# Maps without hands (article published in 'GIS i Aktion', Informi GIS, November 2015)

Develop your own software or use standard out of the box? There are many stories about government IT implementations that go down the drain or do not meet the efficiency gains hoped for. Here is a story about a project that has been successful and where efficiency is visible and measurable.
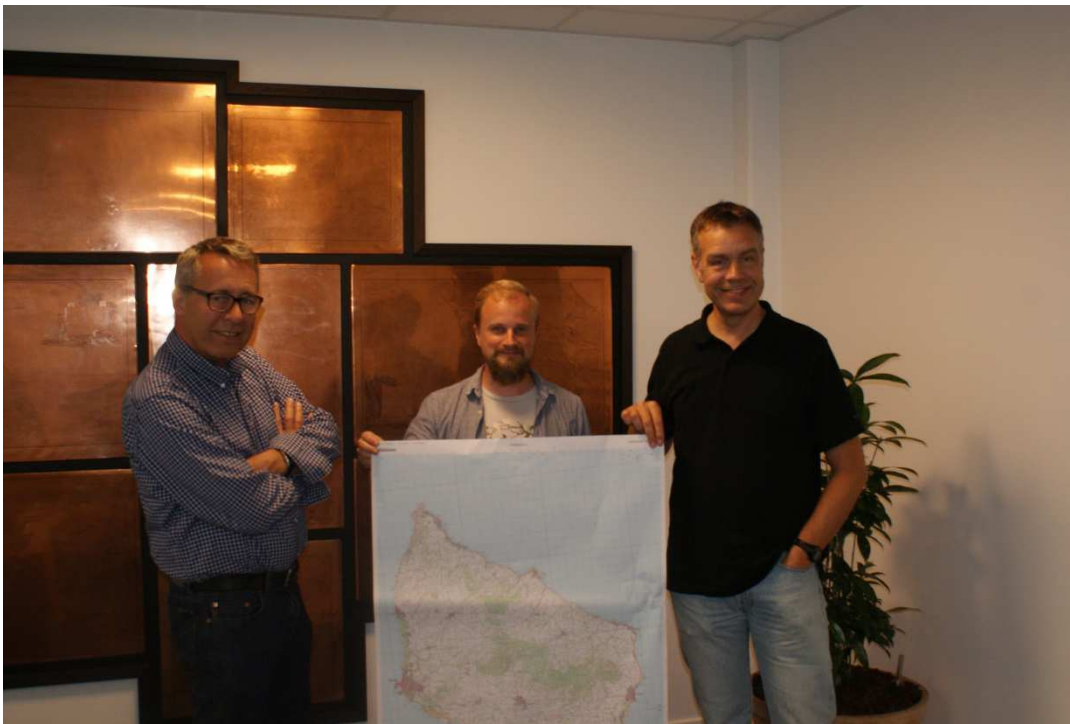
Left to right: Anders F. Jensen, Head of Section, Stig Heinesen, GIS-developer, Morten Winkler, Project Manager

In the Danish Geodata Agency, the Department of Data Visualization has carried through a long project where they have introduced a new standard technology and redesigned the workflows associated with the production of topographical maps and aeronautical charts. The result is a brand new map production environment based on standard ESRI ArcGIS software. The project was popularly called "Maps without hands 2" (in continuation of a previous project "Maps without hands" (2008), which developed automation in generalization and cartographic vizualisation). The project is now completed, and the efficiency gains are considerable. And they will continue to be so every time a new map is produced.

The new map production environment (MPE) consists of a common database, a standard IT tool and in the near future also a standardized workflow description for each map product. Thus DGA is moving closer to a standardized process for the production and updating of its variety of map products.

Anders Faerch Jensen (AFC, Head of Section): "The project is innovative because we now share a common data model across all scales and with a single tool we can produce and update our various map products without having the workflows closely tied to individual cartographers. It gives us a good flexibility and is a major improvement on the past when data were scattered around the organization and typically closely tied to individuals. "

Morten Winkler (MW, Project Manager): "There are many benefits with a standardized set-up and the whole project was meant as a journey towards more transparency and consistency of data, IT systems and workflows in the production of more than 25 different topographical and aeronautical charts."

AFJ: "Our idea was to create a robust and flexible production environment that supports standard production of all our maps. In this process we have established a common development environment around our map production, and we have managed to consolidate our activities around a few efficient IT applications, so we are less vulnerable to IT-systems, change of employees and production processes. By using the ESRI ArcGIS platform we benefit from a robust tool for cartographic production with a large community of users around the world and good support."

As concrete and measurable results he mentions that the reuse of data and rule-based cartography has strengthened quality assurance, reduced production time and reduced staff resources. At the same time the new map production environment has prepared the ground for a new knowledge community and working environment.
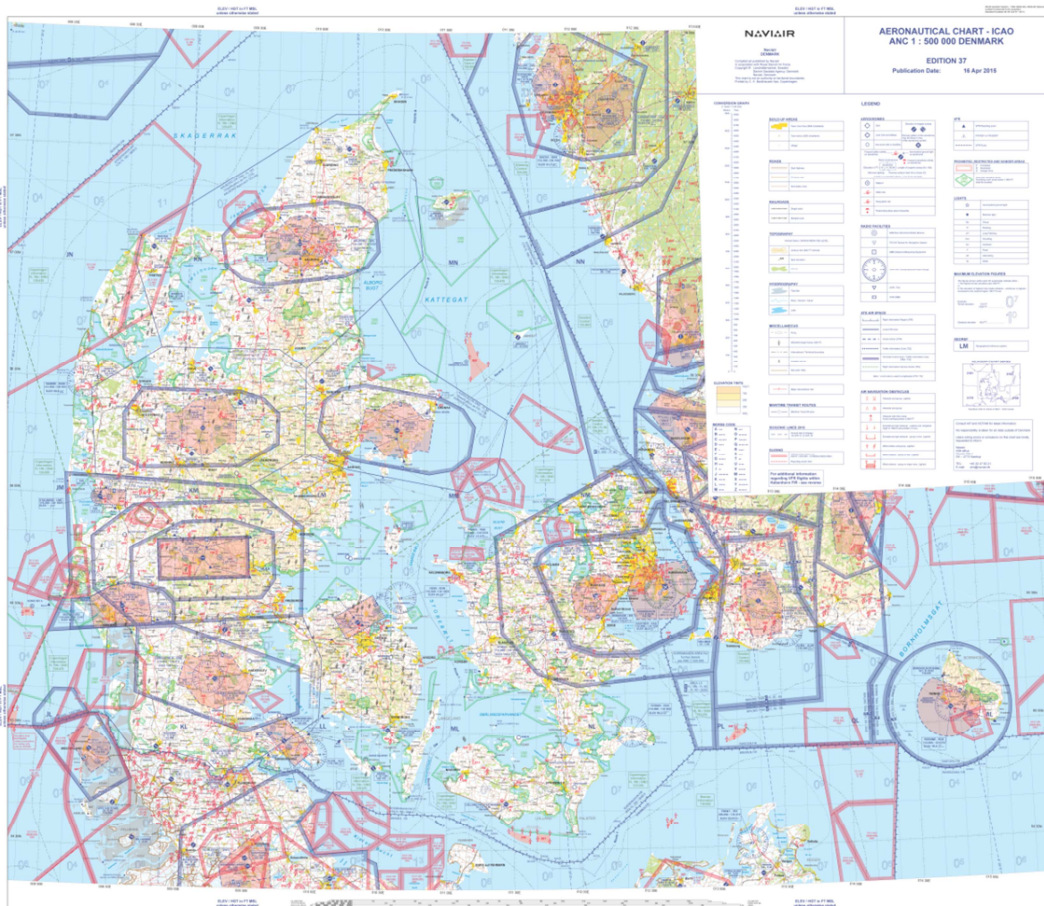
Aeronautical chart produced by the Danish Geodata Agency

Paradigm shift
One of the major tasks to start with, Morten explains, was creating a common data model for all of DGA's topographical and aeronautical map production.

MW: We have transformed all the source data into the same model. So the big advantage of the new MPE is that we now have a central ArcSDE database, so all cartographers and operators are working with common data. The central task of the Map Production Environment is to visualize the data that are stored in the common data model. No geometrical corrections are performed on the data, only alterations in the cartographic representations that visualize data.

Corrections on data are performed elsewhere in the DGA, in our base data systems (and in the GeoDanmark system, which contains the base data collected and provided by the 98 Danish municipalities) as well as in our derived (generalized) datasets, and when the data are updated, it must ideally be reflected in all our products. For this to happen we have to create datatransfers in the different scales from the DGA datawarehouse into the MPE production database with updated base data and generalized data. This task has not been completed yet, and there is still work to be done in order to develop methods and procedures for doing incremental updating of the many different data.

With the new MPE the cartographers of the DGA can produce different products based on the same data, and the overall effect is less resources needed during the production time and much less manual corrections.

It is now easier for the DGA to carry out additional tasks. DGA has since the spring of 2015 had a formal collaboration with TRAP Denmark (a huge publishing task preparing a new 24 volume printed (and online) edition of "The Statistical-Topographical Description of the Kingdom of Denmark", originally authored by Cabinet Secretary Jens Peter Trap) to help incorporate geography in the coming TRAP releases. This collaboration has now resulted in the production of a brand new TRAP Topographic Atlas in the scale 1:75,000, based on a recently updated dataset in scale 1:100,000.
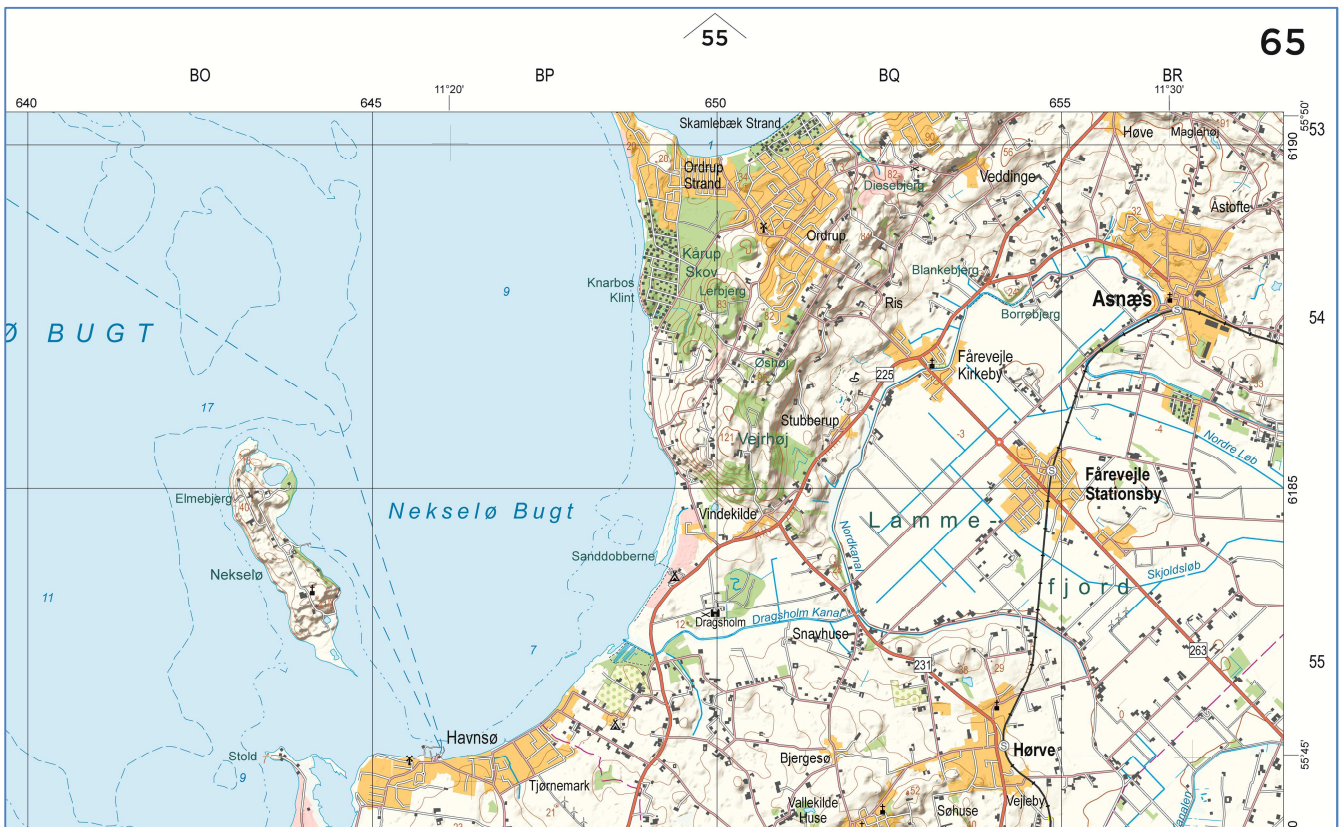
Extract from the new Trap Topographic Atlas, 1,75.000

In just over 2 months DGA has produced 122 new map pages, complete with gazetteer and key maps. The technique was taking the newly generalized nationwide 1:100,000 dataset, upload it in the MPE database and select the desired features for the new atlas. The dataset was then visualized with specific colors and symbols and placed "on top" of a hillshaded elevation model, and finally a selection of Danish place names (extracted from DGA's new base data register of place names) was added using Maplex and a lot of handwork. All map sheets were then processed into a desired layout using the tool "Data Driven Pages". Apart from the manual correction of text labels the whole production was based on automation and as such untouched by human hands.

AFJ: Today the production can be adapted more quickly to a specific task or customer desire, and productions can be performed with much fewer hands involved. And everything is done with standard tools, standard settings and just one production-ready database.
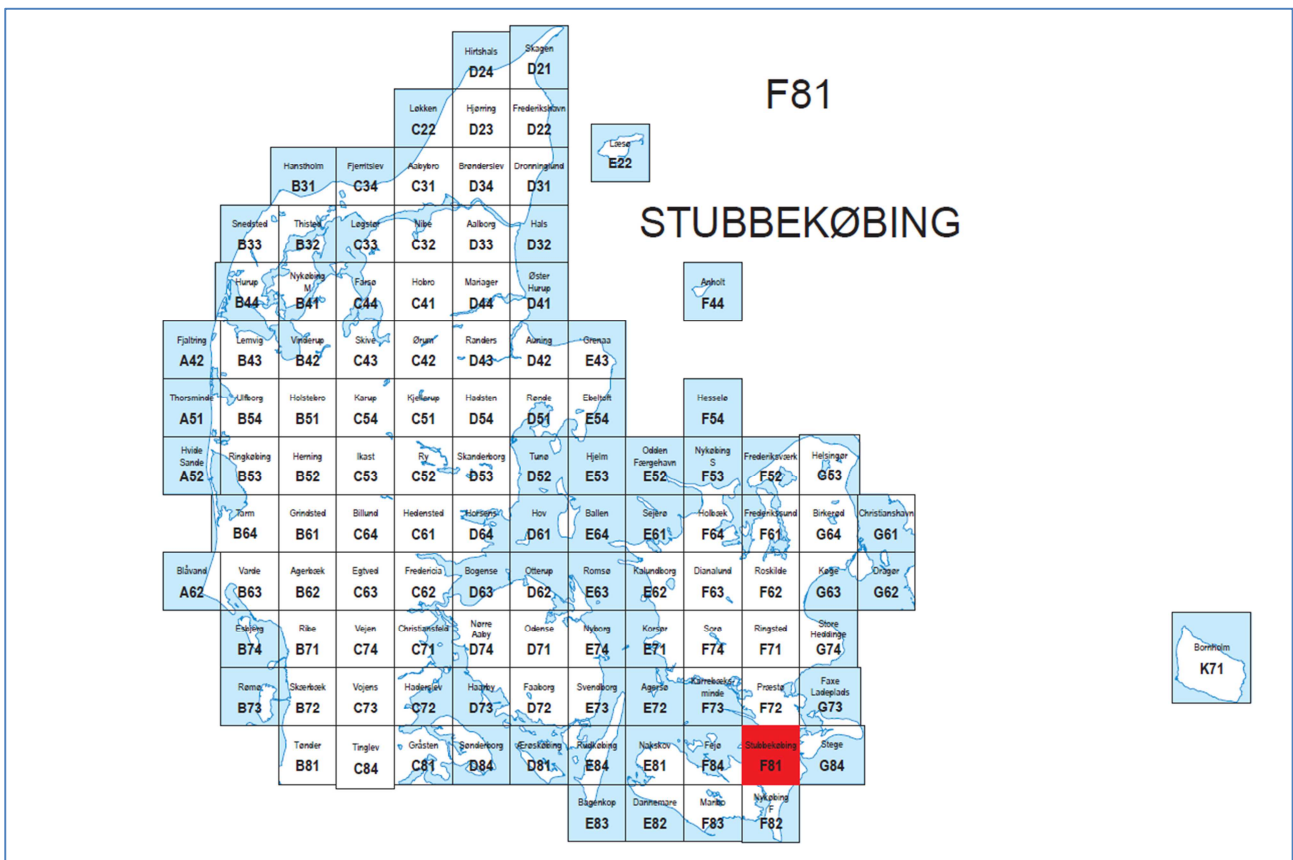
The tool Data Driven Pages is used to produce a whole map series, 1:50,000, 115 map sheets.

Performance

With one database being the central unit of all map production, it is important that the database performs very well, i.e. in relation to response times when working with data. And in the early stages DGA met some challenges of getting the database to function properly.

Stig Heinesen (SH, GIS-developer): "We don't edit features in the database, but we sometimes have to make corrections in the representations, if the cartographic rendering is not satisfactory. In a small scale map you will typically see that symbols for a railway and a road lie on top of each other so you need to pull them slightly apart. In that process, it's no use if it takes five minutes before you see the actual update on

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the screen. It was annoying for us that response times were so long and that the database performance generally so bad."

None of the employees of DGA's Department of Data Visualization were database experts. But through research in the user community and with the help of Danish ESRI-distributor Informi GIS they gradually gained insight into how the database works. I.e. the central ArcSDE database creates delta tables that contain changes in geometry and attributes. In practice this meant that it would eventually have several thousand different records to read through for each request, and therefore of course worked very slowly after some time.

SH: With the help of a database expert from Informi GIS we were shown various tools and methods to clean up and optimize the database. We've also gained a lot by introducing various maintenance tools, and this has made it clear to us how versioning works and how clean-up procedures must be performed again and again. It requires a fairly high level of technical knowledge to handle a database in a multi-user environment."

Another technique that was recommended was that you should not work directly in the database, but duplicate (replicate) smaller parts of the database into temporary file-geodatabases and work locally with them for a short time and then check them back into the mother database. This practice is now also used by the DGA.

The advantages of standard tools

When Morten is asked about the benefits of the new map production environment, the first thing he mentions is that the entire map production process has become standardized and harmonized and that the DGA has achieved a consistent documentation environment. It has already made a big difference and the advantages will keep unfolding as more products are redesigned to be produced from the new environment.

MW: "It has always been our aim to automate as much as possible and to avoid handwork. All handwork takes time and tends to lead to even more handwork. Therefore, our aim has been to make the full transition into automatic production, where we make use of representation rules, which create the whole symbolization and cartographic rendering based on fixed specifications."

If you look at the organization as a whole, the three colleagues agree that there are advantages in using a standard tool. Before, there were several different tools in use throughout the agency and each employee had a natural preference in relation to his or her own way of doing things. This made it difficult to share knowledge and virtually impossible to create common workflows.

AFJ: "It is an advantage for us to have a standard tool, which is well supported and has good documentation, and various development tools where several of our developers can contribute with knowledge. It is easier to organize a developing environment, when only one tool is used. And we can upgrade it all at once. As an example it has not given us any challenge to upgrade to ArcGIS 10.3.1. And another very important thing to mention: We have hardly written one line of code of our own in this whole project. It is all based on standard tools - out of the box - and we have reached 99.9% of our goals with these standard tools and some Python scripts to tie it all together."