

## **Minutes of the NKG Working Group for Height Determination in Copenhagen, 31 March and 1 April, 2003**

Participants:

### **Finland**

Pekka Lehmuskoski  
Jaakko Mäkinen  
Veikko Saaranen  
Mikko Takalo

### **Norway**

Olav Vestøl

### **Sweden**

Per-Ola Eriksson  
Mikael Lilje  
Runar Svensson  
Per-Anders Olsson  
Martin Lidberg (only Monday)

### **Iceland**

Markus Rennan

### **Lithuania**

Arunas Buga

### **Denmark**

Klaus Schmidt  
Karsten Engsager  
Casper Jepsen  
S. Stampe Villadsen (not all time)  
Kirsten Johansen (not all time)  
Lola Bahl (not all time)

**Chairman: Mikko Takalo**  
**Secretary: Casper Jepsen**

Enclosed: The agenda  
Extracts from the minutes of Presidium.

Before the meeting we had a Lunch at Kort og Matrikelstyrelsen (KMS) at 12:00.

### **Opening of the meeting**

The Chairman welcomed all participants to Copenhagen and opened the meeting of the Working Group for Height Determination (WGH) and two Sub Working Groups (SWG) at 13:00. The first day was for two SWGs and the second for the WGH.

### **Approval of Agenda**

The Agenda was approved after a short discussion.

### **Input from the NKG Presidium**

The chairman introduced the following topics for later discussions:

### **Remaining actions of the Working Groups from the period 1998-2002**

From the minutes of the meeting of the Presidium on 30 September – 1 October, 2002 the following remaining actions relating to WGH can be found:

The Working Group for Height Determination is asked to develop routines and rules for distribution of levelling data to persons doing research and report to the next meeting of the Presidium in June, 2003.

Jaakko Mäkinen told that Mikael Lilje has developed a draft and distributed it. Jaakko thought that it should be structured differently.

### **Position paper**

The Presidium asks the Working Group for Height Determination to write a Position paper on the required conditions on a European height system in order to make a connection of an unified Nordic Height system to that system possible for practical use. The paper shall be presented by a representative from the Working Group on the meeting of the EUREF Technical Working Group on June 3, 2003 in Toledo, Spain. The Presidium shall be used as a reference group for the paper, i. e. a draft of the paper shall be reviewed per capsulum by the Presidium early May.

This topic was treated later.

### **Contact persons**

**According to email enquiry by Presidium following persons are registered as contact persons of WGH:**

Mikko Takalo, Finland <mikko.takalo@fgi.fi>

Klaus E. Schmidt <kes@kms.dk>

Casper Jepsen <cj@kms.dk>

Veikko Saaranen <Veikko.Saaranen@fgi.fi>

Olav Vestøl <[vestol@statkart.no](mailto:vestol@statkart.no)>

Per-Ola Erikson <per-ola.eriksson@lm.se>

Per-Anders Olsson <per-anders.olsson@lm.se>

And the Presidium appointed **Risto Kuittinen** the contact person between the Presidium and the Working Group for Height Determination.

To this topic was not any comments.

### **Intermediate seminar between the General Meetings**

All the Working Groups are asked to discuss the present need of a 2-3 days NKG intermediate seminar before the next General Meeting in Denmark 2006 at their start-up meetings. The results of these discussions should be reported to the Secretary of the Presidium, who will report on the next meeting of the Presidium in June 2003.

No action to the topic "Intermediate seminar between the General Meetings" was taken and agreed to take action on next day.

### **The next NKG Autumn School**

The Presidium has discussed of the conditions for an Autumn School in 2004 in Denmark.

Stampe Villadsen informed the meeting that in 2004 the NKG autumn School will take place in Denmark, properly at Bornholm. The theme is not yet decided.

## **Technical session of SWG for Transfer and Computation**

Mikael Lilje as Chairman.

### **Discussion of height systems**

#### **Discussion of height system in Sweden**

Mikael Lilje opened this session with a briefly review.

All Danish leveling data is in the database (DB). Swedish data has not introduced to the database due to the problem with "tågnummer". Stampe Villadsen and Casper Jepsen explained the necessity of uniquely identifying the BM . Sweden was asked to review this number and try to reduced to under 23 digits. All Norwegians data is ready but not in DB . A Finnish test loop has been tested and it should be ok. Casper Jepsen is the new contact person at NCC

#### **Telnet problems to NCC**

Veikko Saaranen had problems due to bad battery in his secure ID card, and a new one is going to be sent to Finland. Other country was asked to go and try to connect to NCC, otherwise contact Casper Jepsen.

#### **NCC (KMS) software**

Klaus Schmidt and Karsten Engsager has discussed land uplift problems and Karsten has almost implemented Martin Ekman (BIFROST) model. Øresunds loop is not calculated, but will be finished this year. Klaus Schmidt is responsible for this.

#### **Ålands loop**

The GPS/Geoid leveling connection over the Åland see was measured in Swedish-Finnish co-operation in 2002. GPS observations have been processed and the first height analysis made. The final analysis is missing and Jaakko is responsible for this.

#### **Levelling connection though Russia**

Levelling connection though Russia around the Gulf of Finland is not yet available. It is not necessary either since the Gulf of Finland can be crossed by GPS/Geoid and/or oceanographic levelling.

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### **Martin Lidberg's presentation**

Martin Lidberg ([martin.lidberg@lm.se](mailto:martin.lidberg@lm.se)) gave a presentation about the coming Height system in Sweden. A lot of questions were presented: What land uplift parameter should be used and what height system should be defined, the European system, why do we need this, INSPIRE, GIS and EUREF people what will they use?

### **Connection to NAP using UELN-95 through Denmark and through Baltic countries**

Jaakko Mäkinen considered the connection of the Nordic Height Block to the NAP using the UELN-95/98 network. The Western path through Denmark is the only one available so far. There is no connection around the Gulf of Finland but nevertheless an Eastern path through the Baltic countries can now be considered using an oceanographic tie over the Gulf of Finland. For either path, the question arises whether the UELN-95/98 observations should be used as-is (EVRF2000), or improved using available information. In particular, land uplift corrections should be introduced, especially into the Baltic levellings. All data should also be reduced to the zero tidal system as specified by the ETRS2000 but not fulfilled in the EVRF2000.

An estimate of the UELN-95/98 misclosure (as-is) around the Baltic can be obtained using the published EVRF2000 results and the oceanographic tie over the Gulf of Finland: the misclosure is about 10 cm. An estimate of the misclosure using rectified UELN-95/98 data can be obtained using the NH60 height system by Ekman and Mäkinen (including the oceanographic tie over the Aland sea), and the aforementioned Gulf of Finland Tie: the misclosure is then about 5 cm. Cooperation with Baltic countries and other countries around the Baltic must be sought to improve the present ties.

### **Coffee Break**

### **Technical session of SWG for land uplift**

Chaired by Jaakko Mäkinen

### **Experiences of new height system in Denmark**

After a break the SWG meeting started. The first presentation was from Stampe Villadsen. Stampe talked about Introduction of new Height System in Denmark called DVR90. In 2001 was 47000 point recalculated, 37000 points was transformed. A freeware program KMSTrans is available on [www.kms.dk](http://www.kms.dk) and can be used to transfer from DNN (old height system) to DVR90. 27 of may 2002 was DVR90 the official height system in Denmark. Until 2004 will all height will be calculated in DVR90 and old DNN.

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All tide gauge in Denmark will be measured in the same system. Pilot projects with 3 Municipalities are ongoing. A lot of technical problems appears all the time. Close contact with GIS providers. 1/1-05 the only height system in Denmark should be DVR90.

### **Comparison and synthesis of land uplift rates**

Jaakko Mäkinen talked on comparison and synthesis of land uplift rates. There are at present three uplift models that cover the whole area. Ekmans's model is based on tide gauges and repeated precise levellings (first two campaigns). Lambeck's geophysical model is based mainly on relative sea level histories but it is tuned to tide gauges and lake level tilts. The Bifrost geophysical model is fitted to the 3-D motion observed with permanent GPS and uses the deglaciation model by Lambeck. Ekman's model and Bifrost are now available in digital form, and the next generation of Lambeck's models will become available later. Agreement between the models and between observation results is surprisingly good, less than 1-2 mm differences. In half a year we will have a model synthetizing observation results with different techniques.

### **Summaries**

#### **Summary 1: Status of Nordic Block**

After a short break we had to summary up. Summary 1: Jaakko Mäkinen will send data distribution paper with new comments.

#### **Summary 2. Position paper**

Jaakko Mäkinen, Martin Lidberg and Klaus Schmidt will be providers of a draft version. The first version of this paper has to be finished before the 15 of April. The writers have to take in concern the aspect discussed on this meeting. After that chair of WGH will distribute this paper to the presidium.

The evening was ending at a Restaurant on Nørrebro.

## **Tuesday 1st April**

### **WHG meeting**

#### **Intermediate seminar**

The meeting started at 9:00. Stampe Villadsen presented a proposal of the presidium. A discussion about the response to the presidium was carried out, and we regarded it as a good idea to make joint meetings with other WG, but it should be upon the WG own initiative and only if the WG have some topics to discuss.

#### **Minutes of SWG Espoo meeting , 2002**

The minutes from Espoo meeting 2002 was approved, without any comments.

#### **Feedback from the NKG General meeting 2002**

The chairman introduced Works of the WGH during the time period 2002-2006 as feedback from the NKG General meeting 2002. It was discussed, but no actions were agreed.

### **National Reports**

#### **Denmark (Casper Jepsen)**

New height system DVR90 was introduced on 27th May, 2002. Going from 3 teams to 1,8. Lots of contract with municipalities have been done.

#### **Finland (Veikko Saaranen)**

The Third Levelling of Finland will be completed in 2004. In 2002 two junctions to Russia were measured and in 2003 five have been planned. Final calculation of the net will be performed in 2005-2006. No plans for introduction of new height system.

#### **Norway (Olav Vestol)**

In 2002 production was 564 km, which of 195 km was measured by Metria. Releveling percent was 6.7%. A fjord crossing and nine tide gauge controls were done in 2002. Plans for 2003 is 320 km, which of only 160 km is behind the general leveling plan. Other activities: Preliminary analyses of leveling network and creation of the HREF national geoid model.

### **Sweden (Per-Ola Eriksson)**

Most activities are in releveling. It seems like the good releveling plans lead on to reduction of -> misclosures. Good results were obtained on the Öland loop. The production in 2002 was 2885 km in Sweden and one line for Norway. The releveling percent was 9% probably due to the old instruments. For the years 2002-2003 the Project "Riksavvängningen" consists of 5 subprojects. The Project "Introduction of new Height System" consists of 3 subprojects.

### **Iceland (Markus Rennett)**

In Iceland 1380 km was levelled in 2002 – by 3 teams, a contribution of other Icelandic authorities was needed. Very good results were achieved. The loop around Iceland is now closed. GPS and Gravity survey was also done in 2002. This year 2003 one line will be measured going from north to south.

### **Lithuania (Arunas Buga)**

Establishment of National Geodetic Vertical Network. 263 km leveling was done in 2002. 5 loops are measured, and ongoing Gravity measurements.

### **Latvia (Janis Kaminskis/Mikko Takalo)**

Mikko had a map sent from Latvia illustrating the status of national leveling in Latvia. No further comments on that.

### **Maintaining of bench marks**

We had about 15 min discussion about maintaining of benchmark which are under threat of destroy. In Finland every announced bench mark will be replaced with a new one. The first agreement with the user organization of Railway have been done. In Sweden, Norway and Denmark not any special arrangements to maintain the leveling bench marks have been done.

### **Lunch**



## **Commemorate**

The meeting respected with one minute of silence the memory of Sievert Bakkelid from Norway.

## **Presentations**

### **Rene Forsberg: “Report of NKG2002-geoid**

Rene Forsberg (rf@kms.dk) gave a review of status of the NKG 2002 geoid computations. He mentioned problems with the Russian gravity data behind the Finnish border. Rene promised that the Geoid will be finished before the IUUG conference 2003.

### **Klaus Schmidt: “Status of the computation of the Øresund loop closing error”**

Casper Jepsen and Klaus Schmidt gave a status of the Øresunds loop. It was decided that it should be calculated in CPU. The calculation will be finished 2003.

### **Pekka Lehmuskoski: “ On Stability of the Metsähovi test field”**

Pekka Lehmuskoski told about precise leveling tests in the Metsähovi test field carried out in the period of 2000-2002. According to the results relative movements between certain bench marks have been found. Pekka supposed that these movements could depend on temperature changes of bedrock. Investigations will be continued. -

### **Mikko Takalo: “ On application of the system calibration results”.**

Mikko reviewed of principle and necessity of the system calibration of the digital leveling system. Briefly, he described the problems of system calibration and determination of the scale factor of digital level. Mikko concluded that the system calibration comparator is an excellent tool to study behavior of digital leveling systems.

### **Klaus Schmidt: Some theoretical aspects on different collocation approaches with reference to land uplift determination from repeated levelling”**

Klaus gave a presentation of different approaches in collocation with special reference to land uplift determination from the linear model.

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### **SWG organization**

After a short coffee break, we continued with the organization of the SWG. In the last meeting at Espoo was supposed that the two Sub Working Groups should be merged into one. After discussion a new “Nordic Height Block”- SWG was decided to establish and Jaakko Mäkinen was voted to the chairman of this new SWG.

### **Summary**

Chairman made a short summary of the meeting, thanked the participants and expressed special thanks of the WGH to the host, KML, for arrangements of the meeting.

### **Next meeting and closure of the meeting.**

The new SWG will meet in October in Norway and Jaakko will act as covener. Next WGH meeting will be arranged next spring in Sweden and Mikko will express the invitation. The meeting was closed at 15:30.

## Appendix 1.: The Agenda

# Agenda for the Meeting of the NKG Working Group for Height Determination in Copenhagen, Denmark on 31<sup>th</sup> March and 1<sup>st</sup> April, 2003

## Monday 31th March, 2003.

**12.00-13.00: Lunch**

**13.00-13.30: WGH meeting**

- Opening of the meeting
- Approval of the agenda
- Input from the NKG Presidium:
  - request for status of Nordic Block
  - request for WGH concept of EVRS connection

**13.30-15.15 Technical Session of SWGs:**

Chair **Mikael Lilje**

- Discussion of height systems
  - Discussion of height system in Sweden ( Mikael and Martin)
  - Connection to NAP using UELN-95 through Denmark and through the Baltic countries (Jaakko)

Coffee break

**15.30-17.00 Technical Session of SWGs continues.....**

Chair **Jaakko Mäkinen**

- Experiences of new height system in Denmark (Stampe)
- Comparison and synthesis of land uplift rates (Jaakko)
- Summary 1: Status of Nordic Block (Mikael)
- Summary 2: WGH's conception of EVRF2000 - letter to EUREF meeting (Jaakko)

**17.00- Dinner somewhere in Copenhagen**

## **Tuesday 1st April, 2003.**

**09.00 - 10.00: Technical Session of SWGs** continues if necessary

Chair **Jaakko Mäkinen**

Discussion of height system, response to presidium request

**10.00 - 11.30: WGH meeting**

- Minutes of the SWG Espoo meeting, 2002 (Jaakko)
  - Feedback from the NKG General meeting 2002:

Coffee break

- National reports: DK, FIN, N , S and Iceland, Lithuania, Latvia

**11.30 – 12.30: Lunch**

**12.30 - 15.00: WGH meeting**

**Presentations**

- Rene Forsberg: "Report of NKG2002-geoid"
- Klaus Schmidt: "Status of the computation of the Øresund loop closing error"
- Pekka Lehmuskoski: "Stability of Metsähovi test field"
  - Mikko Takalo: "On application of the system calibration results"
  - Klaus Schmidt: "Some theoretical aspects on different collocation approaches with reference to land uplift determination from repeated levelling"

Coffee break

**15.15 – 15.45: WGH continues**

- **SWG organisation**

**15.45 – 16.00:** Summary; Next meeting; Closing of the meeting.

## **Appendix 2.: Extracts from the minutes of the Presidium**

### **-Remaining actions of the Working Groups from the period 1998-2002**

that according to the minutes of the meeting of the Presidium on 30 September – 1 October, 2002 the following remaining action for the Working Groups can be found:

#### **Working Group for Height Determination**

*All Nordic levelling data will be collected in a database at KMS and persons doing research are encouraged to use the data in their studies.*

***Agreed action:** The Working Group for Height Determination is asked to develop routines and rules for distribution of levelling data to persons doing research and report to the next meeting of the Presidium in June, 2003*

### **-Position paper**

On the basis of Resolution no 2 of the 14th General Meeting of NKG the Presidium ask us the position paper

#### ***Background:***

*The Nordic Geodetic Commission recommends the representatives of the National Mapping Authorities and Geodetic Institutions in NKG to be active for the adoption of a unified Nordic height system with minimal differences from national height systems and from the European Vertical Datum*

***Agreed action:** The Presidium asks the Working Group for Height Determination to write a Position paper on the required conditions on a European height system in order to make a connection of an unified Nordic Height system to that system possible for practical use. The paper shall be presented by a representative from the Working Group on the meeting of the EUREF Technical Working Group on June 3, 2003 in Toledo, Spain. The Presidium shall be used as a reference group for the paper, i. e. a draft of the paper shall be reviewed per capsulum by the Presidium early May.*

## **-Contact persons**

**According to email enquiry by Presidium following persons are registered as contact men of WGH:**

Chairman: Mikko Takalo, Finland <

**Contact persons**

Klaus E. Schmidt <kes@kms.dk>

Casper Jepsen <cj@kms.dk>

Veikko Saaranen <Veikko.Saaranen@fgi.fi>

Olav Vestøl <[vesola@statkart.no](mailto:vesola@statkart.no)>

Per-Ola Erikson <per-ola.erikson@lm.se>

Per-Anders Olsson <per-anders.olssom@lm.se>

*In order to try to improve the interaction between the Presidium and the Working Groups the agreed plan for the Structure of the NKG Work states that members of the Presidium shall be appointed contact persons for continuous contacts with the Working Groups.*

***Agreed action:*** *The Presidium appoints the following contact persons between the Presidium and the Working Groups: Geodynamics – Anders Olsson, Geoid Determination – Niels Andersen, **Height determination – Risto Kuittinen**, Reference frame and Positioning – Hans-Peter Plag.*

## **-Intermediate seminar between the General Meetings**

*In order to make it possible for the Working Groups to concentrate themselves on a few issues the Presidium should invite all NKG members to a 2-3 days intermediate seminar between the General Meetings. During these seminars each Working Group can be assigned a session in order to highlight the ongoing work in the Working Group. Overlapping issues can be discussed in a common session.*

***Agreed action:*** *All the Working Groups are asked to discuss the present need of a 2-3 days NKG intermediate seminar before the next General Meeting in Denmark 2006 at their start-up meetings. The results of these discussions should be reported to the Secretary of the Presidium, who will report on the next meeting of the Presidium in June 2003.*

## **-The next NKG Autumn School**

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*The NKG Autumn School takes place every fourth year and the time for the next school should be 2004 and the turn has come to Denmark to arrange it. For earlier Autumn Schools funds for the Autumn School has been applied at NorFa (Nordisk Forskerutdanningsakademi) with various results, the closing date for the application has usually been in springtime the year before the Autumn School.*

*The conditions for an **Autumn School in 2004 in Denmark** were discussed. Some proposals for topics for an Autumn School are:*

- *the next generation of Geodesy - education etc.*
- *the long term monitoring of reference frames*
- *monitor of changes in the earth crust*
- *marine geoid and altimetry*

**Agreed action:** *KMS will develop and distribute a proposal for the next NKG Autumn School to the members of the Presidium early May 2003.*