata

17.4.1 A physical application schema specifies the physical structure of a national operational database application. Like the DES, physical application schemata can be derived from the logical Generic Hub Data Model. Physical application schemata are however not prescribed, because, in general, they depend on the specific purposes, requirements, and the user views of the systems, for which they are used to define the databases of those systems. Thus, every physical application schema is considered to be a national or a system responsibility.

17.4.2 The derivation of a national physical application schema from the logical Generic Hub Data Model entails taking into account some physical parameters that are specified in the DES, such as the lengths of attributes (i.e. number of characters) or the precision of numeric values (i.e. the number of digits after the decimal point).

17.4.3 A physical application schema defines the structure of database tables for a national C2IS. It may cover anything required for the particular system; however, to be GH-conformant, it is required that all those parts of the application schema, which are relevant for data exchange with other GH-based systems, can be mapped to the logical Generic Hub Data Model (or to the DES) and vice versa.

17.4 Key Management Rules to be Taken into Account for Database Implementation

17.4.1 Beside the data structures defined by the aforementioned data schemata, some additional constraints need to be taken into account for system implementation, if LC2IEDM conformance is to be achieved. All data schemata contain key attributes for identification of data records (i.e. those attributes, of which the Class Word (last term of the attribute name) is either *identifier (id)* or *index*. The domains for data identification keys need to be centrally controlled in order to avoid confusion by multiple use of the same key values for identification of different data records. [NB: This needs to be a topic for NATO resolution.]

17.4.2 The details of the management rules for generating unique keys (by dividing the domains of allowed key values into sub-domains and assigning these to specific organisations) are specified in [to be developed by NDAO?], which needs to be used in combination with the domain specifications provided in Annex J of this document.

17.5 Contents of Databases for GH Data and Meta Data

17.5.1 Information Resource Dictionary (IRD)

There will be one centrally controlled Meta Database, which is the IRD. This meta database will contain, beside other meta data, the specifications of the Logical Generic Hub Data Model and of the DES. This includes the complete definitions of all entities, attributes and relationships as well as of all domains including the individual values of enumerated domains.

17.5.2 Static and Dynamic Contents of Databases

17.5.2.1 The database in an GH-conformant system contains two kinds of data: reference data and dynamic data.. Reference data is static, i.e. it is used to describe static facts and information that does not change over a long period of time. Reference data can be referred to by instances of dynamic data. Examples of the static reference data are OBJECT-TYPEs, their subtypes, and establishments. The replication mechanisms are not expected to replicate reference data between databases, because reference data is assumed to be already present in all conformant databases.

17.5.2.2 Dynamic data ("live data") is generated by database applications. E.g., it is used to describe the actual situation in the battlespace and its changes. This kind of data is replicated to other databases.

17.5.2.3 The data, which is transferred between databases, needs to be consistent with the DES, as the DES is used as the common reference for data exchange. There is no need to use the same data structures for the physical implementation of a database in a national system, i.e. for the physical database application schema, as long as all data in the database can be uniquely mapped to the DES.

(This page intentionally left blank)

18. TRANSFORMATION RULES FOR PHYSICAL DATA SCHEMATA

18.1 Introduction

18.1.1 This chapter describes the rules that govern the actual transformation from:

a. The logical data model (called the *Generic Hub Data Model*) into the Data Exchange Schema (DES).

b. The logical Generic Hub data model into a (national) Physical Application Schema.

18.1.2 The DES is used or referred to by the replication mechanism. The rules described in this chapter are *mandatory* insofar that the data exchange format used by a replication mechanism is based on the physical properties for entities and attributes as specified in the DES.

18.1.3 The transformation from the logical Data Model into a Physical Application Schemata is a national responsibility. However, in Chapter 19 some optional guidelines to implement such an application database schema are given.

18.2 General Transformation Rules

18.2.1 Building Blocks of Physical Data Schemata

18.2.1.1 A physical schema is a translation (implementation) of a logical data model. All elements used in a logical data model must have a corresponding counterpart in the physical schema. Table 137 gives an overview of the elements used in a logical data model and their physical counterparts (based on a relational database). In some cases there is more than one possible physical representation for a single element in a logical data model.

18.2.1.2 In principle, the physical schemata are derived from the logical data models by translating every logical element into a physical (one-to-one mapping). However, due to implementation reasons some departures from the logical models have been applied. These are described and justified separately in Paragraphs 18.3 and 18.4.

Table 137. Elements in a Logical Data Model and their Physical Counterparts

Element in Logical Data Model	Element in Physical Schema
Entity	Table
Attribute	Column
Relationship	Referential Integrity Constraint
Primary Key	Primary Key Constraint /Unique Index
Alternate Key	Index (no duplicates or nulls allowed)
Inversion Entry	Index (duplicates or nulls allowed)
Logical Datatype	Physical Datatype
Optionality	Null / Not Null Indicator
Domain Value	Check Constraint / Entry in Look-Up Table

18.2.2 Specification of Physical Schema

18.2.2.1 The Data Exchange Schema is specified through:

a. Scripts written in Structured Query Language (SQL) for creating a relational database. These are provided in Annex I.

b. IDEF1X diagrams representing tables, columns, and references between them in a graphical representation. These diagrams are provided in Annex H.

18.2.2.2 The SQL statements used in the scripts comply with the SQL-92 standard (also known as SQL2), which is described in ISO/IEC 9075:1992, Database Language SQL [Ref.]). However, the SQL specifications presented in this document adhere to the Oracle syntax for presentation purposes only.

18.2.2.3 Paragraph 18.2.3 through 18.2.8 describes the elements of the physical schemata and some general rules that have been applied to them.

18.2.3 Physical names

Physical names are specified for all tables, columns and indexes. They differ from their logical equivalents due to technical limitations of commercial Database Management System products. Characteristics of physical names are given below.

18.2.4 Tables

18.2.4.1 Separate tables have been specified for each entity in the logical model, using standard SQL syntax. Figure 99 shows the general format:

```
CREATE TABLE <table_name>
      (<column_name_1>          <physical_datatype> <null/not null indicator>,
             ...
       <column_name_n>          <physical_datatype> <null/not null indicator>
);
```

Figure 99. General SQL-Statement for Creating Tables and Columns

18.2.4.2 The following general rules apply for table names:

a. Maximum length of 24 characters

b. Only upper case letters, digits and underscores are used.

18.2.4.3 The rules that have been applied in the transformation from logical entity names into physical table names are described separately in paragraphs 18.3 and 18.4.

18.2.5 Columns

18.2.5.1 Separate columns have been specified for each attribute in the logical model, using standard SQL syntax as shown in Figure 99.

18.2.5.2 The following general rules apply for column names:

a. Maximum length of 24 characters

b. Only lower case letters, digits and underscores are used.

18.2.5.3 The rules that have been applied in the transformation from logical attribute names into physical column names are described separately in paragraphs 18.3 and 18.4.

18.2.6 Physical Datatypes

18.2.6.1 Physical data types have been specified for columns in all tables, using standard SQL syntax as shown in Figure 99. Foreign key columns (attributes) receive the same physical datatype as their originating base column (attribute).

18.2.6.2 Table 138 shows the generic datatypes that are used in the physical schemata together with their characteristics.

18.2.6.3 The datatype to be used is determined by the class word contained in the logical attribute name. The rules that have been applied are described separately in paragraphs 18.3 and 18.4.

Table 138. Generic Physical Datatypes

Physical Datatype	Meaning	Properties
char(n)	Fixed length character string with length n	n ≤ 255
varchar(n)	Variable length character string with maximum length n	n ≤ 2000
number(n)	Integer with maximum of n significant digits	n ≤ 20
number(n,m)	Fixed point number (real) with maximum of n significant digits and m decimal places	n ≤ 20, m ≤ 20

18.2.7 NULL / NOT NULL Indicator

18.2.7.1 NULL / NOT NULL indicators have been specified for all columns in all tables, using standard SQL syntax. Format as in Figure 99.

18.2.7.2 Table 139 specifies the transformation rules for optionality.

Table 139. Transformation Rules for Optionality

Logical Optionality Indicator	Physical Optionality Indicator
Optional	NULL
Mandatory	NOT NULL

18.2.8 Primary Key Constraints

18.2.8.1 The following methods can be used to implement primary (unique) key constraints:

a. Use of SQL primary key specification

b Use of indexes

c. Use of insert, update triggers. These are specified using product specific SQL dialects and are therefore outside the scope of this paper.

18.2.8.2. Primary key constraints have been specified for all primary keys in the logical data models, using standard SQL syntax. Figure 100 shows the general format using 'Method a'. Figure 101 shows the general format using 'Method b'.

```
        ALTER TABLE <table_name>
        ADD  (  PRIMARY KEY (<column_name_1>
                                   ...
                             <column_name_n>) ) ;
```

Figure 100. General SQL-Statement for Creating Primary Key Constraints Using 'Primary Key' Syntax

```
        CREATE UNIQUE INDEX <index_name>
          ON <table_name>
        (
               <column_name_1>                ASC,
                     ...
               <column_name_n>                ASC
        );
```

Figure 101. General SQL-Statement for Creating Primary Key Constraints Using Indexes

18.2.8.3 Annex I contains separate SQL scripts for 'Method a '. Depending on which RDBMS product is used, nations are free to choose. Note that only one method is sufficient to ensure key uniqueness.

18.2.8.4 Prescribed index names are not mandatory. However, the following rules have been applied for index names within the SQL scripts:

a. Maximum length of 27 characters

b. Only upper case letters, digits and underscores are used

c. Structure of an index name is: XPK<table_name>, where <table_name> stands for the host table for the index.

18.2.8.5 Alternate keys and Inversion Entries have not been implemented in the physical schemata.

18.2.9 Foreign Key Constraints

18.2.9.1 Foreign key constraints have been specified for all relationships between logical entities to ensure referential integrity. Figure 102 shows the general SQL format:

```
        ALTER TABLE <table_name>
        ADD  (  FOREIGN KEY  (<column_name_1>
                                      ...
                               <column_name_n>)
                       REFERENCES <parent_table_name> ) ;
```

Figure 102. General SQL-Statement for Creating Foreign Key Constraints

18.2.9.2 An alternative implementation to ensure referential integrity is the use of insert, update and delete triggers. Since these are specified using product specific SQL dialects, specifications of such triggers lie beyond the scope of this paper.

18.2.9.3 Annex H contains a graphical representation of all tables, columns, and references between them. Relationships between tables are annotated with physical verb phrases that correspond to the verb phrases used in the logical data model. The following rules have been applied for these physical verb phrases:

a. Maximum length of 30 characters (due to technical limitations of the modelling tool ERwin). In case of a logical verb phrase longer than 30 characters, the physical verb phrase consists of the first 30 characters.

b. Only lower case letters, digits and underscores may be used. Slashes (‘/’) are converted to underscores.

18.2.10 Domain Constraints

18.2.10.1 Together with primary key constraints and foreign key constraints, domain constraints ensure the semantic correctness of data that is stored in a physical database. In general there are several ways to implement domain constraints. In this paragraph some possible implementations are described. Nations are free to implement any method as long as data that is being replicated according to the Data Exchange Schema.

18.2.10.2 Use of Check Constraints. Check constraints could be used upon the implementation of a database to ensure the correctness of the data, which will be entered into the database through database applications.

18.2.10.3 Separate Look-up Tables for Enumerated Domains. For enumerated domains, i.e. for attributes with a set of allowable values, look-up tables can be used to offer a value list to the user, from which he may select a possible value. This is to ensure that only allowed values could be stored in the database. The database applications should present the logical values (i.e., the semantic meaning of the domain values) to the users rather than the physical codes, which are stored in the database and exchanged between databases. This would also allow a listing of values and their meanings in other languages, instead of the original list containing English only.

18.3 Transformation Rules for the Data Exchange Schema

18.3.1 Tables

18.3.1.1 All general rules described in Paragraph 18.2.4 apply.

18.3.1.2 The following additional naming rules have been applied in the transformation from logical entity names into physical table names:

a. Preserve all terms in the logical name.

b. Preserve the separating hyphens between those terms as well, by replacing them with underscores.

c. Replace long terms of the logical name with clear abbreviations to fit within maximum name length (optional).

d. If the physical name is still too long replace multiple terms by single terms, hereby deleting the hyphens in between.

e. Maintain consistency with similar terms throughout the data model.

18.3.1.3 Abbreviations of logical terms and multiple abbreviations are provided in Paragraph 18.3.4 and 18.3.5.

18.3.2 Column Names

18.3.2.1 All general rules described in Paragraph 18.2.5 apply.

18.3.2.2 The following additional naming rules have been applied in the transformation from logical attribute names into physical column names:

a. Leave out the host prime term (= host entity name) in the logical names of non-key attributes and foreign key attributes. Only primary key base attributes keep their host entity name. The migrated prime term in foreign key attributes always remains.

b. An exception to 'Rule a' applies to foreign key attributes that have been role named, i.e. they keep a possible host entity name. For instance, it must be UNIT.unit_id and not UNIT.id, because this attribute originates from OBJ_ITEM.obj_item_id and has been role named.

c. Preserve all remaining terms in the logical name.

d. Preserve the separating hyphens between those terms by replacing them with underscores.

e. Use a pre-defined abbreviation for the class word used in the logical attribute name.

f. In the case where the attribute kept the prime term, abbreviate this in the same way as the host entity name.

g. Replace long terms of the logical name with clear abbreviations to fit within maximum name length (optional).

h. If the physical name is still too long replace multiple terms by single terms, hereby deleting the hyphens in between (optional).

i. Maintain consistency with similar terms throughout the data model (optional).

18.3.2.3 Abbreviations of class words, logical terms and multiple abbreviations are provided in Paragraph 18.3.3, 18.3.4 and 18.3.5.

18.3.3 Class Word Abbreviations

Table 140 shows the class words used in the Generic Hub Data Model and their physical abbreviations.

Table 140. Generic Hub Class Word Abbreviations

Class Word	Physical Abbreviation
angle	angle
code	code
coordinate	coord
date	date
dimension	dim
duration	dur
fraction	frac
identifier / id	id
index	index
name	name
quantity	qty
rate	rate
temperature	temp
text	text
time	time

18.3.4 Logical Term Abbreviations

Table 141 shows the physical abbreviations used in the Data Exchange Schema for all entity and attribute names in the Generic Hub Data Model.

Table 141. DES Logical Term Abbreviations

Logical Term	Physical Abbreviation
abbreviated	abbrd
absolute	abs
action	act
aircraft	aircrft
alternate	alt

Logical Term	Physical Abbreviation
approval	app
assessment	assess
association	assoc
authorisation	auth
authority	authy
candidate	cand
category	cat
capability	capab
classification	classific
completion	compl
compound	comp
condition	cond
confirmation	conf
consumable	cons
context	contxt
control	ctrl
counting	count
description	descr
detail	det
direction	dir
discriminator	discrim
effective	effect
element	elmnt
elementary	elmnty
elevated	elevd
elevation	elev
employment	employ
engagement	engage
engineering	eng
environment	environ
equipment	equip
established	estabd
establishment	estab
facility	fac
feature	feat
functional	functl
geographic	geo
horizontal	horiz
hostility	host
headquarters	hq
identification	identific
indicator	indic
immediate	immd
latitude	lat
location	locat
logical	log
longitude	long
manoeuvre	manov
materiel	mat
maximum	max
measure	meas
meteorologic	met
military	mil
minimum	min
network	netwrk
nonperson	nonpers

Logical Term	Physical Abbreviation
number	nr
object	obj
objective	objve
operational	operat
organisation	org
orientation	orient
person	pers
planned	plnd
priority	prio
qualifier	qual
reference	ref
regular	reg
relative	rel
reinforcement	reinforce
reporting	report
required	reqd
requirement	require
resource	res
rule-of-engagement	roe
sequence	seq
status	stat
subcategory	subcat
subject	subj
support	supp
surveillance	surv
temporal	tmprl
terminal	trmnl
tracked	trckd
tramsmittal	trans
unit-of-measure	uom
vertical	vert
weight	wgt
wheeled	whld

18.3.5 Multiple Term Abbreviations

Table 142 shows the multiple term abbreviations used in the Data Exchange Schema (DES) specification.

Table 142. DES Multiple Term Abbreviations

Multiple Physical Term	Multiple Term Abbreviation
cand_target_det	ctgtdet
cand_target_list	ctgtlst
ctrl_feat	cfeat
geo_feat	gfeat
inflight_report	iflrp
mat_type	matt
mil_load_classific	mlc
org_type	orgt
pers_type	perst
report_data	rptd
surface_region	sregion

18.3.6 Physical Datatypes

18.3.6.1 All general rules described in Paragraph 18.2.6 apply.

18.3.6.2 Physical datatypes for columns have been primarily determined by what class word is contained within an attribute name. For some class words physical datatypes have been differentiated per column. Table 143 shows the relationship between class words and physical datatypes. Column specifications are provided in Annex J.

Table 143. Relationship between LC2IEDM Class Words and Physical Datatypes

Class word	Physical Datatype	Differentiation
angle	number(7, 4)	
code	char(6)	
coordinate	number(n,m)	Differentiated per co-ordinate attribute. latitude-coordinate (n = 9, and m = 6) longitude-coordinate (n = 10, and m = 6)
date	number(6)	
dimension	number(12, 3)	
duration	number(13, 3)	
fraction	number(6, 3)	
identifier / id	number(n)	Differentiated per identifier attribute category as follows[63]: action-id (incl. derived attributes) - n = 15 candidate-target-list-id (incl. derived attributes) - n = 12 capability-id (incl. derived attributes) - n = 12 context-id (incl. derived attributes) - n = 12 location-id (incl. derived attributes) - n = 15 object-item-id (incl. derived attributes) - n = 15 object-type-id (incl. derived attributes) - n = 15 reference-id (incl. derived attributes) - n = 12 reporting-data-id (incl. derived attributes) - n = 18 rule-of-engagement-id (incl. derived attributes) - n = 12
index	number(12)	
name	varchar(n)	Differentiated per name attribute. Values used are: n = 25, n = 50 and n = 80.
quantity	number(n) number(n, m)	Differentiated for integer quantity attributes. Values used are: n = 3, n = 6, n = 9 and n = 12. Differentiated for real quantity attributes. Value combinations used are: (n = 9, m = 3) and (n = 12, m = 3).
rate	number(n, m)	Differentiated per rate attribute. Value combinations used are: (n = 4, m = 1), (n = 7, m = 1) and (n = 8, m = 4).
temperature	number(5, 1)	
text	varchar(n)	Differentiated per text attribute. Values used are: n = 13, n = 50, n = 100, n = 255 and n = 2000
time	number(5)	

18.3.7 NULL / NOT NULL Indicator

All general rules described in Paragraph 18.2.7 apply.

18.3.8 Primary Key Constraints

All general rules described in Paragraph 18.2.8 apply.

18.3.9 Foreign Key Constraints

All general rules described in Paragraph 18.2.9 apply.

---

[63] The number of digits and other rules for the generation of the various identifiers and indexes are initial working values that will have to be adjusted when NATO develops a scheme for key management.

18.3.10 Domain Constraints

For all enumerated domains in the Generic Hub Data Model separate look-up tables are provided in Annex J. Domain values are sorted on the physical abbreviation.

18.3.11 Departures from the Generic Hub Data Model

18.3.11.1 Two additional columns have been specified for each table in the physical Data Exchange Schema for replication management[64]:

a. owner_id—The unique value, assigned to represent a specific proprietor of a certain data item (record) that is responsible for maintaining that data item.

b. update_seqnr—An absolute sequence number, assigned to represent the validity (in terms of seniority) of a certain data item.

18.3.11.2 Table 144 specifies the physical datatype and the NULL / NOT NULL indicator for the owner_id and timestamp column.

Table 144. Physical Datatypes and Optionality Indicator for Additional Columns in DES

Additional Column Name	Physical Datatype	NULL / NOT NULL Indicator
owner_id	number(11)	NOT NULL
update_seqnr	number(15)	NOT NULL

18.3.12 Specification of the Data Exchange Schema

18.3.12.1 The Data Exchange Schema is fully specified in Annex I. The following SQL scripts are provided:

a. *Base Table Definitions*. Definition of all tables and columns based on a 1-to-1 translation of entities and attributes in the Generic Hub Data Model.

b. *Primary Key Constraints*. Definition of all (unique) primary key constraints (optional in combination with d.).

c. *Foreign Key Constraints*. Definition of all foreign key constraints to insure referential integrity.

d. *Index Definitions*. Definitions of unique indexes for all tables (optional in combination with b.).

18.3.12.2 Annex H contains a graphical representation of the Data Exchange Schema in IDEF1X notation.

---

64 These particular attributes refer to the replication mechanism used in ATCCIS-conformant system. It may change when NATO develops and documents a future replication schema.

19. RULES FOR CREATE, READ, UPDATE AND DELETE (CRUD) DATABASE OPERATIONS

19.1 Introduction

19.1.1 This chapter provides mandatory guidance for system developers. It consists of several tables which document create, read, update and delete (CRUD) rules which apply to Generic Hub-conformant databases. The tables are derived from various parts of the data model. Together with a physical database schema these rules govern the implementation of a conformant system. Table 145 gives an overview of this chapter.

Table 145. Overview of Chapter 19

Paragraph	Contents
19.1	Overview of Chapter 19
19.2	Independent Entities
19.3	Loggable Entities
19.4	CRUD Rules for Entities
19.5	Specific CRUD-rules for Entities

19.1.2. All rules are intended to enforce unambiguous data entry by the user. Strict application of these rules will result in a high degree of database-to-database interoperability and assist in maintaining global database integrity. For information exchange purposes, only the create and update rules are critical.

19.2 Independent Entities

The independent entities are listed below:

(a) ACTION

(b) CAPABILITY

(c) CANDIDATE-TARGET-LIST

(d) CONTEXT

(e) LOCATION

(f) OBJECT-ITEM

(g) OBJECT-TYPE

(h) REFERENCE

(i) REPORTING-DATA

(j) RULE-OF-ENGAGEMENT

19.3 Loggable Entities

A loggable entity specifies operational data for which a historical record is to be maintained, i.e. it cannot be overwritten once entered. In technical terms a loggable entity is characterised by one of the following conditions:

a. It has reporting-data-id in the key area. This includes the REPORTING-DATA entity and its subtyping hierarchy.

b It has index in the key area and reporting-data-id in the non-key area.

c. It has index in the key area and date or time in the non-key area.

d. It is one of the associative entities relating two OBJECT-ITEMs.

e. A child entity of a loggable entity is loggable.

Table 146 shows the loggable entities in the ATCCIS Generic Hub 3 Data Model.

Table 146. Loggable Entities in the ATCCIS Data Model

Entity Name
ACTION-EFFECT (with subtypes OBJECT-TYPE-ACTION-EFFECT and OBJECT-ITEM-ACTION-EFFECT)
ACTION-EVENT-STATUS
ACTION-TASK-STATUS
CANDIDATE-TARGET-DETAIL (with subtypes CANDIDATE-TARGET-DETAIL-ITEM and CANDIDATE-TARGET-DETAIL-TYPE)
CANDIDATE-TARGET-DETAIL-AUTORISATION
CANDIDATE-TARGET-LIST
CANDIDATE-TARGET-LIST-AUTHORISATION
CONTEXT-ASSESSMENT
CONTEXT-ELEMENT
CONTEXT-REPORTING-DATA-ASSOCIATION
CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION
CONTROL-FEATURE-CONTROL-FEATURE-ASSOCIATION-STATUS
CONTROL-FEATURE-GEOGRAPHIC-FEATURE-ASSOCIATION
CONTROL-FEATURE-GEOGRAPHIC-FEATURE-ASSOCIATION-STATUS
FACILITY-FACILITY-ASSOCIATION
FACILITY-FACILITY-ASSOCIATION-STATUS
FACILITY-FEATURE-ASSOCIATION
FACILITY-FEATURE-ASSOCIATION-STATUS
FACILITY-LOCATION
FEATURE-LOCATION
HOLDING
MATERIEL-MATERIEL-TYPE ESTABLISHMENT
MATERIEL-POINT
MATERIEL-TYPE-ESTABLISHMENT (with child entity MATERIEL-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL)
OBJECT-ITEM-CAPABILITY
OBJECT-ITEM-STATUS (with subtypes CONTROL-FEATURE-STATUS, FACILITY-STATUS, GEOGRAPHIC-FEATURE-STATUS, MATERIEL-STATUS, ORGANISATION-STATUS, and PERSON-STATUS)
OBJECT-ITEM-TYPE
ORGANISATION-ACTION-TASK-ASSOCIATION
ORGANISATION-CONTROL-FEATURE-ASSOCIATION
ORGANISATION-CONTROL-FEATURE-ASSOCIATION-STATUS
ORGANISATION-FACILITY-ASSOCIATION
ORGANISATION-FACILITY-ASSOCIATION-STATUS
ORGANISATION-MATERIEL-ASSOCIATION
ORGANISATION-MATERIEL-ASSOCIATION-STATUS
ORGANISATION-ORGANISATION-ASSOCIATION
ORGANISATION-ORGANISATION-ASSOCIATION-STATUS
ORGANISATION-ORGANISATION-TYPE-ESTABLISHMENT
ORGANISATION-PERSON-ASSOCIATION
ORGANISATION-PERSON-ASSOCIATION-STATUS
ORGANISATION-POINT
ORGANISATION-TYPE-ESTABLISHMENT (with child entities: ORGANISATION-TYPE-ESTABLISHMENT-MATERIEL-TYPE-DETAIL, ORGANISATION-TYPE-ESTABLISHMENT-ORGANISATION-TYPE-DETAIL and ORGANISATION-TYPE-ESTABLISHMENT-PERSON-TYPE-DETAIL)
PERSON-POINT
REPORTING-DATA (with subtypes REPORTING-DATA-ABSOLUTE-TIMING and REPORTING-DATA-RELATIVE-TIMING)
REQUEST-ANSWER

REQUEST-ANSWER-ELEMENT

19.4 CRUD Rules for Entities

Table 147 contains CRUD rules for entities in the data model.

Table 147. CRUD Rules for Entities

Create rules

1. All systems must maintain referential integrity.
2. The *primary key* is generated (filled in/copied) depending on what kind of entity X is and according to the Key Management Rules to be developed by NATO Data Administration Group.
3. Each time an OBJECT-ITEM or OBJECT-TYPE record is created, a corresponding record in the first-level subtype entity must be created as well.

Read rules

There are no read-rules.

Update rules

1. Updates are not allowed for loggable entities (dynamic data) and for entities that are part of the OBJECT-TYPE subtyping hierarchy.
2. The following rules only apply to non-loggable entities.
   a. Primary-key attributes may not be changed;
   b. The user may change any non-primary-key attribute of an owned record:
      - mandatory attributes must be updated by replacing one value by another;
      - optional attributes may be updated by removing or replacing the value
3. If a category-code is used to discriminate between subtypes, the following rules apply:

   Alternative A: *changing the category-code is not allowed.* In this case the change in views can only be catered for by an explicit deletion of the record of X and the subsequent creation of a new record of X;

   Alternative B: *changing the category-code is allowed.* This could imply the creation of a (new) subtype record for the related record of X, an attempt to retain as much related information as possible, and the deletion of the old subtype record.[65]

Delete rules

Records of X can be deleted without any restriction, as long as referential integrity is maintained.

19.5 Specific Create and Update (CU)-Rules for Entities

Table 148 contains specific CU-rules for selected entities in the data model.

Table 148. Specific CU-Rules for Entities

Entity Name	(Non)loggable	Create Rules	Update Rules
ABSOLUTE-POINT	Non-loggable		Alternative B.
ACTION	Non-loggable		Alternative A.
ACTION-OBJECTIVE	Non-loggable		Alternative B.
ACTION-OBJECTIVE-ITEM	Non-loggable		Alternative B.
ACTION-RESOURCE	Non-loggable		Alternative B.
ACTION-RESOURCE-EMPLOYMENT	Non-loggable		Alternative A.
ACTION-TASK	Non-loggable		Alternatvie A.
CAPABILITY	Non-loggable		Alternative B.
CONTEXT	Non-loggable		Alternative A.
CONTEXT-REPORTING-DATA-ASSOCIATION	Non-loggable		Alternative B.
CONTROL-FEATURE	Non-loggable		Alternative B.

65 Because the retaining of related information can be very hard to achieve under this alternative, it is recommended to change the category-code only in those cases where not much related information is specified.

Entity Name	(Non)loggable	Create Rules	Update Rules
FACILITY	Non-loggable		Alternative B.
FEATURE	Non-loggable		Alternative B.
FEATURE-TYPE	Non-loggable		Alternative A.
GEOMETRIC-VOLUME	Non-loggable		Alternative B.
LINE	Non-loggable	When a specific side of a LINE must be specified, left always relates to the ascending numeration of LINE-POINTs (Left Hand Rule). LINEs which have a direction have that direction stated by ascending enumeration of its LINE-POINTs.	
LOCATION	Non-loggable		Alternative A.
MATERIEL-MATERIEL-TYPE-ESTABLISHMENT	Loggable	The MATERIEL in the MATERIEL-MATERIEL-TYPE-ESTABLISHMENT must be of the same type as the MATERIEL-TYPE in the MATERIEL-MATERIEL-TYPE-ESTABLISHMENT.	
MATERIEL-TYPE	Non-loggable		Alternative A.
METEOROLOGIC-FEATURE	Non-loggable		Alternative B.
OBJECT-ITEM	Non-loggable		Alternative B.
OBJECT-ITEM-TYPE	Loggable	A subtype of OBJECT-ITEM may be classified only by its equivalent subtype of OBJECT-TYPE, any subtype thereof, or the nearest supertype if neither of the former are available. This means that classification of an OBJECT-ITEM within the OBJECT-ITEM subtyping hierarchy must be compatible within the OBJECT-TYPE classification hierarchy.	
OBJECT-TYPE	Non-loggable		Alternative A.
ORGANISATION	Non-loggable		Alternative B.
ORGANISATION-TYPE	Non-loggable		Alternative A.
PERSON-TYPE	Non-loggable		Alternative A.
POINT	Non-loggable		Alternative A.
SURFACE	Non-loggable		Alternative A.
SURFACE-REGION-BOUNDING-LINE	Non-loggable	The boundary LINE of an AREA may not cross itself in the projection on the horizontal plane; The inside of the projection of an area will always be the left hand side of its projected boundary line.	
UNIT-TYPE	Non-loggable		Alternative A.

(This page intentionally left blank)