DGIWG – 301

Portrayal of the Recognized Environmental Picture

Document Identifier:	TCR-DP-07-026-ed1.0.1-Portrayal_REP
Publication Date:	12 June 2007
Edition:	1.0.1
Edition Date:	12 June 2007
Responsible Party:	DGIWG
Audience:	Approved for public release

Abstract: This technical report examines the issues arising from the requirements for portrayal of the Recognised Environmental Picture (REP) and thus serves as a guide for planning future work in this area.

Contents

Executive Summary

There is a requirement to portray environmental information in a joint-services-supporting, comprehensive "Recognised Environmental Picture (REP)". Merging existing datasets, displayed with existing portrayal standards would cause confusion between the communities attempting to understand the REP. There must be sufficient flexibility in the portrayal standard for views of the REP to support multiple modes of use. Views of the REP will be required to support joint and component-based, planning and execution and be usable in isolation or as a situational awareness backdrop for tactical pictures.

Harmonisation of portrayal standards cannot succeed if disconnected from harmonisation at the feature content model. A harmonised data model and corresponding harmonised portrayal standard is required to support multiple representations of features defined by complex rules. Composite symbols able to represent attribute level information without dependence on colour or size are required. New symbols are required to harmonise extreme variations in portrayal using symbols derived from existing standards where features are of interest to more than one community.

The single largest unresolved issue is how to control the large volumes of data which will comprise the REP. The issue is not how will the REP be portrayed but how will the portrayal constrain the content of any given view of the REP.

1   Introduction

This project was initiated at the 2005 DGIWG conference and will close by the 2006 DGIWG conference. The project was proposed by the UK on behalf of the NATO AML co-ordinator of the Geospatial Maritime Working Group (GMWG).

The short to medium term future will see the increasing use of service based architecture supported by databases. This anticipated change away from data products creates new opportunities and new challenges.

The project examines the issues arising from the requirements for portrayal of the Recognised Environmental Picture (REP). The report will make recommendations for action where the issue is considered to be understood and a clear way forward has been identified and for further research where either the requirement is not fully understood or no solution has been identified. Due to the limited time and resource allocated to this project the deliverable report is likely to be a basis for further investigation.

2   Background

The Recognized Environmental Picture (REP) is a relatively new concept, its name implies a strong dependency on the way the environmental information is recognized by either the user or the system in use. Recognition itself implies a level of familiarity and understanding. Up to this point geo-spatial information has been compiled for specific user communities in support of specific activities. The REP is the first time that disparate types of digital, environmental information, which has hitherto been created specific to one community, has been required to form a consistent view, in a single system and in concert with other sources of information and understood by a broad range of users.

The unique characteristics of the REP are the diversity of information types which will be used to form the environmental picture and the diversity of ways in which it is required to be "recognized" or viewed & understood.

This project will investigate the assumptions arising from the concept of the REP and make recommendations for the portrayal of the REP such that the understanding or recognition of the environmental information is as effective as possible.

3   Stakeholders

3.1 Effecting (Key) stakeholders

The Digital Geospatial Information Working Group (DGIWG)
The Geospatial Maritime Working Group (GMWG)

3.2 Affected stakeholders

The GMWG Industry representatives
NATO NC3 NATO Core GIS

3.3 Review stakeholders

The Digital Geospatial Information Working Group (DGIWG)
The Geospatial Maritime Working Group (GMWG)

Inter-service Geo-spatial Working Group (IGeoWG)

4 Requirements and constraints

4.1 Assumptions

4.1.1   That various views of the REP will be used by component commanders and others for planning purposes.

4.1.2   A wide variety of views of the REP will be required

4.1.3   Established environmental information products already routinely used by various specialist communities will in future be generated from a REP database, to ensure that a common understanding of the environment is achieved.

4.1.4   Many of the features to be displayed in the REP will already have a well established portrayal within their communities of interest.

4.1.5   The intended use of the data influences its established portrayal.

4.1.6   The REP may be used as a backdrop over which tactical information is required to be displayed, this severely constrains the use of colours in portrayal of the REP.

4.1.7   Relative size of symbols may be more difficult to control in digital systems than on hardcopy products. This may generate a requirement for new symbols where size variation has been used to convey meaning in the past (eg. conspicuous points on navigation charts)

4.1.8   Portrayal of well known features within a given community of interest may require an alternative portrayal to indicate their meaning in a new context or for a new user.

4.1.9   Multiple representations, determined by display scale, of any given feature are required.

4.1.10 Multiple & unrelated concepts, represented by a single symbol should be prohibited.

4.1.11 Dynamic elements of the REP will have the same portrayal requirements as the foundation data (only the temporal dimension varies).

4.1.12 The REP or various bespoke subsets of the REP may be required to be displayed in a variety of systems, the options to be considered are:
  1. Current high performance PC
  2. Current low performance PC
  3. Laptop PC
  4. PDA
  5. 3D future hardware/software

4.1.13 There is no requirement to consider the old green screen with no greyscale, as no-one would seriously expect to display graphics on this type of display.

4.1.14 Composite symbols are required, this is not necessarily the case with point symbols but will be required for complex patterned lines and patterned area features. Portrayal of concepts may be achieved through:
  1. Building composite symbols from symbol element graphics which have no meaning when viewed in isolation.
  2. Applying discrete symbols.

      3. Specialising discrete symbols through the addition of extra symbol elements.

      4. Associating several discrete symbols to define a single concept

4.1.15 Network Enabled Capability will facilitate the bringing together in a single display, environmental datasets which have not been hitherto considered.

4.1.16 The display of multiple and disparate datasets will increasingly be required whether data products were designed to be used together or not.

4.2 Key Questions (KQ)

4.2.1 Is it possible to model the environment in a generic way such that all users of environmental information are adequately served?

4.2.2 To what extent is it desirable or practical to standardise portrayal of environmental information?

4.2.3 How much environmental information is required to be displayed in a view of the REP or as a backdrop to the tactical picture?

4.3 Hard Requirements

See Annex A: General Geo-spatial Data Portrayal Requirements.
See Annex B: REP-specific Geo-spatial Data Portrayal Requirements.

4.4 Hard Constraints

Communications bandwidth in support of Network Enabled Capability will require that the minimum possible amount of data be exchanged.
See Annex A: General Geo-spatial Data Portrayal Requirements.
See Annex B: REP-specific Geo-spatial Data Portrayal Requirements.

5   References

- The DGIWG DFDD
- The IHO Object Catalogue
- The AML Object and Attribute spreadsheet
- The DAFIF Data Dictionary (not seen)
- The World Met Organisation (WMO) Data Dictionary (not seen)
- (A working assumption has been that Aero and Met do not introduce unique problems, this should be confirmed at a later stage).

5.1 Standards reviewed

- ISO 19117 & 19135
- MIL-DTL-89045 (GeoSym)
- MIL-STD-2402 (hardcopy map & chart)
- APP-6A (military map)
- MIL-STD-2525B (common warfighting symbology)
- IHO Int-1 (hardcopy charts)
- IHO S-52 (ENC)
- STANAGs
  - 7170 (AML)

- o 4564 (WECDIS) refers to STANAG 4420 (tactical symbols)
- o 3675 (Joint Ops at 1:250,000

5.2 Standards not reviewed

- WMO (weather)
- ANSI (emergency management)
- FLIP (air navigation)
- ATP-24 (AB21)
- M4

5.3 Technologies

This project is intended to deal with abstract concepts and is therefore independent of any technology or data format.

6 Technical Approach

This portrayal analysis project will be conducted as a Digital Geospatial Information Working Group (DGIWG) project, under the Data Structures Technical Panel (DSTP). Requirements will be gathered from the stakeholder community, primarily the NATO Geospatial Maritime Working Group (GMWG) including the industry representatives to the GMWG technical meetings and DGIWG.
DGIWG Portrayal activity will provide the geospatial community-wide portrayal requirements and the GMWG will provide the REP specific requirements.

Recognition of environmental information is discussed within the stakeholder community in terms of display, presentation, visualization, symbology, portrayal and possibly other terms. For the purposes of this paper the term portrayal will be used, as defined in ISO 19117 "presentation of information to humans".

Analysis of the requirements and recommended follow-up activity will be reported in this document.

6.1 Dependencies

- Validation of Requirements & Assumptions
- Publication of a Concept of use (CONUSE) of the NATO Recognised Environmental Picture (REP)
- Answers to Key Questions (KQ)

7 Scope

This investigation is concerned with the content of environmental data portrayal registers rather than the mechanism of establishing, hosting and managing those registers.

7.1 Inclusions

7.1.1 The effective portrayal of the data elements comprising a holistic model of environmental information, for a wide range of scales, views and viewing systems.

7.1.2 The anticipated major components of the REP; Topographic, Hydrographic, Aeronautical & Meteorological geo-spatial information.

7.1.3 The relationship between data volume, portrayal and display scale, whether views of the REP are manually or automatically generated, is a major unresolved issue.

7.1.4 Generalisation, defined as the use of multiple representations defined by portrayal scale.

7.2 Exclusions

7.2.1 Human Factors aspects will not be considered in this report.

7.2.2 Cartographic considerations e.g., Offset symbols

7.2.3 Transparency or otherwise of data layers and the potential for duplication of features in multiple layers is a data management issue and will not be considered.

7.2.4 The placement of descriptive text labels.

7.2.5 Unknown potential future inputs to a REP beyond the Topo, Hydro, Aero & Met content.

8   Purpose

Development of a single, homogenous, coherent, reference portrayal for the entire REP and by definition any subset of the REP content.

9   Objectives

Provide advice and policy recommendations on standardization of portrayal of environmental information in the NATO REP, specifically:

- Assessment of the perceived issues inhibiting effective portrayal of environmental information within the various views of the REP in the context of its anticipated concept of operations, including recommended solutions.

- Guidelines for the development of any symbol sets required to support common understanding of environmental information as recommended at point 1.

9.1 Desirable Outcomes

Due to the scale of the task, time constraint and resource allocation this report may be regarded as a scoping study providing the business case and context for further activity. As such the desirable outcome is a statement of recommended work and high level plan for the next phase of activity

9.2 Deliverables

This report, and any annexes, will be the only deliverable of this project.

If the report recommends the development of new symbols they will become deliverables of a subsequent project.

10   Analysis

Analysis of the various portrayal standards shows that there are several well established symbology standards containing many symbols. In the case of the symbology standards designed to support digital datasets portrayal rules also exist. The scope and content of the existing standards overlap, in some cases symbols are consistent between standards in others they are not. In general consistency occurs when symbol sets support the same community and inconsistency occurs when different communities portray the same real world feature but are interested in different attributes of that feature. The occurrence of multiple symbols to represent different aspects of a real world feature is necessary at present and will continue to be necessary. Creation of families of symbols to replace the random situation which arises when symbology standards covering the same content are maintained by different communities would be beneficial. Another consequence of this situation is that the same or very similar symbols occur in different symbology standards and mean different things to different communities.

Portrayal of a REP requires the collation and de-confliction of geo-spatial environmental information, derived from the data dictionaries and feature catalogues of existing products, created in support of the various military communities. Each of these communities has well established symbols but there is no complete and homogenous portrayal standard for the combined hydrographic, topographic, aeronautical and meteorological information which comprises the REP.

The DGIWG Portrayal roadmap identifies three levels of harmonisation as follows:

1. Making all established symbols available through a single technical solution ie, the DGIWG portrayal registry.

2. Within-domain harmonisation, which is already occurring at various rates of progress.

3. Cross domain harmonisation, which has hitherto, not been required and has consequently seen very little progress.

Management of portrayal standards is closely related to management of product feature catalogues, this means that coherence in product feature catalogues is preserved in the portrayal standard applied to those products. The DGIWG Digital Feature Data Dictionary (DFDD) is the only data dictionary which serves multiple military communities. Because DFDD and its predecessor FACC has hitherto supported standard topographic map and nautical chart products it holds the features necessary to support product related feature catalogues and has not sought to harmonise features to form a single homogenous data model to serve the entire community.

The Standardization of geo-spatial data portrayal seeks to reduce the interpretation burden on users whilst increasing their understanding of the data. In pursuit of clarity of presentation symbols have been simplified to the extent that they need no longer look very much like the object being represented. This has potential disadvantages if views of the REP are not well tailored to the requirements of the viewer e.g., a generic symbol for a power station might be a simplified pictorial representation of a cooling tower. Application of this symbol to all instances of power station even when cooling towers were not present may be appropriate or not depending on the needs of the user.

As user requirements evolve portrayal of fine distinctions between some features increase in their importance and others become redundant eg in the mine countermeasures community ease of recognition of distinctions between mine types is increasingly important. In the maritime navigation community the many distinctions between vegetation type shown on old charts have been reduced to distinction is between deciduous and evergreen forest.

In order to satisfy the information needs of the entire community a harmonized data model will need to contain and portray a fused superset of the existing information models. It is anticipated that responsibility for provision of data to the REP will remain with specialist environmental information providers but that ownership and primacy of features will be assigned to allow rules and filters to be applied to data as it is exported from Specialist Environmental Centre (SEC) databases as input data product components for the REP.

In this scenario the taxonomy is consistent but multiple views, defined by data content requirements (specifically feature and attribute combinations) are required to support different communities. Portrayal is also consistent; this is standard portrayal of alternative views and not multiple representations of the same feature.

The current evolving requirement is for speed of response and network enabled capability. In order to satisfy the need for high resolution, near real time, geo-spatial information satellite imagery is often used. Photograph like images are a geo-spatially referenced accurate representation of the real world. However none of the information held in these images is accessible to the untrained eye, they require interpretation.

Image maps have been for some time an efficient compromise of data volume and speed of production to serve some communities. Eg for coastal pilotage purposes, identification of accurately positioned fixing marks is important but whether the building identified on the image map as a position fixing mark is a place of worship or a place of manufacture is unimportant to the pilot.

Familiarization with hardcopy or raster maps, charts, aerial photographs & satellite images may drive a degree of expectation in the user community. In the case of the above, displayed features are fixed in size relative to the size of the product in which they are represented, they increase in size as the user zooms in either through technology or by closer inspection of the hardcopy product. This phenomenon is replicated in raster products but not necessarily in vector ones.

Three basic options for the portrayal of digital geo-spatial information are considered below, depending on the chosen approach the creation of portrayal rules could become a major overhead. Option three considers a scenario where the most efficient possible holding of data must be supported by portrayal at a wide range of scales. In this scenario multiple representations based on display scale are required (generalisation) and the option of not portraying a symbol at all is required. As a consequence symbols outnumber features and portrayal rules outnumber symbols.

The IHO has included scale minimum and scale maximum attributes in its S-57 (ENC) data model but these are portrayal attributes and have not been widely implemented. Scale related portrayal is managed through compilation of datasets for use in a controlled range of scale bands, see option one below. The Additional Military Layers (AML) community may implement these attributes to control the portrayal of features which appear in the un-scaled products.

11   Issues

One of the major considerations when achieving clarity of display of environmental information is establishing the volume of data it is appropriate to attempt to display. The rigorous exclusion of inappropriate information has long been the role of the environmental information product compiler. Whatever judgements are made on the suitability of portrayal mechanisms for environmental information display will be based on assumptions with regard to scale and anticipated volumes of environmental information to be simultaneously displayed (KQ3).

12   Options

Three options for portrayal of environmental information delivered by the new technology are considered below;

12.1 Option 1

Manage the data content display according to display scale, in this scenario all symbols are displayed at the optimum size on screen and the data content is constrained to ensure clarity of display within a scale band. This is achieved by establishing a minimum and maximum scale setting for the scale band and involves selection and de-selection of data between scale bands.

12.1.1 Advantages

- This option replicates the rigor of the paper era when a compiler made product-specific decisions.

- Small bespoke datasets are created and exchanged.

12.1.2 Disadvantages

- Conserving the rigor of the paper era also conserves an unacceptable production overhead

- Automated compilation of products would require a very complex rule set to constantly re-select the data content.

- Either automatic generalization or multiple versions of the data at different scales are required.

12.2 Option 2

Display all the available information, in this scenario all symbols are displayed at the optimum size on screen and the data content is unconstrained, symbols retain their size relative to the screen.

12.2.1 Advantages

- An indication of the data volume is displayed.

- The data content does not vary.

- Generalization is unnecessary.

12.2.2 Disadvantages

- Clarity and usability vary with zoom setting.

- When zoomed out the display becomes unacceptably cluttered.

- Scale bands are still required but fewer than for option 1

- Large datasets are exchanged

12.3 Option 3

Display all available information but retain a symbol scale relationship consistent with optimum display of the data at the largest scale. This is a digital replication of a photo-reduction. Symbol scale when zooming out is tied to the level of the smallest scale at which display clarity is acceptable.

12.3.1 Advantages

- An indication of the data volume is displayed.

- The data content does not vary.

- Generalization is unnecessary

- There is an indication of the presence of data if only by a symbol at such a low zoom setting that it appears on the screen as a dot.

- An open & uncluttered display is retained.

- An immediate pictorial indication to the user of when she is over scale.

12.3.2 Disadvantages

- Data is unreadable at low zoom settings.

- Scale bands are still required but fewer than for option 1

- Large datasets are exchanged.

13 Conclusions

13.1 For effective portrayal there is a high degree of dependency on the underlying semantic definition of data elements. The data model & portrayal must satisfy user requirements.

13.2 Portrayal can only convey required variations in meaning held in the data model.

13.3 Portrayal is required to be driven by attribute value level information.

13.4 Portrayal is required to be driven by metadata.

13.5 Portrayal is profoundly impacted by Data Management, Data Volume (this issue remains unresolved).

13.6 The volume of data displayed as a backdrop to the tactical picture will vary widely depending upon the use case.

13.7 There is potential for a very high degree of variation in views of the REP.

13.8 A complete and internally consistent portrayal standard is necessary.

13.9 Symbols need to convey meaning without dependence on colour.

13.10 Symbols need to convey meaning without dependence on size.

13.11 Composite symbols are required because the level of sophistication required in future symbology would make individual unique symbols impractical.

13.12 Maximizing the use of symbol variation to convey meaning reduces the requirement for text labels.

14   Recommendations

14.1   Required views of the REP should be supported by specific feature attribute combinations and each semantic variation should have a unique portrayal at the optimum display scale.

14.2   A precursor to this portrayal work is the establishment of a "core" data model which supports the information requirements of the high priority user communities.

14.2.1   All semantic conflict should be resolved at the data structure level.

14.2.2   This should be considered possible until proven otherwise. (KQ1).

14.2.3   This will almost certainly generate the requirement for new symbols.

14.3   Standardisation of portrayal, like all other standardisation, is desirable. In the REP it becomes essential. (KQ2).

14.3.1   A complete & consistent default portrayal standard should be developed.

14.4   When used as a backdrop to a tactical picture views of the REP should be portrayed in grey-scale, this implies;

14.4.1   A requirement for unique symbols irrespective of colour.

14.4.2   Assignment of tonal variations in grey scale for area tints.

14.4.3   This also satisfies day/night display requirements

14.5   Where symbol size is a discriminator, new symbols are required.

14.6   Multiple representations of features should have a family resemblance, this implies development of hierarchies of symbols which accommodate variation in;

14.6.1   Meaning, due to variation in feature attribute values.

14.6.2   Screen resolution of target systems eg. a PDA

14.6.3   Data display scale.

14.7   Follow-on activity should examine the issues surrounding the bringing together in a single display, via web services, environmental datasets which have not been hitherto considered.

14.8   Follow-on activity should examine issues surrounding text placement (hover over areas to display place names or contour labels for example, is an option).

14.9   In response to the data management issue (KQ3) and in addition to creation of a default portrayal standard it is appropriate to consider the creation of default views of the REP. This, in some respects, replicates creation of products from the REP, which is exactly what the views become if output to paper or pdf and become "uncontrolled" views of the REP. User requirements are likely to vary between those who want to have absolute control over a highly bespoke view and those who desire a standard view, possibly a REP view which replicates existing products. Until users are able to establish standard views a series of default views based on a matrix of purpose and function could be created, as follows:

Purpose/Function	Strategic Planning	Tactical Planning	Operations
Mine Countermeasures			
Logistics support			
Situational Awareness			

Annex A
Portrayal Requirement

Glossary

Symbology standards are collections of symbols and the rules required to make the symbols meaningful in geospatial data products, e.g. GeoSym.

Capability Requirements

1. The user shall be able to create an effective visualization of geospatial information.

    1.1. The user shall be able to visualize geospatial information using "proven" sets of symbols.

        1.1.1. The user shall be able to portray geospatial information on digital displays and hardcopy media output

    1.2. The user shall have access to an efficient registry of symbology standards.

        1.2.1. Symbology standards shall be sufficiently flexible to support frequent revision and re-issue in a controlled way.

            1.2.1.1. Symbology standards are required to be easy and cost effective to maintain.

                1.2.1.1.1. Symbology standards are required to be registered and maintained in softcopy.

        1.2.2. Symbology standards are required to be registered such that subject matter expert groups may maintain different symbology standards or subsets thereof in a hierarchical or compound portrayal registry.

            1.2.2.1. Symbology standards are required to contain graphic definitions of the symbols.

            1.2.2.2. Symbology standards are required to contain rules associating instances of geospatial information to specific symbols.

            1.2.2.3. Symbology standards are required to contain additional rules to develop a coherent rendering of individual symbols to best portray a common geospatial picture.

2. Current versions of symbology standards are required to be easily accessible to users.

    2.1. The user shall have an efficient mechanism to access the symbology standards.

        2.1.1. The user shall be able to access symbology standards via standards-based commercial off-the-shelf (SCOTS) applications.

        2.1.2. The user shall be able to access symbology standards in a remotely hosted web-enabled environment.

            2.1.2.1. A portrayal service is required to enable users to discover, retrieve and render symbols from many symbology standards.

2.1.2.2.   A portrayal service is required to enable users to query the symbology standards in many different ways.

2.1.2.3.   A portrayal service is required to be flexible enough to enable users to mix symbols from different symbology standards, maintained by diverse communities of interest in a single display and to create new bespoke portrayals when designing their rendering of geospatial information.

2.1.3. The user shall be able to access symbology standards in a locally hosted web-enabled environment when disconnected from a central server.

2.1.4. The user shall be able to access guidance and rules to produce an understandable and coherent display through the use of the new technical solution.

2.2. The user shall be able to easily maintain and expand upon their symbology standard as new requirements for geospatial intelligence visualization emerge.

Constraint Requirements

3. Symbology standards are required to be registered conformant to an internationally agreed standard.

    3.1. A portrayal service is required to return symbols to the requestor through a standard interface such that they may be rendered by the receiving system.

4. Symbology standards are required to be backwardly compatible such that legacy products are supported as the standard develops in support of newer geospatial data products.

Annex B

DGIWG User Requirements
(Derived from GMWG-1 Symbology Workshop)

Requirements

1 The user shall be able to view the data, portrayed with a range of complexity dependent on the constraints of the display system. (screen resolution, screen background colour)

1.1 The user shall be able to view the data in a specific system with appropriate portrayal resolution (defined below) dependent on the data feature and attribute content selected.

1.1.1 The user shall be able to define the feature and attribute content required in support of any given user role on a specific system.

1.1.1.2 The user shall be able to select from a range of pre-defined and registered symbols when configuring a user role profile for data portrayal on a specific system.

1.1.1.3 The user selection of symbols when configuring a user role profile shall be constrained to use of symbols designed to represent the same concept for different users and not a free selection from any previously defined symbol.

1.1.1.4 The user shall be able to select a high resolution (level-4 below) portrayal to utilise metadata to trigger either visual or audible alarms when within a specified range of a qualifying feature.

1.1.2 The user shall be able to store the feature and attribute content required in support of any given user role as a user role profile for automatic configuration of data portrayal upon login to a specific system.

1.2 The user shall be able to view the data, portrayed with appropriate flexibility dependent on the range of anticipated operating conditions (night & day, low light, monochrome or red light conditions).

1.3 The user shall be able to view the data, portrayed with appropriate clarity dependent on the data/system display scale selected.

1.4 The user shall be able to define data display priority to ensure the correct order of portrayal of features and the correct emphasis in the final display (ie area tints to not obliterate point features within the tinted area)

1.5 User training in the use of data portrayal capability is required in support of common understanding and effective interoperability

1.6 The user shall be able to easily identify displayed features from their portrayal.

1.6.1 The standardisation authority shall define a single homogenous default portrayal standard for the general user.

> 1.6.1.1 The standardisation authority shall use well established symbology wherever possible

> 1.6.1.2 The standardisation authority shall create new symbols with the involvement of the user community to be as pictorially intuitive as possible.

1.6.2 The standardisation authority shall define crosswalks between the new default portrayal and all previously defined symbol sets.

> 1.6.2.1 The standardisation authority shall use the feature/attribute combination unique identifier as the reference code for the portrayal of a concept.

1.6.3 The standardisation authority shall make recommendations to retire or supersede symbols from user community specific symbol sets where different concepts are represented by the same or very similar symbols.

Next phase of work
The above implies a range of lower level requirements, for example additional symbols to cope with low resolution display screens, red light conditions etc

Definitions

Portrayal resolution

The extent to which, fine distinctions between features, defined according to attribute values, are represented in the portrayal of features.

Level-1 all features at the feature class level are portrayed the same
Level-2 all features at the sub-class or "category-of" level are portrayed the same
Level-3 the value of one other enumerated attribute influences portrayal
Level-4 the value of one other enumerated attribute and one meta value influences portrayal