Working Committee of the

Surveying Authorities of the





Progress Report 2005

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Almost all planning and decision processes in politics, economy and administration have a spatial reference. For this reason, the geodata derived from official surveying and mapping are increasingly becoming a basic resource for the information society and a fundamental component of the e-government architectures, particularly from an European point of view.

Consequently it is crucial that AdV (Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany) co-ordinates and standardises all essential lines of action of the responsible state surveying authorities on a national level. AdV sees its objectives and mission confirmed by politics since the minister-presidents of the German Federal States backed up the enduring importance of AdV as a cross-national harmonisation and co-ordination committee at the beginning of this year.

To live up to this task even more efficiently, AdV is currently concerned with the reformation of its working and decision structures. Within this context, it follows the "Grundsätzen und Verfahren für die Zusammenarbeit der Länder" (principles and procedures for the co-operation of the German Federal States), which were defined by the conference of the minister-presidents of the German Federal States at the end of 2004.

Also in 2004, AdV concentrated its work on the maintenance and advancement of the AFIS[®]-ALKIS[®]-ATKIS[®] concept, which aims at the modelling of geographic information of official surveying and mapping as well as on conceptual contributions and the corresponding know-how transfer of the surveying authorities of the Federal States for the establishment of the Geospatial Data Infrastructure Germany (GDI-DE). Since last year, most of the Federal States have been represented in the steering and co-ordination committee of the GDI-DE by

experts from the respective cadastre and surveying authorities. There, they exercise an integral mandate for all geodata areas of the respective Federal State.

Meanwhile, version 4.0 of the documentation for the modelling of geographic information by official surveying and mapping (GeoInfoDok) has been published. With this documentation, AdV has created a modern and standard-based modelling principle, which is also suitable and appropriate for application in many other segments of geographic information. This principle will have a central meaning for the entire GDI-DE as well as for the e-government architectures. AdV, in turn, has to accept the obligation to guarantee all potential users the maintenance and advancement of this work over a long period of time. This is why the committee has decided to warrant long-term maintenance.

In the future, AdV will play an even more prominent part in the international standardisation in the field of geographic information. Particularly the development of the INSPIRE process calls for such a commitment to secure the German standards issued so far also on an international level.

Further information on the individual activities, projects, etc. of AdV is available in the following progress report, which the AdV has presented for 2005.

Reinhard Klöppel President of AdV Wilhelm Zeddies Secretary General

Organisation and Performance of Tasks

In Germany, the Federal States (Länder) assume responsibility for the performance of tasks in field of official surveying and mapping. Since 1948, the specialist authorities of the Federal States and Federal Ministries of the Interior, Defence as well as for Traffic, Construction and Housing responsible for official surveying and mapping have been cooperating in the Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany (AdV), in order to handle technical issues of fundamental and national importance. The German Geodetic Commission (DGK) for geodetic education and research and the Bund/Länder Working Committee for Rural Development (ArgeLandentwicklung), responsible for land consolidation and rural development in Germany, have guest status in AdV.

Surveying and cadastral authorities of the Federal States

In most of the Federal States, the specialist authorities responsible for surveying, mapping and real estate cadastre are assigned to the Ministry of the Interior of the respective Federal State. They



usually have a three-level administrative structure. The administration of topographic geobasis information lies in the area of responsibility of the respective state surveying authorities. At regional level, cadastral authorities handle real estate cadastre tasks and provide large-scale geobasis information.

The range of services includes, among others,

- the constantly operating Satellite-supported Positioning System - SAPOS®,
- the fixed control point networks and their proof in the Authoritative Control Point Information system AFIS[®],
- the Authoritative Topographic-Cartographic Information System - ATKIS[®] including the official topographic maps and aerial photographs as well as special-purpose maps,
- the proof of some 62 million land parcels in the official real estate cadastre (including automated real estate map ALK, automated land register ALB, in future the Authoritative Real Estate Cadastre Information System ALKIS[®].

Federal Agency for Cartography and Geodesy



The Federal Agency for Cartography and Geodesy (BKG) is a federal authority responsible to the Federal

Ministry of the Interior. In co-operation with the Federal States, the BKG fulfils the following tasks in the field of geographic information and geodesy,

- Provision and representation of current analogue and digital topographic-cartographic information as well as the advancement of the procedures and methods required for this purpose,
- Provision and updating of the geodetic reference networks of the Federal Republic of Germany including the required

- services pertaining to surveying and mapping as well as the theoretical services for the acquisition and processing of measuring data and the participation in bi-lateral and multi-lateral works for determining and updating global reference systems

- advancement of the implemented measuring and observation technology,

• Representation of interests of the Federal Republic of Germany in the field of geodesy and geographic information on an international level.

Bundeswehr Geoinformation Service

The task of the Bundeswehr Geoinformation Office

(BGIO) is to merge all geosciences relevant to the Bundeswehr (geodesy, geography, geology, remote sensing, cartography, geoinformatics, meteorology, climatology, ecology, biology), so



that under the slogan "Geographic information from one source" the geoscientific basis for deployment of the armed forces can be created and the fulfilment of all spatial tasks of the Bundeswehr can be guaranteed. BGIO closely co-operates with the surveying departments of the Federal States and the Federal Government.

Federal Ministry for Transport, Construction and Housing (BMVBW)

The BMVBW has been a member of the Working



Committee of the Surveying Authorities of the States of the Federal Republic of Germany

(AdV) since 1950. It has assigned the Federal Water and Shipping Authority (WSV) of the Federal Government as a specialist authority, which employs its own surveying personnel, with the operation and maintenance of the federal waterways stretching over 7,300 km. The surveying and real estate division has almost 5.000 employees. Throughout Germany, official surveying and mapping tasks are carried out that require close consultation with AdV. The WSV maintains its own reference network (position and height control points) and operates its own SAPOS[®] stations on the rivers Rhine and Main, which are integrated in the satellite positioning service of AdV. For the waterway network, a digital, object-oriented map system (1:2000) is created and updated, the contents of which are used for advancement of the ATKIS[®] basic DLM. The BMVBW is represented in AdV by the railways and waterways division.

Tasks of AdV:

- Issuance of recommendations and binding regulations for a uniform approach towards the creation, maintenance and advancement of geodetic basics, the topographic map series and of the real estate cadastre
- · Joint realisation of cross-state projects
- Co-operation in the development and application of technical processes
- Statements on draft laws
- Discussion of subject-related questions pertaining to organisation, personnel, training and examination as well as cost and use
- Co-operation with subject-related organisations and authorities as well as institutions of geodetic research and education
- Representation of the official German surveying and mapping sector in the European Union and in international institutions
- Co-operation with foreign countries, also in the field of development aid.

Organisation of the Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany (AdV)

Plenum						
Members: Baden-Wuerttemberg, Bavaria, Berlin, Brandenburg, Bremen, Hamburg, Hesse, Mecklenburg-Western Pomerania, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate, Saarland, Saxony, Saxony- Anhalt, Schleswig-Holstein, Thuringia, Federal Ministry of the Interior, Federal Ministry of Defence and Federal Ministry for Traffic, Construction and Housing						
President		Secretary General				
Working Groups (WG)						
Spatial Reference	Real Estate Cadastre	Geotopography	Information and Communication Technology			



www.adv-online.de

The addresses of the above-stated parties and further information can, among others, be found on the following Websites:

AdV	www.adv-online.de
BKG:	www.bkg.bund.de
BGIO:	ageobweingang@Bundeswehr.org
BDVI	www.bdvi.de
ArgeLandentwicklung	www.argeland.de
Geodetic education and research (DGK)	www.dgfi.badw.de

Joint Establishment of the GDI-DE by the Federation and the Länder

With the joint establishment of the Geospatial Data Infrastructure Germany "GDI-DE" by the Federal Government, its states and communities, the potential of geographic information, particularly for political as well as administration- and economy-relevant decision processes is increased. The modernisation of administration is pushed ahead, decisions in all social sectors are supported and the industrial valueadded services are promoted.

On November 27, 2003, the head of the Federal Office of the Chancellor and the heads of the State and Senate Chancelleries in Germany (CdS) passed the resolution over the establishment and the future organisation of the GDI-DE. The GDI-DE steering committee was formed by representatives of the Federal Government, its states and the municipal head organisations in 2004. It has taken over the political and conceptual control of the GDI-DE development on a level spanning the diverse administrative levels.

In the steering committee of the GDI-DE, representatives of the Federal Government, its states and municipalities, who have been appointed for e-government on a resort-spanning level and who lie in the political responsibility of the secretaries of state, control the development and arrangement of the GDI-DE for all administrative levels. The GDI-DE steering committee is expected to work out a balanced concept for the joint and open establishment of a geospatial data infrastructure in Germany, also with regard to a European geospatial data infrastructure (ESDI) which also has to be set up. Its primary task is the coordination of the partially existing and developing strategies for the establishment of the geospatial data infrastructures at the Federal Government, its states and municipalities and the sustainable promotion of standardisation developments on a cross-national level.

The GDI-DE steering committee decides on the required pilot schemas for the establishment and operation of linked geodata portals, for the realisation of a linked metadata information system and for a sustainable activation of the co-operation of public and private, including scientific, players in the field of geographic information. It co-ordinates the implementation of all projects in accordance with the

motto "Some-for-all" and assures the transfer of knowledge and the exchange of process solutions between the Federal States, the municipalities and the Federal Government.

A GDI-DE business and co-ordinating office supports the practical implementation of this work by means of a respective project management. This office is composed of representatives of the Federal Government and its states. Available institutions and structures are to be utilized and parallel or double works avoided. For the practical work, it is furthermore important that in a decentralized structure, which is typical for the field of geographic information, the projects implemented for the establishment of the GDI-DE are supported by the respectively responsible data owners and users.

The role of AdV in the Federation-Länder Organisation GDI-DE

AdV has essentially contributed to the development of the new organisational structure. The further involvement of the state surveying authorities is partially ensured via a direct representation for the respective state in the steering committee, via a personnel involvement in the business and co-ordinating office as well as via the projects in the GDI-DE supported by the state survey offices. This goes hand in hand with the already existing co-operation of AdV with the Interministerial Committee for Geoinformation (IMAGI).

In addition to this, AdV plays an important role in the development of necessary procedures and technologies as well as in the distribution and application of standards. At this point, particularly the ISO-based data model for AFIS[®], ALKIS[®] and ATKIS[®] must be mentioned. The data model describes the structure and composition of geobasis data in a future-oriented manner and offers the pre-requisite for an efficient integration of geographic reference and geotechnical data.

Hence, the described data model fundamentally contributes both in a technical and practical way to the GDI-DE. In return, the development of the GDI-DE under application of the respective concept will entail a considerable development surge for its distribution and application.

Recent Work of AdV

Dealing with special issues and tackling uniform problems on a cross-state level, the bodies of AdV have basically concentrated on the following key activities during the reporting period.

Spatial reference

AdV and BKG participate in diverse international projects for the realisation of spatial reference, linking the national spatial reference with international, global reference systems.

With state-of-the-art technology, the standardised $SAPOS^{(R)}$ satellite positioning service provides a uniform, homogeneous spatial reference system. For nationwide operating users, the central $SAPOS^{(R)}$ agency pools the data of the state centres. The GPS reference network GREF operated by the BKG has been further extended.

As the conventionally marked fixed control point networks are continuously losing significance, the fixed control point networks have been re-structured. The connection to global reference systems has been further extended and consolidated by the BKG.

The set-up of the European satellite system GALILEO was observed and resulted in recommendations for AdV member authorities.

The repeat measurement of the German Main Height Network (DHHN) for the years 2006 to 2011 was decided. Additionally, works on the quasi geoid model and absolute gravity measurements were carried out by the BKG.

The Authoritative Control Point Information System $AFIS^{\mathbb{R}}$ is established throughout Germany. All products of the spatial reference will be subjected to quality assurance and standardisation measures.

Link to global reference systems

With its strong participation in the international services of the International Association for Geodesy (IAG), the BKG ensures the basic geodetic supply of Germany and simultaneously contributes to the advancement of geodesy.

Together with the Satellite Geodesy Research Facility (FESG) of the Munich Technical University, the BKG operates the Fundamental Station Wettzell (FSW) within the scope of the Satellite Geodesy Research Group (FGS). Based on the "weekly solution, position and EOP" project, the FGS regularly provides the International Laser Ranging Service (ILRS) with analysis results. Since 2004, the VLBI analysis group has been preparing the time series "Tropospheric Parameter" (wet & total zenith delays, horizontal gradients) starting in 1984 as a new product for the International VLBI Service (IVS). By means of the ring laser G, a local procedure for the detection of rotation fluctuations of the earth is developed for the first time. The time system of Wettzell, likewise the TIGO system, is integrated in the generation of the international universal time scale UTC.

The BKG also contributes to the maintenance of a homogeneous, global reference system with the establishment and operation of a larger number of IGS stations equipped with GPS/GLONASS receivers in Germany, Europe and other parts of the world. In the regional BKG data centre, mainly the European IGS stations are processed and managed. With the start of three new GLONASS satellites in 2003 and 2004 each, the Russian satellite navigation system was further completed.

The central office of the International Earth Rotation and Reference System Service (IERS), which is managed by the BKG, is building a Data and Information Centre, that will transfer the IERS production information obtained from a complex system of measuring and evaluation procedures to the user professionally and on time (http://www.iers.org). Workshops are organized for the IERS to practically implement scientific findings, new definitions of standards and resolutions for the IERS product and research centres and other IAG services.

The collaboration between the BKG and the University of Bern has been expanded to include the development of special evaluation software for the future European GALILEO navigation system. Due to the technological progress, also the EUREF GPS Permanent Network (EPN) requires regular updating. The activities of the BKG are embedded under the designation EUREF-IP in pan-European endeavours to submit RTCM data via the Internet. The BKG currently provides real-time data streams of approx. 40 (partially virtual) reference stations. Worldwide, more than 500 GNSS data streams from approximately 20 states are transmitted in the NTRIP format.

Within the scope of the COST Action 716 "Exploitation of ground-based GPS for climate and numerical weather prediction applications" completed in March 2004, the BKG developed an evaluation environment, which, based on the Bern Software Version 4.2, fully automatically and hourly estimates the total propagation delay for the current hour of the involved stations. Since March 2004, the "Zenith Total Delay" parameters of approximately 100 stations have been transmitted to the "UK Met Office" this way, which, in co-operation with the "Koninklijk Nederlands Meteorologisch Instituut", is responsible for the implementation and visualisation (http://www.knmi.nl/samenw/cost716/). The evaluation of the BKG considers all EPN stations which regularly provide hour data as well as some other, e.g. GREF stations.

In the Information System for European Coordinate Reference Systems CRS-EU, test coordinates for transformations were provided, further national height systems published and transformation parameters for individual states updated. In a first test version, possibilities for an online transformation of individual points are currently created.

The measuring data of the supra-conducting gravimeters at the Fundamental Stations Wettzell (Germany) and Concepción (Chile) as well as at the stations Bad Homburg (Germany) and Medicina (Italy) are available to the international "Global Geodynamics Project (GGP)". A detailed analysis of these data aims at, for example, contributing to the validation of the current satellite-borne gravity field missions and to the improvement of the time-dependant gravity field components.

National geodetic spatial reference

The conventional, marked authoritative fixed control point networks are continuously loosing significance. Despite the satellite measuring technology, they still cannot be completely dispensed with. This is why, based on the possibility of providing a major part of the spatial reference via SAPOS[®] in the future, AdV has decided upon a strategy for a nationally uniform spatial reference of the official surveying and mapping in the Federal Republic of Germany. In the future, the national fixed control point network will consist of the geodetic reference network points, the height control points of 1st order in the DHHN92 reference system, the gravitational control points of the gravity reference network and the gravity network of 1st order in the DHSN96 reference system as well as the SAPOS[®] reference station points in the ETRS89 reference system. On the basis of this new fixed control point structure, a new directive for a nationally standardised fixed control point network is currently prepared.

The nationally standardised, homogeneous official fixed control point network is densified by the fixed control point networks required by the respective states.

After AdV issued a nationally standardised formula for the transformation of the Gauss-Krüger coordinate system in accordance with ETRS89/UTM featuring an accuracy of few meters already several years ago, a data record with identical points for a transformation in the decimetre range was developed by all Federal States for interested customers, e.g. for transformation in the GIS range.

The objective of the **SAPOS**[®] satellite positioning service, which is operated by AdV as a joint project, is to provide a uniform, homogeneous spatial reference system for all application areas of the surveying, mapping and cadastral system as well as for further applications on the basis of state-of-the-art technology. **SAPOS**[®] is based on a widespread network of more than 250 permanently operated GPS referen-

ce stations that were determined as fixed control points of the state survey based on a diagnostic adjustment within a homogenous, standard reference system of the European Terrestrial Reference System 1989 (ETRS89). SAPOS[®] offers its customers standardized service applications throughout Germany with varying degrees of accuracy. Transfer media, charges, monitoring as well as the data format are standardized for the whole of Germany. Realtime networking was introduced to enhance the reliability and accuracy of the realtime service SAPOS[®] HEPS. It tackles the problem with residual errors caused by the influences of ionosphere and troposphere and errors in the orbital data.

To enhance acceptance of $SAPOS^{\textcircled{R}}$, the central $SAPOS^{\textcircled{R}}$ agency has been established in the State Survey and Geospatial Basic Information Lower Saxony (LGN) in Hanover. The agency is responsible for the nationwide pooling and provision of $SAPOS^{\textcircled{R}}$ data for national users.

For all **SAPOS**[®] reference stations, a coordinate monitoring in accordance with standardized principles was introduced in 2005. It consists, on the one hand, of an online-monitoring within the scope of the networking of these stations and, on the other hand, of a monitoring with precise orbital data in post processing for controlling the highly precise coordinates in ETRS89.

The GPS reference network GREF operated by the BKG has been further extended. For the nationwide networking, 21 stations are connected in realtime via the Internet (mainly DSL) to the host station in Frankfurt. From the obtained data, correction data in RTCM format are output for NTRIP by means of the Trimble software GPSNet and the original observations are archived in RINEX format in the GPS/GLO-NASS data centre of the BKG. Some of the stations are located close to water level measuring stations, geophysical observatories or stations of the German gravity reference network. This way, the geometric satellite positioning technique can be combined with the dynamic methods of height determination and gravity measurement.

The **SAPOS**[®] sub-networks of the states are integrated by the BKG into the national GREF network as well as into the European EUREF and the global IGS

network. These activities are carried out to define individual buffers for repeated monitoring of the official state coordinates.

As the German Main Height Network DHHN92 is based on observations from the eighties of the past century, AdV decided, on the basis of plannings and cost calculations for a levelling partial modernisation in compliance with the previous accuracy standard, in favour of the repeat measurements of the DHHN92. Additionally, isochronous, highly precise GPS measurements and, hence, the creation of an integrated fixed control point network within the German Main Height Network are planned.

The works on the quasi geoid model for Germany were continued by the BKG in 2004. Comparisons with an independent model solution of the Institute for Earth Surveying at the University of Hanover (IfE) reveal a connection between the differences of both models and the topography. To improve the quasi geoid model, the examinations are focused on the effects of topographic reductions using the new digital terrain models DGM25 (for Germany, 50mx50m) and GTOPO30 (for Europe, 30"x30").

In addition to the point mass illustrations, analytical geoid and gravity models are developed by means of which, among others, data from the CHAMP and GRACE satellite-borne gravity field missions are verified in the regional area.

To safeguard the gravity reference system for the Federal Republic of Germany as regards level and scale in the long term, the BKG conducts regular absolute gravity measurements in combination with continuous recordings from the supra-conducting gravimeters in Wettzell, Bad Homburg and Moxa (station at the University of Jena). Moreover, interconnection possibilities between the gravity component, the height determination with spatial geodetic techniques, the precision levellings and selected coastal level points were created on the basis of absolute gravity measurements on the GPS stations of the GREF network and on points of the integrated "European Combined Geodetic Network (ECGN)". The objective of this approach is the independent control of geometric height changes by means of a physical measurement procedure.

Real estate cadastre

The introduction of the Authoritative Real Estate Cadastre Information System ALKIS[®] as a standardized cadastre information system for Germany is within reach. The data of the Real Estate Cadastre which have been pooled and standardized in the new model offer here-tofore undreamed-of information possibilities. Currently, the Real Estate Cadastre Working Group is dealing with questions on the portrayal and presentation of Real Estate Cadastre data as well as with joint charging structures for the new products.

AFIS[®]-ALKIS[®]-ATKIS[®] poised for implementation

In some states, the implementation of the $AFIS^{\mathbb{R}}$ -ALKIS[®]-ATKIS[®] concept is in full swing. To provide for an overview of implementation planning measures, a survey was conducted, which has revealed that, with the exception of only few states, all states have already organized working groups dealing with the migration into the AAA data model. The majority of states wants to use ALKIS[®] in practice

as early as 2006 or 2007. Either directly in connection with the migration to $ALKIS^{(\mathbb{R})}$ or directly after the migration, most states also prepare for the conversion to the new official reference system ETRS89 / UTM. The implementation of $ALKIS^{(\mathbb{R})}$, questions concerning presentation (Fig. 1) and the provision of data connected therewith were the topics of the year 2004.



Fig. 1 Presentation with the ALKIS[®] signature catalogue

"Official basic map"

The market orientation of the real estate cadastre requires the exploitation of the real estate cadastre's entire data potential. Standardized state outputs, exceeding standard outputs, offer additional possibilities at this point. AdV is preparing a concept for the presentation of a data stock (real estate map plus topographic additions) on a basic scale of 1:5.000. Among others, the concept contains the following key stones:

For this "basic map", presentation guidelines are created for B&W and colour. The standard version shall be coloured. The presentation guidelines shall also cover possible state-specific expansions of already existing products (Fig. 2) and focus on the requirements of practical applications. The standard version optionally contains the land parcel or ownership structure. One map version is to facilitate the representation of house and land parcel numbers. With the basic presentation, AdV wants to address a major concern of planners, e.g. landscape architects and authorities, calling for a work paper on

the basis of the real estate map on a scale of 1:5000.



Real estate map as basis for the official area statistic

Every four years, the statistical authorities perform area data collections pertaining to the actual ground use, which has been annually supplemented for the part quantity of residential and traffic areas since 2001. These statistics are to produce reliable basic information for decisions concerning regional planning and environment on the federal, state and regional level. Area data collection can, however, only live up to its expectations if the available data from the real estate cadastre describe the actual owner and user relationships and provide a suitable accuracy as regards time and content. AdV has recognized the importance of data on the actual use and is in close contact with the statistical authorities to meet their requirements.

To be able to also satisfy the interests of other users and increase topicality, AdV has examined solutions for the assessment and improvement of the topicality of the actual ground use shown in the real estate cadastre. The results of these examinations were given a positive response by the statistical authorities.

Community for the distribution of house coordinates (GVHK)

For many customers, official house coordinates are the key to open up new markets and identify and exploit customer potentials. In connection with additional information and own customer data, the wholesale and retail sector, banks, publishing houses, insurance or power supply companies are able to gain more information on their customers and their respective requirements and to control sales and promotion campaigns in a more efficient way. A wide application range is also given in the fields of vehicle navigation, location based services and municipal environments. The house coordinates are generated from the real estate cadastre and are therefore precise and very reliable. Since the beginning of 2005, a total of ten states have been represented in the GVHK. If cross-state customer requests have to be processed, the state survey office of North Rhine-Westphalia is responsible for the central marketing of house coordinates for the surveying authorities of the Federal States of Baden-Württemberg, Bavaria, Brandenburg, Bremen, Hamburg, Hesse, Lower Saxony, Rhineland-Palatinate and Saxony-Anhalt.



Fig. 3 Community for the distribution of house coordinates

Geotopography

The necessary enhancement of topicality and customer-oriented distribution of geobasis data continue to confront the surveying authorities with additional challenges. With the completion of the Geodata Centre at the Federal Agency for Cartography and Geodesy (BKG) and the progress in state-specific "geodata portals", data and metadata can be offered to a wider circle of users. An animated exchange of ideas regarding dealing with access conditions and extended usage conditions is still pending. The developed concepts and strategies for the enhanced topicality of geobasis data are being put into practice.

Digital landscape models

One of the core tasks of state survey remains the establishment of the Digital Basic-Landscape Model in ATKIS[®] (Basic-DLM). Due to its importance for the small-scale Digital Landscape Models DLM50, DLM250 and DLM1000, for the derivation of the official digital topographic maps and its basic function within the scope of the establishment of the national geotopographical database, the state survey offices have set themselves the goal of completing the third and final realisation stage by the end of the year 2006.

For the derivation of the DLM50, the Federation and the Länder have concluded an agreement on the basis of which the state survey offices are to create a digital, cartographically generalised landscape model with a resolution of 1:50 000 (DLM50.2) and to provide this model to the BKG for use in the field of federal administration until 2006. A first test data stock was generated in 2004 and handed over to the BKG.

Currently, the feature catalogues for the DLM250 and the DLM1000 are finally adapted to the present feature catalogues of the Basic-DLM and DLM50. An updated version is scheduled for 2005. In addition to the seamless modelling over all resolution levels, compatibility with the EuroRegionalMap 1:250 000 and EuroGlobalMap 1:1 000 000 landscape models, which were uniformly designed for Europe by EuroGeographics, is a further focal point. Furthermore, the requirements of the Bundeswehr Geoinformation Service are incorporated into developments in respect of future civil-military products.

The DLM250 and the DLM1000 edited in the BKG are available in the first realisation phase covering wide areas and are annually updated. The contents

are continually extended for the production of the EuroGeographics products EuroRegionalMap and EuroGlobalMap and for the linking of technical data. Thus, in the DLM100 for example, the preconditions for linking hydrological technical data with the water network on the basis of the EU water framework directive have been created in close collaboration with the Federal Environmental Agency, the Federal Agency for Hydrology and the federal state authorities responsible for the waters.

The digital landscape models can only meet the requirements if a high topicality of information can be ensured. The state survey offices and the BKG go different ways as to the topographic information management to gain up-to-date information. Within this context, co-operations with public and private causers of modifications are prioritised. However, also modern communication media and photogrammetric and computer-controlled terrestrial reconnaissance systems are increasingly applied for the collection of information (Fig. 4).

The implementation of the continuous object structuring of real estate cadastre data and of geotopography within the scope of the AFIS[®]-ALKIS[®]-ATKIS[®] project is crucial to the further advancement of the digital landscape models. For the ATKIS[®] technical concept, the feature catalogue for the Basic-DLM has been available since 2004 with the version 3.0 of the GeoInfoDok. Further feature catalogues will be integrated into the GeoInfoDok in 2005. The rules for the migration of the Basic-DLM into the AFIS[®]-ALKIS[®]-ATKIS[®] data structure were formally specified in a first version in 2004 and examined by many Federal States for their special conditions. Based on this, the BKG has scheduled to complete the development of migration software and subject this software to an initial test including the provision of NAS test data in 2005.



Fig. 4 TIM-online by the State Survey Office of North Rhine-Westfalia

Digital terrain model (DTM)

The state survey offices use digital terrain models (DTM) with varying levels of accuracy. Thanks to the feature catalogue for the digital terrain model, version 1.0 of 25.10.2004, a comprehensive description of the DGM in ATKIS[®] and the DGM standard products to be derived from the data stocks is available for the first time. For the ATKIS[®] technical concept within the scope of the project, the DGM feature catalogue is integrated in the GeoInfoDok in 2005 (Fig. 5).

As a result of the computerised merger of the state survey offices' DTM in the BKG, a homogeneous DTM with a terrain-type dependant height accuracy of ± 1 to ± 3 m and a grid width of 50 m was derived for 85% of the area of the Federal Republic of Germany in 2004. For the remaining area, an accuracy of ± 8 m is given. The software is offered in this preliminary version as DTM-Germany (DGM-Deutschland) by the geodata centre. Customer requests for a further quality enhancement will be responded to with an extended data offer of the DTM-Germany featuring a grid width of 25 m.

Model Type	Criteria for Data Capture und Accuracy	Remarks
Digital Terrain Model 2 (DTM 2)	Secondary DTM: - grid width ≤ 1 m or - grid width ≤ 5 m with structure data - height accuracy of grid points: - flat to less inclined surface with low vegetation ≤ 0,15 m - highly inclined surface with low vegetation ≤ 0,3 m - low to less inclined surface with high vegetation ≤ 0,4 m	Highly accurate DTM in flood endangered areas
	Primary DTM: - point distance of primary data < grid width or - point distance of primary data grid width with structure data - height accuracy of primary data in accordance with secondary DTM	
Digital Terrain Model 5 (DTM 5)	Secondary DTM: - grid width ≤ 15 m - height accuracy of grid points: < 1m Primary DTM: - point distance of primary data < grid width or - point distance of primary data grid width with structure data - height accuracy of primary data < 1m	DTM e.g. for production of ortho images or for derivation of contour lines for digital topographic maps with a scale \$\$1:5,000
Digital Terrain Model 25 (DTM 25)	Secondary DTM: - grid width ≤ 20 m and ≤ 25 m - grid width ≤ 20 m and ≤ 50 m as limited exeption permitted - height accuracy of grid points depending on surface: lowland ≤ 1,0 m hilly land ≤ 2,0 m steep ground ≤ 3,0 m	DTM e.g. for derivation of contour lines for digital topographic maps with a scale ≤ 1:25.000
	Primary DTM: - point distance of primary data < grid width or - point distance of primary data grid width with structure data - height accuracy of primary data in accordance with secondary DTM	

Fig. 5 DTM standards

Digital topographic maps

On the basis of the already available digital landscape and terrain models, the state survey offices started the derivation of the topographic map books on the basis of new map graphics, documented in the ATKIS[®] signature catalogues. While digital topgraphic maps (DTK) on the scales 1:10 000 and 1:25 000 already make up a large part of the state survey offices' product range, a first map sheet on the scale 1:50 000 of the future joint civil/military map book "Topographic map 1:50 000" was published in 2004 (Fig. 6).

For the DTK on the scales of 1:100 000, 1:250 000 and 1:1 000 000, the map graphics and portrayal catalogues are currently developed. The portrayal catalogues will be integrated into the $\text{ATKIS}^{\text{(R)}}$ technical concept within the scope of the $\text{AFIS}^{\text{(R)}}$ -ALKIS^(R) ATKIS^(R) project in 2005.

Until the topographic map books to be created on the basis of the $ATKIS^{\textcircled{R}}$ portrayal catalogues are available, the Federal Government and its states will update the conventional topographic map books within the required scope, keep them ready for printing and store them as raster data record for diverse applications.



Fig. 6 Section of the digital topographic map 1:50 000 (ATKIS[®]-DTK25)

Interactive topographic maps on CD-ROM

The CD-ROM series published for the whole of Germany by the Federation and the Länder which presents the raster-formatted topographic map 1:50 000 "Top50" and the topographic overview map 1:200 000 "Top200" as software, is completely available in the version 4.0. It is now possible to take a virtual flight over Germany.

Toponymy

The Permanent Committee for Geographic Names (StAGN), which has its business office at the Federal Agency for Cartography and Geodesy (BKG), primarily focuses on the standardisation of the official and private use of geographic names in the Germanspeaking zone. These activities are taking place in close collaboration with the United Nations Expert Group for Geographic Names (UNGEGN). The StAGN called two meetings in 2004, the 115th StAGN meeting in the Sankelmark Academy near Flensburg and the 116th meeting in the BKG in Frankfurt/Main.

Several StAGN members took part in the 22nd meeting of the UNGEGN in New York, where 9 working papers were presented by StAGN. Among others, the new EuroGeoNames projects was comprehensively introduced (www.eurogeonames.org).

From the map book "Geographische Namen in den deutschen Küstengewässern 1:200 000" (Geographic Names in the German Costal Waters 1 : 200 000"), sheet 1 – Lower Saxonian Coast and sheet 2 - Schleswig-Holstein west coast were published by the State Survey and Geospatial Basic Information Lower Saxony (LGN). Sheet 3 - Schleswig-Holstein east coast, West Mecklenburg coast and sheet 4 – East Mecklenburg and Western Pomeranian coast will shortly be printed by the Schleswig-Holstein or Mecklenburg-Western Pomeranian state survey offices. All in all, the four sheets document 1377 geographic names in the German coastal waters.

Even after the recent discussion on the German spelling reform, the StAGN does currently not see any reason to modify its recommendation of 17.09.1999 concerning the application of the new German spelling reform to geographic names (www.ifag.de/kartographie/Stagn/NeueRechtschreibung.htm). AdV plenum already agreed in the meeting of 11./12.05.2000 to follow the recommendations of the StAGN.

Copyright and sales

The Geodata Centre, which has been established in the BKG, pools the digital landscape and terrain models and the digital topographic maps of the ATKIS[®] and distributes them throughout Germany in a harmonised format. Via the Internet portal of the Geodata Centre www.geodatenzentrum.de, interactive maps for direct access to the data stock, test data for download, online coordinate information as well as technical information and aids are offered. Thanks to the online ordering system, geobasis data can be requested and made available via the Internet. So far, only federal institutions have been able to use this service to its full extent. Linked with the Internet portals and Internet shops of the federal states, the metainformation system informs on the availability, features and contact partners of the products. The conversion to the ISO standard is expected to be completed by mid-2005, supporting data research and the networking of different systems even more efficiently. Some authorities have already changed their data acquisition behaviour as a result of the online sales service. Data are merely retrieved if required. The local storage and administration of large data stocks can be dispensed with.

Public relations work, trade fairs and exhibitions

Within the scope of the development of geospatial data infrastructures in the Federal Republic of Germany, AdV recognised the need to raise the level of awareness for products offered by the state surveying authorities (geobasis data). As in the previous years, the German state survey, represented by AdV, exhibited its products and services at the leading international trade fair for surveying and mapping, the INTERGEO^{(\mathbb{R})} in Stuttgart (Fig. 7), and at the book fair in Frankfurt/Main. Besides the presentation of state survey products, accompanying lectures and discussions were also held. Together with the Inter-Departmental Committee for Geographic Information (IMAGI), the BundOnline project group and the e-government initiative Germany-Online (Deutschland-Online), the "Deutschland Viewer" project, which was completed by AdV, was presented at the joint exhibition stand at the INTERGEO[®] 2004 . The Deutschland Viewer enables access to OGC-based geodata services (Web Mapping Services) for the visualisation of decentrally distributed geodata in an Internet browser.



Fig. 7 The geodata of the German state survey is presented at exhibitions and trade fairs on a joint stand of AdV – here, at the INTERGEO[®] 2004 in Stuttgart

Information and communication technology

Information and communication technology forms the technical interface between operations in the field of spatial reference, real estate cadastre and geotopography. The task of the Information and Communication Technology Working Group is to ensure the uniformity of geobasis data and their provision from the point of view of the information and communication technology in the context of a geospatial data infrastructure and to co-ordinate the information-technological GDI activities within AdV and for AdV on a national level.

The key activities are the advancement of the subject-neutral $AFIS^{\mathbb{R}}$ -ALKIS^{\mathbb{R}}-ATKIS^{\mathbb{R}} - basic schema (AAA basic schema), the validation of the standard-based data exchange interface NAS and the submission of proposals for the specification of standardised services for geobasis and geotechnical data (application profiles for geoservices).

Version 4.0 of theDocumentation on modelling the geographic information of official surveying and mapping – GeoInfoDok), the result of a comprehensive revision management with GIS manufacturers and users, is available on the Internet under www.adv-online -> publications -> AFIS-ALKIS-ATKIS project.

AAA basic schema

The AAA basic schema forms the basis for the technical application schema for modelling the $AFIS^{(\mathbb{R})}$, $ALKIS^{(\mathbb{R})}$ and $ATKIS^{(\mathbb{R})}$ objects and for data exchange. Being a neutral entity, the other technical information systems can also use the classes defined in the AAA basic schema for modelling and reference the contents of it by inheritance (Fig. 8). During the reporting period, the AAA basic schema was further developed based on the knowledge gained from the implementation in the sates and in co-ordination with the GIS manufacturers. This particularly refers to the standard-conforming adaptation of the geometry classes to the ISO standards as well as to the modelling of selection criteria for the AAA outputs following the OGC filter coding specification.

To ensure that the modelling experts of technical



Fig.8: Connection of technical schema to the AAA basic schema

In 2005, AdV prepared a guideline for "Modellierung von Fachinformationen unter Verwendung der GeoInfoDok" (Modelling of technical information using GeoInfoDok). The publication is available at www.adv-online.de. It contains general modelling principles for technical information and selected application examples for the modelling of technical information in the fields of land development, earth reference values and municipal applications. As a basis and recommendation, the guidelines have been widely accepted among modelling experts. information can comfortably and economically "dock" to the GeoInfoDok, the following AAA modelling tools are made available for download from AdV Internet pages after the user has registered online:

- the AAA catalogue tool (derivation of catalogues from an AAA-compliant UML model),
- the NAS schema generator (generation of NAS files from an UML model) and
- the AAA profile tool (determination and import of profiles into an AAA-compliant UML application schema).



Fig. 9 AAA technical standard

The AAA basic schema has been consistently modelled on the basis of the international ISO and OGC geographic information standards. Compliance with international standards facilitates the use of standard software components which have also been implemented on the basis of these standards (Fig 9).

The objective of a geospatial data infrastructure is the description of different technical systems in accordance with standardised rules. This is why the standardisation does not refer to the technical contents but to the methodology and the formal description thereof. The basic schema offers exactly this framework methodology for the structuring of geographic information and therefore forms a basic module for the establishment of a geospatial data infrastructure in Germany.

Standard-based data exchange interface (NAS)

The NAS is used whenever the application emphasis is put on the originality of data, the full evaluation capability and the differentiated continuance. The NAS of the AAA application schema consists of two essential components: one the one hand, of the technical contents being derived from an AAA technical schema and, on the other hand, of the syntax for data encoding using XML schema. The NAS is therefore only applicable with regard to the AAA technical schema. A different "branch NAS" uses the same syntax for data encoding, but contains and transports different technical contents.

The NAS is based on the XML standards developed by the World Wide Web Consortium (W3C). For the description of features, the Geography Markup Language Version 3.0 (GML 3.0) is used. GML is an OpenGIS standard and is currently also integrated into the ISO 19100 standard series.

The published NAS 4.0 complies with the discontinued GML 3.0. Filter encoding in combination with a small number of AdV-specific updates is used in consultation with the GIS manufacturers for the formulation of selection criteria. From a current viewpoint, NAS 4.0 will require only minor changes to ensure compliance of the NAS with the ISO conformity which will soon be based on GML 3.2.

The representation of the conceptual model in the NAS is specified by the NAS encoding rules, which control the automatic derivation by means of the NAS schema generator (Rose Script). The control parameters are formally described additional rules for the representation of the UML data model in the XML schema file (Fig. 10).



Fig. 10 Derivation of the NAS

Geoservices application profiles for the establishment of the geospatial data infrastructure Germany

The establishment of the GDI Germany requires an information-technological co-ordination. AdV contributes its expert knowledge in the fields of data modelling, data exchange and standardised geoservices (application profiles for geoservices) to this coordination process. The generation of a synopsis from the available WMS specifications for geobasis data, an AdV proposal and a guideline for a national Web Map Service (WMS) as part of the development works GDI-DE was the first contribution by AdV. Within the context of the geospatial data infrastructure Germany, AdV contributions for further application profiles enabling access to object-structured geodata (WFS - Web Feature Service), the object-structured selection from a geodata basis (FE - Filter Encoding), the determination of the graphical realisation of layers (SLD - Styled Layer Descriptor) as well as for the procurement conditions and delivery mechanisms (WPOS - Web Pricing and Ordering Service) have to be prepared in a next step.

The BKG and AdV participate in the development of a German application profile for metadata interfaces. Despite the existing ISO, OGC and W3C standards, such an application profile is crucial for a troublefree communication of metadata between different interfaces. The jointly developed ISO application profile for the current Web Catalogue Specification, has been filed with the OGC (Discussion Paper Chicago Meeting, OGC document 04-038r1) and adopted as recommendation paper.

The linking of metadata with geodata is to be carried out via services (ISO 19119) in the future. This way, the webservices of the geodata (digital maps) can be directly accessed via the hit lists of the GeoMIS.Bund.

The standards of the Open GIS Consortium and dejure standards of the ISO/TC211 shall be applied in order to guarantee interoperability of geospatial data infrastructure projects. The initiative "Infrastructure for Spatial Information in Europe (INSPIRE)" is bound to have considerable effects on the GDI developments in Germany (Fig. 11).



Fig. 11 Components of a geospatial data infrastructure

Cooperation in international organizations

Eurogeographics

EuroGeographics (EG), the Association of the National Geodetic, Mapping and Cadastral Agencies of Europe, has defined as its primary goal the setup of the reference data (geodetic reference networks and basic geodata) of a European Geodata Infrastructure and to provide its interoperability. For this purpose, EuroSpec was established as a strategic project with the aim of pushing ahead the harmonization of the specifications of the data and services as required for the European Geodata Infrastructure. To this end, EuroGeographics has set up a coordination group comprised of high-ranking representatives from the member organizations. This group, which also includes BKG, ensures consultation and harmonization within the existing EU working groups and attends to the preparation of new projects. During the period under review different EuroSpec expert groups were set up, which in part are run by BKG.

Within the frame of EuroGeographics BKG took an active role primarily in the development of the products SABE (Seamless Administrative Boundaries of Europe) as a project coordinator, in EuroGlobalMap (EGM) as a regional coordinator, and in EuroRegionalMap (ERM) as a partner. SABE, the vector dataset of the administrative boundaries of Europe, was created in the year 1993 on the basis of a specification developed by BKG and has since then been continuously updated by BKG. All six versions published by now are available in the application scales 1:100 000 and 1:1000 000 as well as in different exchange formats. The second edition of the SABE2001/Census product was completed in April 2004, which contains the geometry, the names as well as the key-numbers of more than 136 000 administrative units, which means in harmonized form and on the basis of data supplied from 35 European countries. Since May 2004 BKG's SABE team has been working on the next, extended version of the SABE product with a status of revision of July 2003 for all former EU countries, and of May 2004 for all new EU countries and all other SABE countries. This revision of the SABE product also includes, in accordance with the agreement made in March 2004 between EuroGeographics and the European Commission/EUROSTAT, the production of a reference of the updated key-numbers of the administrative units to the new NUTS regulation as enacted by EUROSTAT. Besides providing the relevant data and metadata BKG offers to his customers as well as to interested persons comprehensive advice, an upto-date user manual and also a sample dataset for downloading from its website:

http://www.eurogeographics.org/eng/04sabe.asp.

The projects ERM and EGM promoted by the EU could be successfully completed in October 2003 and March 2004, respectively. In the first project a dataset for demonstrational purposes at 1:250 000 scale was generated, which in a first stage comprises 7 countries. In the stage of extension now lying ahead this dataset shall be enlarged to cover all the 25 EU countries. By the end of 2004 the specification had been revised and the work plan set forth with regard to the ensuing extension phase, BKG having contributed considerably to this phase of work. Within the scope of project II, the 2nd version of the dataset 1:1mio which with 36 countries covers already the largest part of Europe was finalized at the beginning of August 2004.

Beyond that, an online ordering and distribution system was developed at BKG to maturity for the product range SABE, EGM and ERM on the basis of the system used in the GDZ (GDC/GeoDataCentre), and released in September 2004 for official use by EuroGeographics (see:

www.eurogeographics.org/eng/04 buying.asp).

In view of the aspired interoperability of the European basic geodata the specifications of the afore mentioned small-scale products were harmonized, within the frame of an expert group directed by BKG, while taking into account the overriding aims as defined by INSPIRE and EuroSpec. Moreover, an application for support of the RISE project was filed to the EU Commission with the participation of BKG. RISE (Reference Information Specifications for Europe) constitutes a common project performed within the frame of the FP6 program, the aim of which is the definition of specifications for the purpose of implementing spatial geodata while taking into account both the particular requirements of the European program GMES (Global Monitoring for Environment and Security and INSPIRE. In this project to be launched in 2005 BKG will deal with some partial components and be especially responsible for the work package "Conceptual Schema & Specifications".

BKG also cooperates with the two Working Groups handling the project "Euroboundaries", which has also been taken care of by EuroGeographics since the year 2004. The target of this project consists in achieving creation - in a first stage with the cooperation and on the basis of six European countries - of a "definitive" database of the European national boundaries as well as of a corresponding data network for the whole of Europe.

The project EuroGeoNames planned for 2006 shall enable the setup of a geoinformation network for official geographic names in Europe. In this way it is aspired to better integrate geographical name data into the respective national databases and also into the European Geodata Infrastructure. Access to the decentrally kept national names data stocks is to be realized through a multilingual Internet service, which for the first time will support all official European languages - including the officially recognized minority languages. The project EuroGeo-Names was presented at the 22nd Meeting of the UN Group of Experts on Geographical Names (UNGEGN), where it was well received. During the first project phase of EuroGeoNames a stocktaking shall be done in 2005 of geographical names data files existing in Europe that is to provide information about availability, quality and conditions of access as well as to clarify the relevant responsibilities for these names data within Europe.

In the autumn of 2004 the 4th General Assembly of EuroGeographics took place in Athens, on the occasion of which Prof. Dr. Dietmar Grünreich, President of BKG, was reelected as President of EuroGeographics for another period of office.

Online harmonization of topographic basic data

First experiences with the harmonization of topographic basic data originating from different European countries could be made within the scope of the EU- supported research project "Geospatial Info-Mobility Service by Real-Time Data Integration and Generalisation (GiMoDig)", which was finished in December 2004. By means of a prototype GiMoDig demonstrates the feasibility of online methods for the purpose of border crossing harmonization and visualization of geotopographic basic data for mobile users. The software implemented at the project coordinator, the Finnish Geodetic Institute, is for this purpose served via OGC conformal interfaces from the project partners' databases located in Finland, Sweden, Denmark, and Germany. Further information on this project is available under http://gimodig.fgi.fi.

Working Party on Land Administration (WPLA)

Also in this period under review the AdV took an active part in the activities performed by the Working Party on Land Administration of the United Nations Economic Commission for Europe (WPLA). The representative of the AdV has been reelected as a member of the Steering Committee (Bureau) of the WPLA for the present term of office, lasting until November 2005, and safeguards the AdV's interests in this body. Besides the workshops held regularly twice a year by the WPLA a number of further activities are carried out which are given support by the AdV, special emphasis being laid on a series of studies on fundamental and topical technical subjects concerning land registration and real estate cadastre. These subjects are elaborated by dedicated working groups (Task Forces).

Permanent Committee on Cadastre (PCC)

On 1st January 2005 Luxemburg took over the presidency within the PCC from the Netherlands. Great Britain will take up the chairmanship for the second half of the year. It was agreed on the occasion of the PCC Meeting, held in Luxemburg at the beginning of January 2005, to deal with a project initiated by the new EuroGeographics expert group "Cadastre" within the frame of a joint Working Group. This task concerns the role of the parcel with regard to the specific data to be supplied to INSPIRE. The first session of this joint Working Group has meanwhile taken place in Brussels, another meeting having been scheduled for June, in Luxemburg.

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