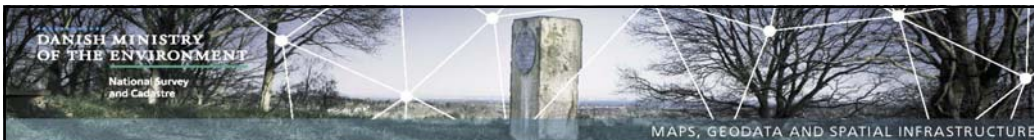




## **Norm for RTK-services and Good GNSS practice in Denmark**

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by  
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### **The National Survey and Cadastre - Denmark**

- Kort & Matrikelstyrelsen – KMS
  - is a government organisation under the Danish Ministry of the Environment
  - is authority for maps and geo-data, as well as the spatial infrastructure of Denmark's eGovernment
  - was founded in 1989, currently app. 300 employees, headquarter in Copenhagen



## Outline

- Background of the Norm for RTK-services
- Content in the Norm
- Good GNSS survey practise
- Assesment of the Process
- Conclusion and future perspectives



## RTK services in Denmark

- In Denmark real time high accuracy GNSS positioning is used as the main positioning "tool" for most mapping and survey applications.
- The development is driven by two competing compagnies, both providing nationwide RTK services

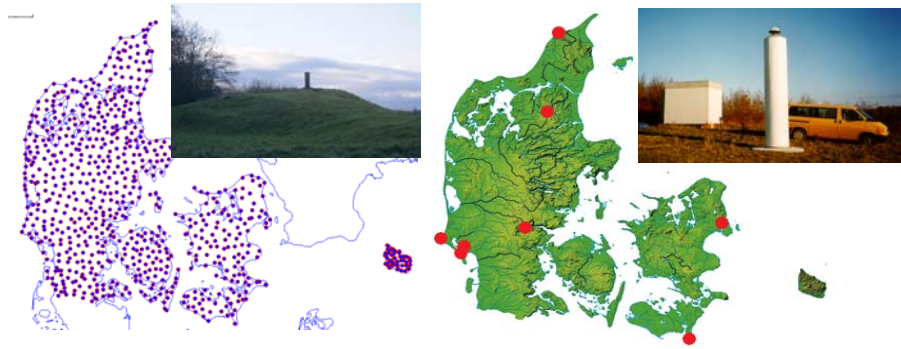


## Background of the Norm for RTK-services

- KMS is the authority for maps and geo-data
- New challenges
  - We have to keep up with the times (developments)
  - The connections to the reference networks is challenged
  - New Act of Cadastral work



## The Danish Infrastructure



## RTK-services in Denmark



GPS-referencen



GPSnet.dk

## Regulations of GNSS applications

- Regulations for positioning and navigation at sea, by IALA and national authorities
- Regulations for positioning and navigation in the air, by ICAO and national authorities
- Almost no regulations for positioning and navigation on land.



## Norm for RTK-services

- Act of Kort og Matrikelstyrelsen (Act nr. 749 §3 stk. 1 og stk. 2) open the possibility to lay down guidelines for completion af survey and mapping.
- A norm consists of lines of directions, which are rooted in a law with status like a departmental order or a guidance.



## Time and process

- First edition...(autumn 2006)
- dialogue/meeting with the services...
- Input from other collaborator (university)...
- Input from nordic colleagues
- New version
- New version in legal terms
- Circulate sth among the services - ultimo 2007
- New version
- Circulate among all interests.
- Implementation in progress - 2008





## Content in the Norm

- There must be at least 5 stations in the RTK-service.
- A description of the area, the service cover, must be available.
- The service must make its own inspection in the form of control measurements and calculations.
- The service must forward corrections in an open format.
- The reference stations in the RTK-service must be connected to correct Danish reference system.
- Quality calculations will be executed by KMS.
- The requirements for availability, continuity, integrity and accuracy must be complied.
- Accuracy better than 5 cm in the horizontal plane and 10 cm in the height.



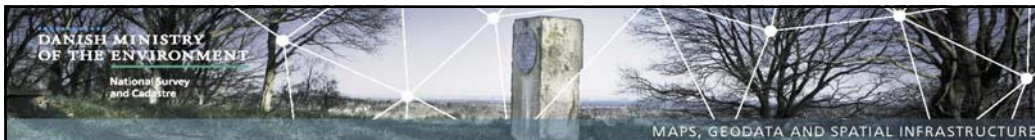
## Good GNSS practice in Denmark

- Basic introduction in Good survey practice with RTK
- In brief the guidance contains things like:
  - *Measure all points again after reinitializing.*
  - *Place the antenna away from buildings trees and other obstructions to receive signals from an optimum number of satellites and to avoid cycle slips and multipath.*
  - *Centre the antenna above the point to be surveyed, and always keep track of the antenna height.*
  - *Be aware of warnings from the receiver concerning accuracy.*
  - *Be aware of the DOP values.*
  - *Keep an eye on the initializing time, as the accuracy can depend on it.*
  - *Measure at least one known point and compare the new coordinate determinations with known coordinates.*



## Assessment of the Process

- Only positive responses -> the need for a Norm
- Good GNSS practice has been received with also good response.
- The implementation in the 2 private firms is still ongoing, and we hope it will be a positive experience for them.
- KMS wish for a closer corporations with the RTK services.



## Conclusion and future perspectives

- KMS wish that the two existing RTK-services apply for registration.
- The Norm is not finished – it most undergo a future development.
- The norm will find applications in many new fields.
- Analyzes of the accuracies is difficult