Missionland: The Creation of a Virtual Continent for Mission Simulation

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ABSTRACT

Training via distributed mission simulation has the potential to enhance force readiness and operational effectiveness in coalition operations. An essential condition for an effective mission simulation environment is correlated representation of the real-world natural and cultural environment in the distributed simulation. Correlating existing geospecific environmental databases is costly, both in effort and in money, and the end result will always be hampered by technical incompatibilities. A generic and non-geospecific, widely available simulation environment could overcome these problems.

In 2008 the NATO RTO task group MSG-071 Missionland started. Its prime objective is to construct a coherent dataset of a static environment, from which databases can be constructed for a wide range of simulators. Based on inputs from military end users the task group has identified the user needs and requirements for a dataset of a virtual continent, named Missionland. The task group has created a design for Missionland and set it in the North Atlantic. Missionland covers multiple climate zones and various elevation regions. The Missionland dataset provides the users with terrain elevation data, vector data, imagery, 3D models, and textures. The users can generate with this dataset the databases they need for their visual out-of-the-window and sensor views, terrain servers and computer generated forces applications.

This paper outlines the approach the task group has undertaken in developing the dataset. It starts with an overview of the user needs, followed by the design of Missionland. The data generation process and the dataset elements are discussed, emphasizing the necessary deviations from standard real-world database development techniques. It explains the tools, technology and data sources used for data generation. Finally the paper describes the deployment of the Missionland dataset for end user applications.

ABOUT THE AUTHORS

Arjan Lemmers is a senior R&D engineer with the National Aerospace Laboratory NLR. Arjan graduated in Aerospace Engineering from the Delft University of Technology in 1996 with an MSc degree. Arjan has more than 15 years experience in working on utilization of distributed simulation environments for mission training and CD&E (Concept Development & Experimentation). Among others he was a member of the SAS-034 First WAVE technical team focused on setting up an MTDS (Mission Training through Distributed Simulation) exercise. Since 2008 Arjan is the chairman of the NATO RTO task group MSG-071 Missionland.

Arno Gerretsen is an R&D engineer with the National Aerospace Laboratory NLR, working at the Training, Simulation & Operator Performance department. His areas of work include the synthetic environment used in simulation systems and the modeling of simulation software. He is the secretary of the Missionland task group and has an MSc in Aerospace Engineering from the Delft University of Technology.

Edward Jones graduated from Bournemouth University in 1997 with a BSc HONS degree in Information Systems Management. After graduating, he joined Computer Sciences Corporation (CSC) where he spent 10 years working in an applications development group. Following this he joined his present employer, the Defence, Science & Technology Laboratory (Dstl), an agency to the UK Ministry of Defence (MOD). Edward works in the Joint Simulation Infrastructure and Services (JSIS) team where he provides impartial advice & support in the use of a wide range of simulation tools including VBS2, OneSAF & JSAF and currently represents the UK on the NATO Modelling and Simulation Group (NMSG)-071 Missionland task group.

Simon Skinner is the Managing Director / Chief Executive Officer of XPI Simulation Ltd. As well as having day to day operational responsibilities for XPI, on behalf of the UK Ministry of Defence he has been involved with the NATO Missionland task group since 2007. Simon has more than 20 years experience of the simulation industry, and has extensive experience in image generators and synthetic environments. He is the Chair of the SISO Product Development Group for the Common IG Interface and has previously presented at I/ITSEC innovative research on real time ray tracing being undertaken for the UK government.

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INTRODUCTION

Imagine a whole new continent is planted in the middle of the North Atlantic Ocean. It is a continent with a variety of climate and eco system types: arctic cold, tropical green, temperate islands, hot deserts and more are represented in this intriguing continent that is populated with a wide variation of cultures. The most interesting feature of this new continent is that it has a very enthusiastic and well-equipped Modeling & Simulation Geodata Office that is capable of delivering whatever data you need to enable simulated exercises on their continent. Everything is available - terrain elevation data, detailed vector data, imagery and all required model libraries - to give your simulators a kick-start into (networked) simulation exercises on this continent.

The name of this new continent is Missionland and its creation was initiated in 2008 by the NATO Modeling and Simulation Group (NMSG) which created the task group MSG-071 Missionland. The aim of the Missionland task group is to create a common dataset of the static environment that can be used for simulation exercises. The focus is on the content itself, not on the way to store or represent it, as for example the Synthetic Environment Data Representation and Interface Specification (SEDRIS) addresses. For more information on the approach of the Missionland task group see Lemmers (2009).

This paper outlines the work the task group has undertaken in developing the dataset. It starts with an overview of the user needs, followed by the design of Missionland. The data generation process and the dataset elements are discussed, emphasizing the necessary deviations from standard real-world database development techniques. It explains the tools, technology and data sources used for data generation. Finally the paper describes the deployment of the Missionland dataset for end user applications.

MISSIONLAND USER NEEDS

The NATO Exercise First WAVE demonstrated in 2004 that training via distributed mission simulation has the potential to enhance force readiness and operational effectiveness in coalition operations. The task group created a distributed training environment in which flight simulators and other crew stations in the nations were linked across a secure wide area network. Many technical, operational and training challenges were encountered and addressed, providing a rich source of experience and lessons, with many deficiencies identified and consequential lessons learned. A full report of Exercise First WAVE can be found in NATO RTO Task group SAS-034/MSG-001 (2007).

One of the challenges for the Exercise First WAVE was to create a common virtual representation of the real-world natural and cultural environment for the participating simulations. When performing distributed (joint) simulations a number of problems exist concerning the selection and use of an environment representation. Different requirements of the participating users or different technical capabilities can be the cause of such problems.

These problems with the environment representation should be addressed, but also the limited availability of source data due to security and political limitations must be addressed. Therefore it is preferable to create a generic and non-geospecific simulation environment. Besides that it offers the advantage of combining geologically different environments in the same simulation environment. This makes a generic environment much more flexible in performing different types of missions within the same simulation environment.

In 2008 the NATO RTO task group MSG-071 Missionland started with the objective to construct a coherent dataset of a static environment, from which databases can be constructed for a wide scope of simulators. From henceforth this coherent dataset is referred to as Missionland. The task group issued a questionnaire to identify potential users and their requirements for Missionland. The Missionland questionnaire was sent out by the task group to relevant people within each participating country. The questionnaire answers were analyzed by the task group members for three different areas: the intended use of Missionland; the requirements for the datasets; and the development and maintenance of the datasets.

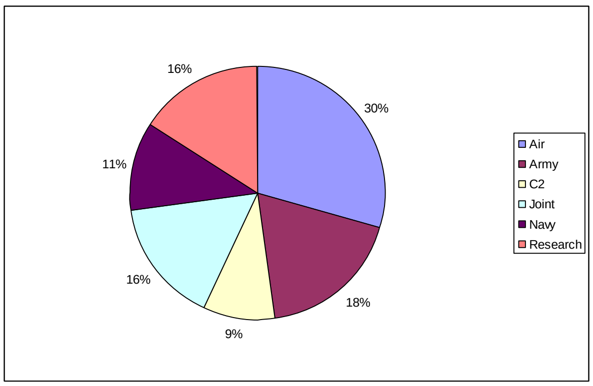

Figure 1: Respondents per branch

The respondents of the questionnaire show a good coverage over the nations participating in the Missionland task group and over the different branches of the armed forces (including research institutes) (see Figure 1). The level of experience with (international) distributed simulations varies a lot over the respondents ranging from novice to experienced users. Taking all the results together it can be concluded that the respondents to the questionnaire form a representative group to derive the user needs for the Missionland dataset from.

The primary intended use of the Missionland dataset for the countries will be training, both in distributed and stand-alone simulations. In addition, concept development & experimentation and doctrine study are other areas where Missionland can be used.

To satisfy the priorities of the different branches in the armed forces, Missionland should contain at least the following 5 terrain types:

1. Coast
2. Mountains
3. Urban, eastern
4. Sea
5. Urban, western

The size of Missionland will have to be at least 1000x1000 kilometres to satisfy most of the potential users, although it should be noted that there is also a substantial group demanding an even larger area. The preferred size of Missionland seems not to be affected by the technical capabilities of the simulators, since most of them support database paging.

It is no surprise that the users expect the Missionland dataset to provide a complete range of products. But to be useable the absolute minimum that should be provided is:

- Maps
- Vector data
- Terrain texture
- Elevation data
- Imagery
- Terrain feature models

Also the users expect a truly multi-spectral dataset, including not only visual data, but also infrared, radar, night vision and the data required for Computer Generated Forces (CGF) applications.

The majority of users expect that the Missionland dataset will be supplied using industry standards (e.g. shapefiles, Geospatial Tagged Image File Format (GeoTIFF), etc.), but there are also requests for Common Data Base (CDB), SEDRIS and compiled OpenFlight. It should also be noted that the format or formats in which the dataset is delivered, does not have to be the format used internally by the task group. For the preferred attribution schema for the data SEDRIS Environmental Data Coding Specification (EDCS) was mentioned most often, however the majority of the respondents were either indecisive or did not provide a response.

More details about the user needs elicitation and the user requirements can be found in NATO RTO Task group MSG-071 Missionland (2010) and Lemmers (2010).

MISSIONLAND DESIGN

Based on the results of the user needs elicitation, the Missionland task group started to create the design of Missionland. The Missionland continent will be located in the middle of the Atlantic Ocean, because that is a real-world location that offers enough space for a new continent. A real world location is necessary because most simulators work with real world coordinates I their models. Besides that, the Northern Atlantic Ocean seems a suitable location for a NATO activity. Figure 2 gives a graphical representation of the Missionland location and the grid cells used.

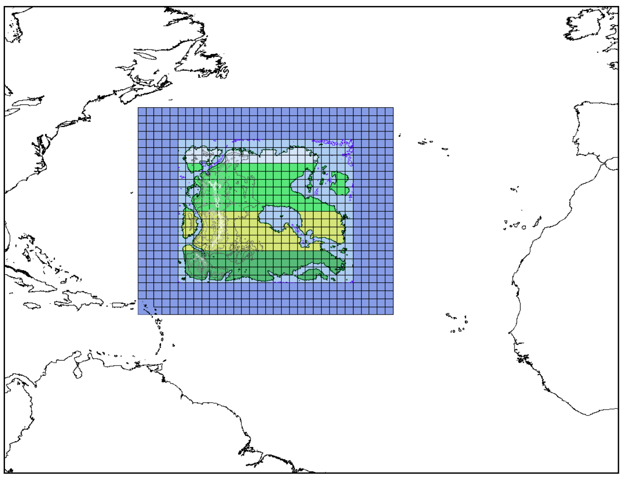

Figure 2: Missionland location

The outer ring of cells has been defined as ocean, to allow a gradual transition from the Missionland bathymetry to the real world bathymetry. Please note that in the south western corner a number of cells had to be removed due to the Caribbean islands located there. This leads up to an effective land area for the Missionland continent of circa 2000x2000 kilometres, with a sea zone around it of circa 400 kilometres in size (see Figure 2).

Climate zones

The Missionland continent will provide a wide range of climates. To ensure realistic transitions between these different climate zones and to assist in positioning the different areas on the Missionland continent a high-level definition of the climate zones has been defined (see Figure 3). The following climate zones have been defined: arctic, temperate, arid and tropical.

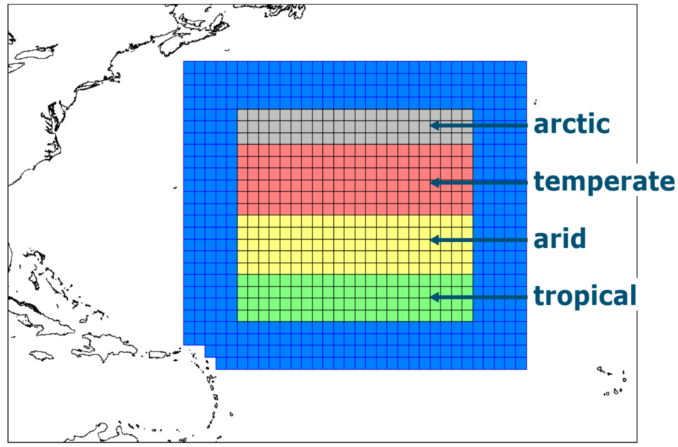

Figure 3: Missionland climate zones

Elevation profiles

The Missionland continent will provide a wide range of terrain characteristics. This is partly defined by the elevation profile of the terrain. To ensure that there is a realistic transition between the different elevation profiles, a high-level design of zones with a certain elevation profile has been defined (see Figure 4). The following elevation profiles have been defined: flat, hilly, mountainous and cliff/fjord.

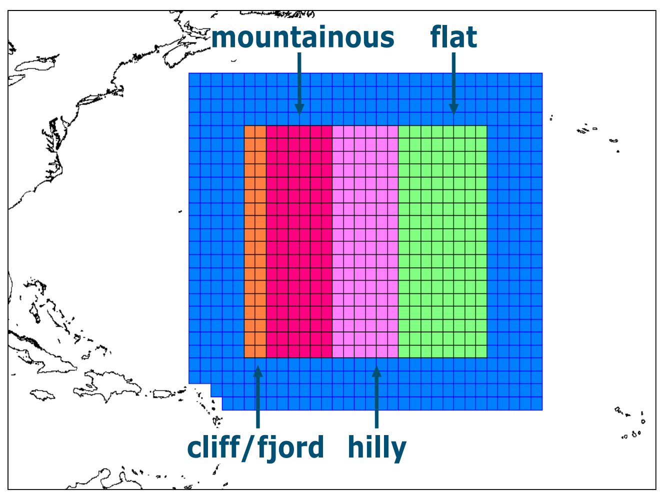

Figure 4: Missionland elevation profiles

The climate zones and elevation profiles give the basic outline for the Missionland continent. From this point the task group started working on filling in the zones with details. In this detailed design the requirements for the content of the dataset are included using the information gathered from the questionnaires. These requirements are stored in design diagrams.

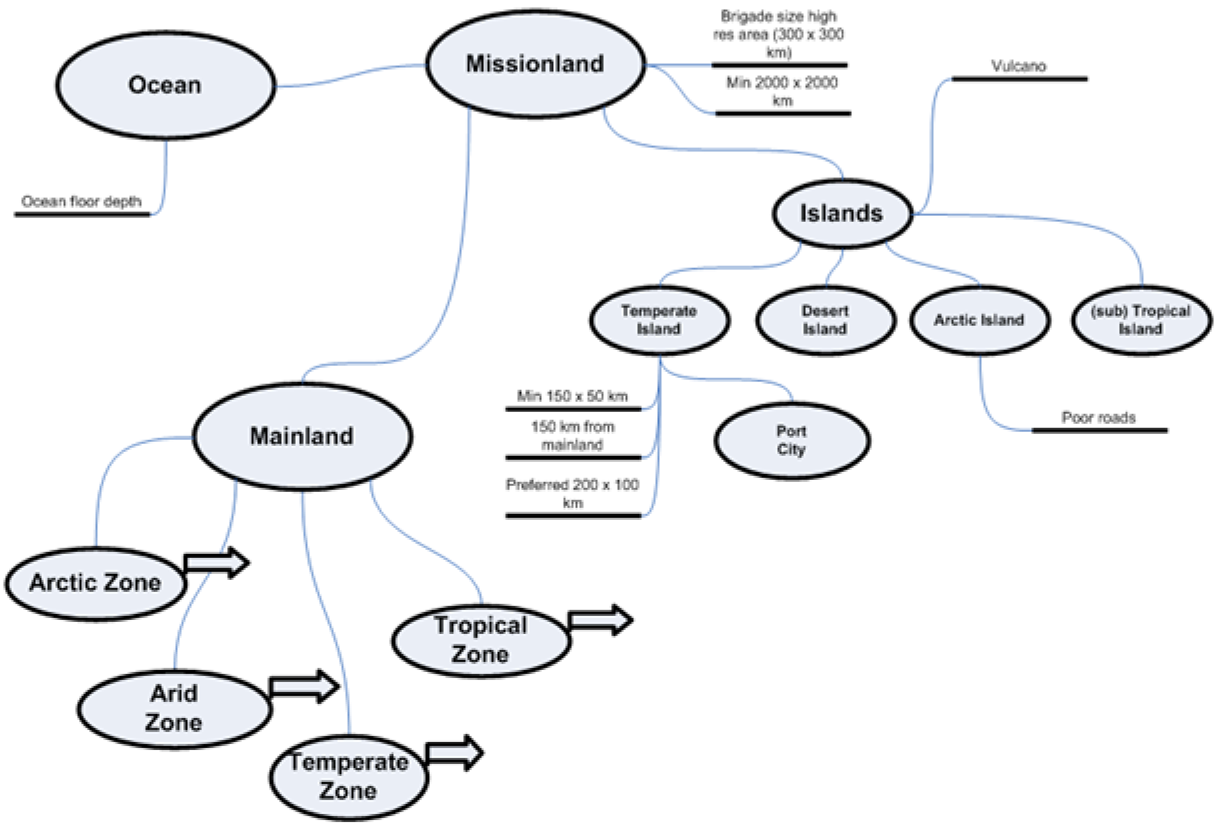

Figure 5: High level requirements diagram

In Figure 5 an overview of the high level requirements on Missionland are given. Some of the features in this diagram are an aggregation of more detailed features. In this way a number of layered diagrams with all requested features for Missionland have been built. More details of these diagrams can be found in NATO RTO Task group MSG-071 Missionland (2011).

MISSIONLAND DATASET

The Missionland dataset contains a number of products:

- Elevation data
- Vector data
- Feature models
- Textures
- Imagery
- Maps

To ensure that all the different products in the Missionland dataset remain correlated with each other, it is important to define which products are the master products. Master products can be edited directly when new content is added to the dataset, while all other products are derived from them. In Figure 6 an overview of the master and derived products of the Missionland dataset is given. Below these products will be discussed.

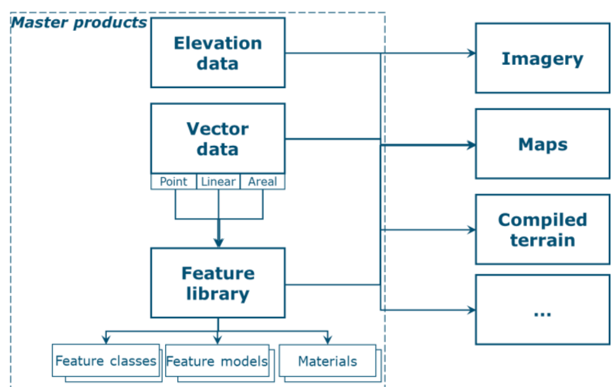

Figure 6: Missionland dataset

Elevation data

The elevation data defines the height of the terrain or the depth of the sea areas. The dataset contains different resolutions of the elevation data. The highest resolution elevation data is used for the areas of interest where land forces are employed, while areas of Missionland that are only observed from the air have a lower resolution. In the future, it is expected that the number of areas with higher resolution will grow. The elevation data is stored as one GeoTIFF file per geocell. The resolution of the whole continent is 30 meter, with higher resolutions possible in the detailed areas.

Vector data

The vector data represents different features in the environment. Vector data consists of point, linear and areal features. The point features define the location of objects, like buildings. The linear features define roads, rivers or power lines, while areal features define areas with certain land cover types, for example forest or city, or a footprint of a building. Additional information of the feature is captured by the feature attributes. Examples of these are the width of a road, the height of a building or the maximum load for a bridge. The vector data is stored as ESRI Shapefile (SHP). The feature library stores all the relations between features, textures, 3D models and the mapping of the features to the commonly used attribution schemas as SEDRIS EDCS, Features and Attributes Coding Catalog (FACC) and Data Format Design Document (DFDD).

Feature library

Man-made features, like buildings, bridges and light posts are represented by geometric 3D models in the Missionland dataset, as is also the case for vegetation objects like trees and bushes. The feature library contains all 3D feature models and their textures that are used within the static Missionland environment. 3D moving models are not part of the Missionland dataset. The positioning of these models at the locations where they are used in the environment is done using point vector features. 3D features are stored in the OpenFlight format and their textures in the Silicon Graphics Image RGB format.

The feature library also contains the textures for the different feature types in the vector data. Material textures are used to give the environment the right representation. The textures are stored in SGI RGB format. The structure of the feature library has been designed so that the material information needed for multi-spectral representations can also be inserted, but the first version does not contain this information.

Derived products

Besides the master products, the end users of Missionland also require a number of products that can be derived from the master products. The most important derived products for Missionland are the imagery and maps. These products will therefore belong to the Missionland dataset. The imagery data is provided as a raster image. The resolution of the imagery varies, with the highest resolution being provided in the areas of interest. The imagery is stored as GeoTIFF files.

DATA GENERATION PROCESS

For synthetic environments of real world areas the data generation process usually starts with gathering aerial or satellite imagery. Other information, like vector data, is then derived from these images. Given that Missionland is a fictitious continent, this normal process cannot be applied directly. This section describes the challenges that have been faced and the solutions found while creating the Missionland dataset.

The general approach of the task group has been to first generate the elevation data of the continent. Next the vector data has been generated so that it correlates with the elevation data. And finally the imagery could be produced using the elevation and vector data as input. So in a sense this is the reverse of the usual process applied for real world environments.

Different approaches can be used for the data generation, the three main approaches that the task group choose between are:

- Manual generation
- Procedural generation
- Reusing of real world data

Manual generation of data was not the preferred choice, because of the size of the Missionland continent. It would simply take too much time to populate the whole continent with this approach. However to enhance specific areas of detail, some manual data generation can be applied.

Procedural data generation has the advantage that it is very scalable. It is possible to produce large amounts of data from a relatively small set of parameters. A tool to procedurally generate elevation data would take the required resolution and characteristics (steepness, height, etc.) as input and use these to generate elevation data for an entire region. The possible downside of this approach is that it is hard to capture the diversity of the real world in the rules used for the procedural generation.

Reusing geographical data from the real world has as advantage that the data looks realistic. However it can be hard to blend different pieces of real world data seamlessly into a fictitious continent. A serious pitfall of this approach is that the resulting environment could look like the real world, thereby likely invoking political restrictions on its use. When the task group made use of real world data it tried to minimize this pitfall by only using relatively small areas of real world data and/or by only using part of the real world data. An example of the last would be to use the elevation data of a piece of real world, but without the real imagery and vector data. That makes the resulting environment less recognizable.

The task group applied a mix of these approaches when generating the dataset. Below it will be discussed which tools, technologies and data sources have been used for the different products in the Missionland dataset.

Elevation data

The initial plan was to generate the elevation data of the Missionland continent using procedural terrain generation techniques. Especially in the gaming domain, there are numerous tools available that can create a fictitious environment. However an evaluation of these tools showed that most do not support a continent with the size of Missionland. The L3DT tool (see Bundysoft (2012)) was the only tool the task group found that could generate the entire Missionland continent. However when evaluating the resulting elevation data, the task group found the results not realistic enough. The main problem was that the tool could not cope with a big diversity in terrain characteristics. Having an area with both mountains and flat lands, would result in flatland that is too hilly and mountains that are not mountainous enough. Figure 7 shows this problem graphically.

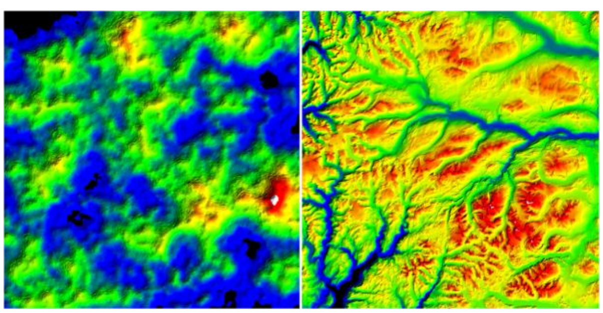

Figure 7: Visualizations of procedural elevation data on the left and real world elevation data on the right

In the end the elevation data generated with the L3DT tool was only used as a guideline for the desired shape of the continent. Real world elevation data was used to give the terrain a realistic elevation profile. The task group mainly used the public domain elevation data provided by the United States Geological Survey (USGS), since it provides elevation data of a good resolution and within the United States a lot of different types of terrain can be found. So therefore suitable samples of elevation data for the different terrain characteristics needed in Missionland could be extracted from it.

To solve the problem of blending this real world elevation data into the Missionland terrain the Interactive Terrain Editor (ITED) tool was used. This tool was developed at the Norwegian Defense Research Establishment (FFI) as a prototype tool for research in ways to enhance existing elevation data and as an aiding tool for the Missionland task group. ITED uses the Graphics Processing Unit (GPU) of COTS graphics cards to interactively process raster elevation data loaded from common GIS format files. A user can edit the terrain using simple, but effective low level brushes in much the same way as a user can edit an image using air brushes in an image editor. This way the elevation data of the entire continent was manually created by blended samples of real world elevation data together. More details about the elevation data generation and its tools is described in Aasen (2011) and Gerretsen (2011).

Vector data

For the vector data two different types of vector data can be distinguished. These are the global and local vector features. Global features are features like rivers that should follow a consistent path over the entire continent, while local features are features like a town or an airport.

For the global vector features the main requirement is that they correlate with the elevation data. Therefore the task group generated them from the elevation data. This was done using the open source Geographic Resources Analysis Support System (GRASS) software (see OSGeo Foundation (2012)). GRASS contains a module to do water management related calculations. This module generates raster maps of streams and water basins. From these raster maps the vector data of rivers and lakes has been derived. The water basins have also been used to generate basic landuse data for the entire continent. Figure 8 shows a sample of this vector data.

The GRASS software has also been used to generate the basic road network over the Missionland continent. The roads have been determined as the least cost route between two points, whereby the elevation data, rivers and landuse were used as factors contributing to the cost of travelling.

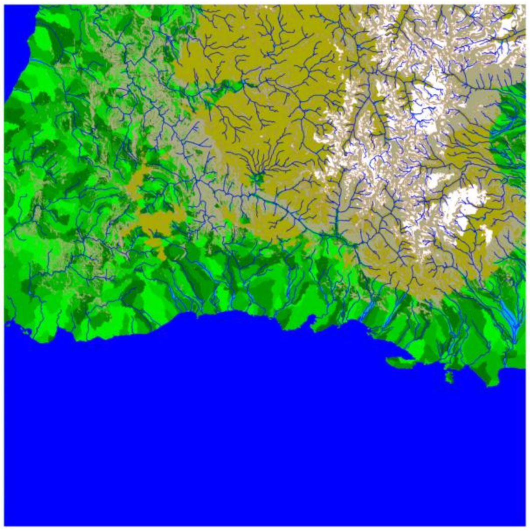

Figure 8: Sample of the global vector data, showing rivers and landuse

The approach just described was sufficient for the global, medium resolution, vector data that needs to cover the entire continent. However it would be much harder to apply it to areas with high detail. In those areas the task group used real world vector data. This real world vector data was then integrated into Missionland. In most cases integrating real world vector data also meant adjusting the elevation data again with the ITED tool, to make sure that the vector and elevation data match with each other.

The scope of the real world vector data used differed per case. Sometimes the data only covered a single airport or town, but there were also cases where an entire island or coastal region was covered. The data contributed by task group members came from different sources ranging from Vector Map (VMAP) to national geo offices.

Integration of the real world vector data was done using GIS applications, like GlobalMapper or QGIS. A translation had to be applied to the data to move it to the Missionland continent and often also a rotation to let it fit in the shape of the Missionland continent, for example to let the coastline in the data line up with the coastline of Missionland. Given that most geographical data uses a specific projection, care had to be taken to not introduce distortions to the data. Especially for high resolution vector data, including footprints of houses, the result would become unrealistic if too much distortion affects the data. However if the vector data lacks such features, the distortion is not a big problem.

The final Missionland dataset should be a consistent representation of the environment. Therefore sometimes not all available vector data was inserted into the dataset. For example if the vector data was gathered for the generation of a map, it might contain a point feature for map symbols like a parking place or an information sign. Including these features in Missionland makes no sense, unless the parking place or object that the information sign refer to are present in the dataset as areal feature or 3D model. The consistency of the data in the dataset was more important than the quantity of data when deciding which data to include.

When using vector data from different sources a common problem is that the attribution of the data is not consistent. For Missionland all vector features are related to a Missionland feature as defined in the feature library. The attributes used in the vector data are specified in that library as well, to make sure that all data in the dataset is consistent. See the section below on the feature library for more details about this.

Imagery

For the generation of the Missionland imagery the only feasible approach is to procedurally generate it. Using real world imagery would make the resulting terrain too recognizable and thereby defy the objective of creating an environment without political restrictions. Besides that real world imagery also often contains additional features that are not present in the vector data of the environment. Such features result in false cues when using the environment. Generating the imagery from the available vector data maximizes the consistency between the two.

When procedurally generating the imagery the vector data is taken as input. Based on a set of rules representative textures are applied to these vector features. When the elevation data is also taken into account it is possible generate even more realistic imagery, for example to make sure no trees grow on a steep mountain. This approach has been used in computer games for some time already. But also in the modeling and simulation world this technique is becoming more common. Another benefit of this approach is that it becomes possible to generate correlated sensor or night imagery by altering the rules and textures used.

After looking at the available tools for the procedural generation of imagery, the task group concluded that the SEGen tool from Presagis (Presagis (2012)) is the most suitable tool for use in Missionland. Figure 9 shows a sample of the procedural imagery generated from some sample data of Missionland.

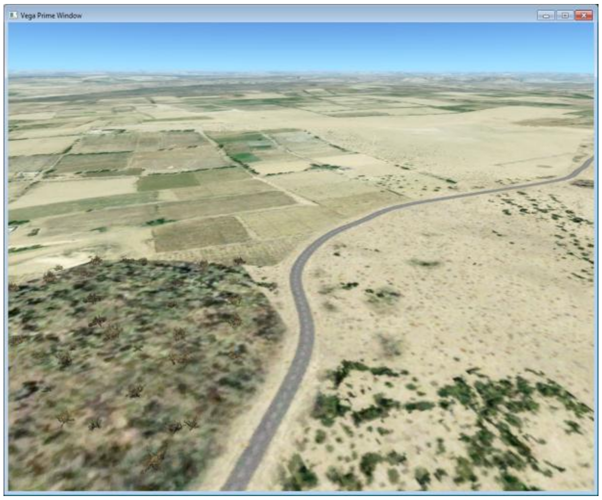

Figure 9: Sample of Missionland imagery generated with SEGen

Feature library

The feature library is an important part of the Missionland dataset. It does contain all the textures and 3D models used within the Missionland environment. But more importantly it also defines how the different features should be represented when constructing a product from the dataset, like a runtime database.

Each vector feature in the Missionland dataset is linked to a feature definition in the feature library. The feature definition defines which feature class, the rules when processing the feature, should be used. Examples of such classes are to position a 3D model at the location of the feature or to apply a specific texture to the areal polygon. This means that the feature definition also specifies which textures and 3D models should be used. A feature class could also just be used to draw a line when generating a map from the Missionland data, for example for the air routes on aeronautical charts.

All relations between features, feature classes, textures and 3D models are stored in an Access database. This database also contains information about who contributed specific assets to the dataset.

Many existing simulation systems use standard attribution schemas. Examples of these are FACC, DFDD and SEDRIS EDCS. The feature library maps the Missionland features to these common schemas, making it easier to use the Missionland data. By creating this mapping once when preparing the data, instead of letting each end user perform his own mapping, the correlation between different runtime databases generated from the dataset is increased.

The 3D models and textures within the feature library come from different sources. Some are public domain, while others have been contributed by countries to the task group for usage in Missionland. Given that the current version of SEGen comes with a set of terrain textures that cannot be updated by the user, the imagery is not generated from the textures in the feature library yet. But in the future that would be the preferred approach.

MISSIONLAND DEPLOYMENT

Generating the Missionland dataset is one major step, but to ensure the deployment and maintenance of Missionland for a longer term a set of rules and guidelines for usage will be necessary.

During the life of the task group, the task group controls the distribution of the Missionland dataset. The initial dataset is deployed by the task group at a selected group of first users to test its utility. The first simulator where Missionland is tested is the Joint Task Force Simulation (JTFSIM) in Turkey. JTFSIM is used to analyze and evaluate the combat environment for analysis and decision support actions, military operational planning, simulation based acquisition, effectiveness analysis of weapon and sensor systems, and doctrine and tactical analysis. The task group is guiding this deployment and helps JTFSIM in the actual construction of the required runtime database from the dataset. Together with other first deployments of the dataset in The Netherlands and United Kingdom, the task group develops documentation and guidelines to enable the future users to build a runtime database in a structured manner and thereby ensure that optimal correlation is preserved between different databases built from the Missionland dataset. After the life of the Missionland task group it is foreseen that the Missionland users are self-supporting in deploying the Missionland dataset.

After the life of the Missionland task group the Missionland dataset has to be accommodated by an organization or group that can control and monitor the distribution of the dataset. For this the task group proposes to install a Missionland Data Authority (MLDA). This MLDA could be placed under the umbrella of MS3 (Modeling and Simulation Standards Subgroup) which is a permanent subgroup of the NMSG. To keep control over the use of the dataset the task group has developed a set of use conditions that each user has to agree with. This will ensure that the data will only be used by the NATO countries and NATO Partnership for Peace countries and that no commercial profits will be made of the voluntary efforts of the participating MSG-071 countries. These use conditions also provide a robust framework for accepting new data, making changes and establishing ownership of the data so that it is freely available to use for NATO purposes.

CONCLUSIONS

In 2008 the NATO RTO task group MSG-071 Missionland started. Its prime objective was to construct a coherent dataset of the static environment, from which databases can be constructed for a wide scope of simulators. These environment databases are generally needed for visual out-of-the-window and sensor views, as well as terrain servers and computer generated forces applications. Based on inputs from military end users the Missionland task group had identified the user needs and requirements for a dataset of a virtual continent, named Missionland.

The Missionland dataset covers multiple climate zones, various elevation settings, coastal areas and large continuous land masses. This ensures a suitable environment for a large variety of applications, including training, tactics development, simulation based acquisition, and concept development and experimentation. The Missionland dataset provides end users with terrain elevation data, vector data, 3D models, textures, imagery and maps.

Given the special requirements for a fictitious continent, different tools and techniques had to be applied by the task group. By combining existing tools in the simulation and GIS field, with the custom made ITED tool, it was possible to generate the data for the dataset. Gathering assets that can be distributed freely to Missionland users was not an easy task, but by combining national contributions with public domain sources enough content is available.

Aside of the data development the task group has also considered some deployment issues. For the future users a data contribution guide has been prepared where the user is explained how to use the dataset and how to insert new data into the original Missionland dataset. The group has put together a document of the use conditions for the data set which provides a robust framework for accepting data, making changes and establishing ownership of the data so that it is freely available to use for NATO and NATO Partnership for Peace purposes.

ACKNOWLEDGEMENTS

The work presented in this paper is a group effort and therefore we would like to think the participating MSG-071 countries Belarus, Canada, Germany, The Netherlands, Norway, Sweden, Turkey and United Kingdom and the NATO Joint Warfare Centre for their support, efforts and donations in making Missionland reality.

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