

Montana Height Modernization Program (MTHMP) – 2010

A public-private partnership to improve elevation and positional information for public health & safety, economic development, and to support commerce ...



1964 Flood ~ Flathead County, Montana

Project Title: Montana Height Modernization Program (MTHMP) – 2010
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Project Duration: Ongoing, Montana has developed a tentative 5 year plan—the funding request is for 4 years with funding on a one year incremental basis.
Funding Type: Grant (funding opportunity number: NOS-NGS-20082001280) for year one. Federal appropriations for remaining years.

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Funding Request/Year: Yr 1: \$75,000; Yr 2: \$1,155,000; Yr 3: \$1,130,000; Yr 4: \$1,030,000; Yr 5: \$1,610,000

Overview

The challenges of managing a rapidly growing state and the need to respond to emergencies make it imperative that Montana continue to develop and improve its geographic information infrastructure. Montana Height Modernization provides a mechanism for significantly improving the accuracy of our geographic information and maps and provides infrastructure for the future. Height Modernization will greatly assist Montana in managing critical geospatial issues and will support commerce with safe, efficient, and environmentally sound transportation by providing a better way to integrate data. Height Modernization in Montana will mean:

- A denser, more accurate geodetic control network tied to the National Spatial Reference System (NSRS); available statewide (not just in the most populated areas).
- A dense network of continuously operating GPS reference stations (CORS), some of which will transmit real-time kinematic corrections (RTK).
- A consistent framework for a more accurate, more accessible geospatial information system (GIS), available statewide.
- An accurate control network to aid the mapping of critical infrastructure and supporting accurate up-to-date maps.
- Better maps mean better E-911 response. CORS not only provide a direct connection to the NSRS but sites broadcasting RTK provide the opportunity for sub-meter navigational accuracy in urban areas improving consistent GIS.

Height Modernization will help Montana to:

- Resolve floodplain inaccuracies and provide reliable vertical control (elevation) for floodplain certification.
- Provide communities with accurate information about flood risks.
- Facilitate spatial information sharing between organizations, minimize data analysis errors, and reduce unnecessary duplication of data.
- Support precision agriculture, by making GPS driven agriculture more accessible and less expensive, and by increasing the efficient application of fertilizers and pesticides, while reducing pollution.
- Enhance and support hydrology studies and reservoir and well monitoring.
- Improve the efficiency in the development of new water delivery and sewer systems.
- Enhance and benefit transportation planning, engineering, construction, maintenance, and navigation.

Other states that have implemented Height Modernization have demonstrated significant cost savings and benefit to multiple user groups. Montana will also realize economic and cost savings benefits through implementing Height Modernization. While many benefits of Height Modernization will be realized immediately, some aspects of the program will develop through time as some of the

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technical issues behind accurately determining elevations and positions using GPS are much more complex. In addition to the benefits listed above, Height Modernization in Montana will provide an improved system for determining height and geodetic positions throughout the state, in terms of accuracy, accessibility, and vastly reduced user cost.

Requested Action

We requested and received funding support for the Montana Height Modernization Program in the form of a grant in the amount of \$75,000 for year 1. Continuing support of the Montana Height Modernization Program in the out-years is required to provide the benefits outlined in this plan. Current estimates indicate **\$5.0M** is required over the **multi-year** plan period to fully implement Height Modernization across all of Montana. The tentative 5-year funding plan is outlined in the chart below.

| Item | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|-------------------|-----------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| HMD | \$75,000 | \$0 | \$0 | \$0 | \$0 | \$75,000 |
| MGRC | \$0 | \$275,000 | \$250,000 | \$220,000 | \$420,000 | \$1,165,000 |
| Projects | \$0 | \$470,000 | \$470,000 | \$420,000 | \$610,000 | \$1,970,000 |
| CORS | \$0 | \$410,000 | \$410,000 | \$390,000 | \$580,000 | \$1,790,000 |
| Total Cost | \$75,000 | \$1,155,000 | \$1,130,000 | \$1,030,000 | \$1,610,000 | \$5,000,000 |

(HMD=Height Modernization Development, MGRC=Montana Geodetic Reference Center, CORS=Continually Operating GPS Reference Station)

Background

Height Modernization is an effort of the National Geodetic Survey (NGS), an agency within the National Oceanic and Atmospheric Administration (NOAA), to assist states in improving their geodetic control networks. A geodetic control network is the fundamental reference system used for all mapping activities, whether they are national or local in scope. Height Modernization began as a technical effort to use emerging Global Positioning System (GPS) technology to determine and propagate precise elevation information.

The primary goal of Montana Height Modernization is to augment state geodetic resources to efficiently support all surveying, engineering, mapping and geodetic positioning activities. The effort in Montana to obtain Height Modernization funding is being led by a consortium of public and private sector surveyors, GIS professionals, and representatives from the precision agricultural community. This group is comprised of geospatial information professionals, surveyors, and engineers from, Montana Department of Transportation, Montana Department of Administration, Montana Department of Environmental Quality, NGS, and other GIS professionals and land surveyors, including the Montana Association of Registered Land Surveyors. The private sector will contribute by assisting in such efforts as the Mark Recovery Program, building the CORS, installing bench marks, leveling, and GPS observation campaigns.

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As of FY 2009, 17 states have received Height Modernization funds ranging from approximately \$500,000 to \$3,000,000. FY08 appropriations totaled \$6.147M (see Table 1) for ten states. No matching funds have been required and the only requirement placed on partners is for geodetic data resulting from projects funded under Height Modernization to be placed in the public domain.

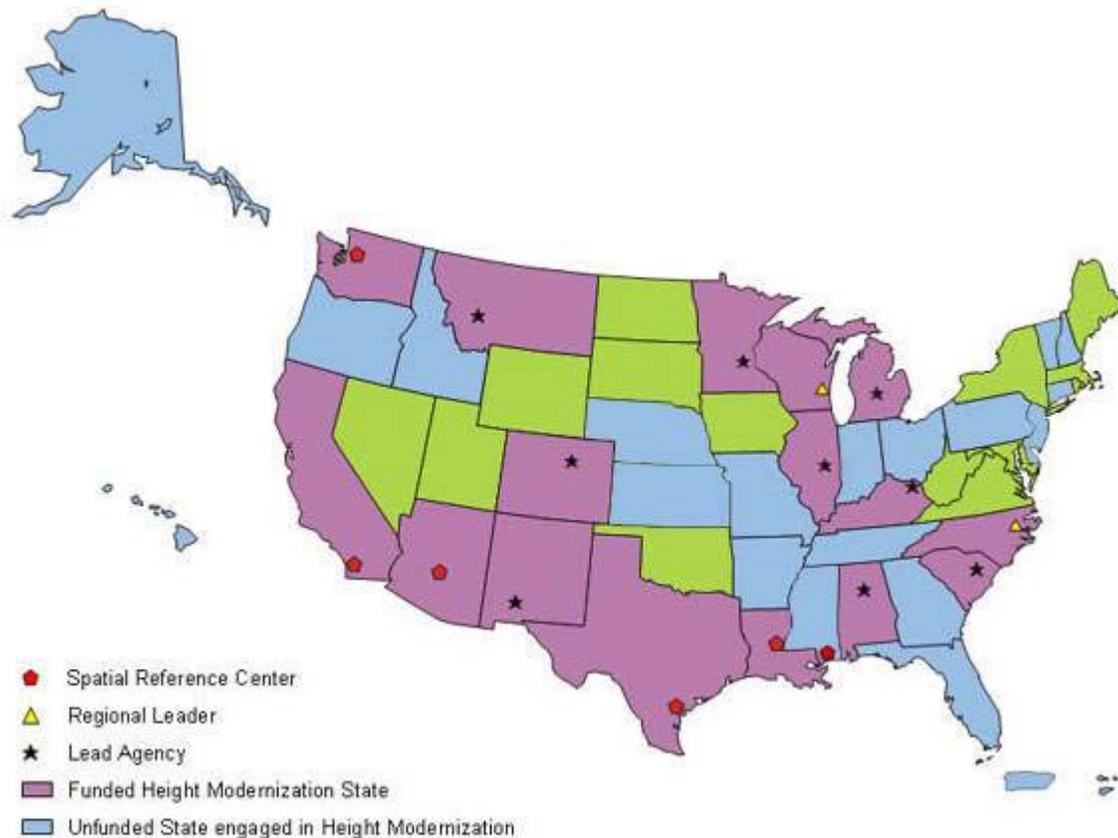
Height Modernization Program Funding Charts and Tables

| Fiscal Year | Appropriations (\$M) | States |
|-------------|----------------------|--|
| FY 2001 | 2.25 | CA, NC |
| FY 2002 | 3.75 | CA, NC, LA, WI |
| FY 2003 | 3.75 | CA, NC, LA, WI, MS |
| FY 2004 | 9.0 | CA, NC, LA, WI, MS, AL, WA, SC |
| FY 2005 | 9.6 | CA, NC, LA, WI, MS, AL, WA, TX, KY |
| FY 2006 | 9.9 | CA, NC, WI, MS, AL, SC, TX, KY, AZ |
| FY 2007 | 9.9 | “without direction” |
| FY 2008 | 4.995 + 1.152 | Line + AL, KY, IL |
| FY 2009 | 2.54 + 9.06 | Line + AL, MS, LA, IL, WI + stimulus? |
| FY 2010 | 2.54 + 7.8 | Line + LA, IL, WI, TX, MS |

Federal Height Modernization Appropriations as of February 2010

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Height Modernization Program Status Map –2010

Montana Height Modernization: The Need Today and the Promise Tomorrow

Rapid growth, wild land fires, homeland and border security, drought, and flood management — these are among the challenges facing Montana now. Through Height Modernization, existing technologies can be better integrated and used more cost effectively to enable Montana to improve its ability to intelligently manage the issues it faces today. Importantly, it will also enable Montana to build a spatial infrastructure that is wisely positioned to take full advantage of inevitable future advances in technology. Height Modernization will help with today's challenges while laying a foundation for tomorrow's opportunities, and support commerce with information for safe, efficient, and environmentally sound transportation.

Project Management

The Montana Department of Transportation would receive and administer Height Modernization funds, unless a more appropriate agency is determined. The Montana Department of Transportation would establish and administer Height

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Modernization funds through the proposed Montana Geodetic Reference Center (MGRC) using guidelines developed by the Montana Height Modernization Working Group in conformance with state regulations. The NGS Advisor to Montana will provide technical guidance and ensure conformance to NGS specifications.

Project Plan

Year One

Year One Funding - \$75,000

Y1 – Item A: Height Modernization Development (\$75,000)

Description: In conjunction with the NGS, continue development/refinement of the *Montana Height Modernization Plan* and as funds allow continue development on an outreach/education plan, conduct further research into establishing Montana Geodetic Reference Center and carry out other Montana height modernization projects. A detailed expense projection for year one is as follows:

| Year 1 | HMD | MGRC | Projects | CORS | TOTALS |
|-------------------------|-------------|-------------|-----------------|-------------|---------------|
| Personnel | \$42,400.00 | \$0.00 | \$0.00 | \$0.00 | \$42,400.00 |
| Fringe Benefits | \$14,225.00 | \$0.00 | \$0.00 | \$0.00 | \$14,225.00 |
| Travel | \$5,000.00 | \$0.00 | \$0.00 | \$0.00 | \$5,000.00 |
| Equipment | \$2,000.00 | \$0.00 | \$0.00 | \$0.00 | \$2,000.00 |
| Supplies | \$2,000.00 | \$0.00 | \$0.00 | \$0.00 | \$2,000.00 |
| Contractual | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| Indirect Charges | \$9,375.00 | \$0.00 | \$0.00 | \$0.00 | \$9,375.00 |
| TOTALS | \$75,000.00 | \$0.00 | \$0.00 | \$0.00 | \$75,000.00 |

(HMD=Height Modernization Development, MGRC=Montana Geodetic Reference Center, CORS=Continually Operating GPS Reference Station)

Year One Accomplishments (as of March 1, 2010):

1. development/refinement of the *Montana Height Modernization Plan*:
 - Updated the Montana Height Modernization Plan*
2. development on an outreach/education plan,:
 - 1.1.1. Developed and produced Height Modernization brochure;
 - 1.1.2. Conducted HT MOD outreach at Montana Association of Registered Land Surveyors 2010 Conference;
 - 1.1.3. Created and maintained HT MOD web page;
3. conduct further research into establishing Montana Geodetic Reference Center:
 - 3.1. Developed a list of potential GRC hosts;
 - 3.2. Developed a list of technical experts to advise the GRC;
 - 3.3. Developed a brochure describing the GRC;

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- 3.4. Performed outreach at the Montana Association of Registered Land Surveyors 2010 Conference;
- 3.5. Created an online database application for Montana control points;
- 3.6. Created a brochure describing the Montana Control Point Database (MCPD);
4. Support densification of the Montana Continuously Operating Reference System (CORS).
 - 4.1. Developed a state-wide CORS densification plan
 - 4.2. Installed 1 new CORS

Year Two

Year Two Funding - \$1,155,000

Y2 – Item A: Height Modernization Development (\$0)

Y2 – Item B: Montana Geodetic Reference Center (\$275,000)

- Description: Establish a Montana Geodetic Reference Center with responsibility for:
- Managing height modernization projects and contracts;
 - Coordinating and leading Montana Spatial Data Infrastructure (MSDI) Geodetic Control efforts;
 - Managing, in cooperation with MT ITSD GIS Bureau, the Montana Coordinate data (control point database) - help to make height modernization data available to the public;
 - Education and outreach for geodetic reference systems, elevation and positional information;
 - Providing leadership and guidance on elevation and positioning related projects, such as elevation data Montana Spatial Data Infrastructure [MSDI] hypsography;
 - Mark Recovery Program - Coordinate work for state-wide mark recovery program to update the NGS recovery notes for all vertical (and horizontal) marks in the state. This is not a rehabilitation or monumentation program. This is merely to identify which marks still exist and are suitable for projects. The bulk of this work must be done the first year in order to assist the planning for future projects and to identify problem areas for vertical control;
 - Support densification of the Montana Continuously Operating Reference System (CORS).

Timeline: Begin when funding becomes available and continue on an ongoing basis.

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Y2 – Item C: Height Modernization Projects (\$470,000)

Description: Complete high priority height modernization projects including installation of new marks and re-observation of existing stable vertical control marks in high priority areas.

Timeline: Begin year two and complete within 18 months.

Y2 – Item D: CORS Projects (\$410,000)

Description: Install CORS stations around the state in the high priority areas (Y2 target 12 new sites).

Timeline: Begin year two and complete within 18 months

A detailed expense projection for year two is as follows:

| Year 2 | HMD | MGRC | Projects | CORS | TOTALS |
|-------------------------|------------|--------------|-----------------|--------------|----------------|
| Personnel | \$0.00 | \$100,000.00 | \$0.00 | \$0.00 | \$100,000.00 |
| Fringe Benefits | \$0.00 | \$25,000.00 | \$0.00 | \$0.00 | \$25,000.00 |
| Travel | \$0.00 | \$10,000.00 | \$0.00 | \$0.00 | \$10,000.00 |
| Equipment | \$0.00 | \$30,000.00 | \$0.00 | \$322,750.00 | \$352,750.00 |
| Supplies | \$0.00 | \$10,000.00 | \$0.00 | \$36,000.00 | \$46,000.00 |
| Contractual | \$0.00 | \$65,625.00 | \$411,250.00 | \$0.00 | \$476,875.00 |
| Indirect Charges | \$0.00 | \$34,375.00 | \$58,750.00 | \$51,250.00 | \$144,375.00 |
| TOTALS | \$0.00 | \$275,000.00 | \$470,000.00 | \$410,000.00 | \$1,155,000.00 |

(HMD=Height Modernization Development, MGRC=Montana Geodetic Reference Center, CORS=Continually Operating GPS Reference Station)

Years Three, Four & Five

Year Three Funding - \$1,130,000

Year Four Funding - \$1,030,000

Year Five Funding - \$1,610,000

Y3, Y4 & Y5 – Item A: Height Modernization Development (\$0)

Y3, Y4 & Y5 – Item B: Geodetic Reference Center (Y3 - \$250,000; Y4 - \$220,000; Y5 - \$420,000)

Description: Continue to fund the Montana Geodetic Reference Center as previously described; create a prioritized list of areas that need new vertical control; develop a plan to install that control; and let contracts for the necessary work.

Timeline: On-going

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Y3, Y4 & Y5 – Item C: Height Modernization Projects (Y3 - \$470,000; Y4 - \$420,000; Y5 - \$610,000)

Description: Continue to identify high priority height modernization projects. Install new marks and re-observe existing stable vertical control marks and perform GPS observations on new and existing vertical control sufficient to meet the demand in identified high priority areas throughout the state.

Timeline: On-going

Y3, Y4 & Y5 – Item D: CORS Projects (Y3 - \$410,000; Y4 - \$390,000; Y5 - \$580,000)

Description: Maintain CORS network and continue to install new CORS stations around the state in the high priority areas. (target Y3-12 new, Y4-10 new, Y5-13 new)

Timeline: 12 months to complete each cycle.

Detailed expense projections for years three, four and five are as follows:

| Year 3 | HMD | MGRC | Projects | CORS | TOTALS |
|-------------------------|------------|--------------|-----------------|--------------|----------------|
| <i>Personnel</i> | \$0.00 | \$100,000.00 | \$0.00 | \$0.00 | \$100,000.00 |
| <i>Fringe Benefits</i> | \$0.00 | \$25,000.00 | \$0.00 | \$0.00 | \$25,000.00 |
| <i>Travel</i> | \$0.00 | \$10,000.00 | \$0.00 | \$0.00 | \$10,000.00 |
| <i>Equipment</i> | \$0.00 | \$15,000.00 | \$0.00 | \$322,750.00 | \$337,750.00 |
| <i>Supplies</i> | \$0.00 | \$10,000.00 | \$0.00 | \$36,000.00 | \$46,000.00 |
| <i>Contractual</i> | \$0.00 | \$58,750.00 | \$411,250.00 | \$0.00 | \$470,000.00 |
| <i>Indirect Charges</i> | \$0.00 | \$31,250.00 | \$58,750.00 | \$51,250.00 | \$141,250.00 |
| TOTALS | \$0.00 | \$250,000.00 | \$470,000.00 | \$410,000.00 | \$1,130,000.00 |

| Year 4 | HMD | MGRC | Projects | CORS | TOTALS |
|-------------------------|------------|--------------|-----------------|--------------|----------------|
| <i>Personnel</i> | \$0.00 | \$80,000.00 | \$0.00 | \$0.00 | \$80,000.00 |
| <i>Fringe Benefits</i> | \$0.00 | \$20,000.00 | \$0.00 | \$0.00 | \$20,000.00 |
| <i>Travel</i> | \$0.00 | \$10,000.00 | \$0.00 | \$0.00 | \$10,000.00 |
| <i>Equipment</i> | \$0.00 | \$15,000.00 | \$0.00 | \$311,250.00 | \$326,250.00 |
| <i>Supplies</i> | \$0.00 | \$10,000.00 | \$0.00 | \$30,000.00 | \$40,000.00 |
| <i>Contractual</i> | \$0.00 | \$57,500.00 | \$367,500.00 | \$0.00 | \$425,000.00 |
| <i>Indirect Charges</i> | \$0.00 | \$27,500.00 | \$52,500.00 | \$48,750.00 | \$128,750.00 |
| TOTALS | \$0.00 | \$220,000.00 | \$420,000.00 | \$390,000.00 | \$1,030,000.00 |

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| Year 5 | HMD | MGRC | Projects | CORS | TOTALS |
|-------------------------|------------|--------------|-----------------|--------------|----------------|
| Personnel | \$0.00 | \$160,000.00 | \$0.00 | \$0.00 | \$160,000.00 |
| Fringe Benefits | \$0.00 | \$40,000.00 | \$0.00 | \$0.00 | \$40,000.00 |
| Travel | \$0.00 | \$20,000.00 | \$0.00 | \$0.00 | \$20,000.00 |
| Equipment | \$0.00 | \$30,000.00 | \$0.00 | \$457,500.00 | \$487,500.00 |
| Supplies | \$0.00 | \$20,000.00 | \$0.00 | \$50,000.00 | \$70,000.00 |
| Contractual | \$0.00 | \$97,500.00 | \$533,750.00 | \$0.00 | \$631,250.00 |
| Indirect Charges | \$0.00 | \$52,500.00 | \$76,250.00 | \$72,500.00 | \$201,250.00 |
| TOTALS | \$0.00 | \$420,000.00 | \$610,000.00 | \$580,000.00 | \$1,610,000.00 |

(HMD=Height Modernization Development, MGRC=Montana Geodetic Reference Center, CORS=Continually Operating GPS Reference Station)

Equipment Over \$5,000 & Travel:

It is anticipated that a number of GPS receivers along with several pieces of computer equipment and software will be purchased with funds under the MGRC and CORS categories. This equipment will be used for and in conjunction with the CORS stations and other height modernization activities. In the past the MDT has determined it is more cost effective to purchase GPS and computer equipment rather than lease it. This may change over time and will be investigated prior to making purchases.

In-state travel is anticipated for reconnaissance work, outreach, and education programs in conjunction with the proposed Montana Geodetic Reference Center functions. In addition, it is anticipated that out-of-state travel for national height modernization outreach and education will also be required. These estimated travel costs have been included under the MGRC item.