



Survey Management Use Cases

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About this document

This document is the summary of the Survey Management (SM) use cases for the National Integrated Land System (NILS) project. These use cases describe how to manage survey measurement data and other geometric data in an automated environment.

These use cases were written with the understanding that the current functionality of the Geographic Measurement Management (GMM) application software will be built into the new Survey Management and Measurement Management applications. Having an understanding of GMM and surveying methods and terminology will aid in reviewing these use cases.

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Change History

Date	Primary Author	Description
7/17/2001	Mark Williams	Compilation of SM use cases
8/8/01	Mani, Jerry	Check/correct grammar, punctuation, etc.

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SM 1.01 Survey Research

High Level Description	
Purpose	Locate, view and evaluate all relevant digital database and non-digital records for the <i>research scope</i> . Sources may include hardcopy records, plats, monument rubbings, aerial photos, survey notes, etc.
Actors	System users, Surveyor, Survey Supervisor
Precondition	Actor needs to research available, relevant records to support a <i>survey project</i>
Postcondition	Available digital and non-digital records have been identified and listed for use in SM-2.01 Field Survey Setup .
Description	Locate, view and evaluate all relevant digital database and non-digital records for the <i>research scope</i> . Sources may include hardcopy records, plats, monument rubbings, aerial photos, survey notes, etc.
Cross reference	SM-2.01 Field Survey Setup ; System Audit Process; GC-01 Conduct Search
Development Implications and Considerations	
Data considerations	
Requirements addressed	

Primary Scenario	
Actor Action	System Response
1. This use case begins when an actor starts the SM-01 Survey Research process.	2. Display research definition tools (e.g. define spatial extent, source types, date ranges) [Run Stored Query] Retrieves previously stored query
3. Actor defines an initial <i>research scope</i> and record types (i.e. query parameters).	4. Search and locate records (GeoCommunicator, internet locations, databases, etc.)
	5. Display research scope and list references to available records. Indicate record location and type.
6. Actor browses list; may view available records of interest.	7. Display record in appropriate format. [view another record] Return to #6.
8. Actor selects records for saving or printing. Note: Actor may choose to view only printed or saved records in the list	9. Process selection. [Save Records] Save selected digital records to actor-specified destination if possible [Save List] Save list of records and their location attributes [Update List] Updates list based on selected records [Print Records] Print selected records [Print List] Print list [Cancel] Cancels record selection
10. Actor may refine list by selecting relevant records. Actor may choose to save and/or print project <i>research scope</i> and/or record list. Actor may choose to relate record list to a <i>Survey Project</i> .	11. <i>Research scope</i> and record list is saved/printed for use in SM-2.01 Field Survey Setup . Link record list, records and <i>research scope</i> to <i>Survey Project</i> . [new Survey Project] create project

List of Records –file on local machine that can be added into survey project file – eliminate duplicates from queries

Query 1**Query 2****Query 3**

Query 1					
Title	Type	Network Link	Local Link	Printed?	Relevant
GLO_T11NR05W_ORIG_PLAT	JPG	http://www.blm.gov/nils	c:\temp	Yes	No
GLO_T11NR05W_ORIG_NOTES	XML			No	
GLO_T22NR05W_ORIG_PLAT					
GLO_T22NR05W_ORIG_NOTES					

Query 2					
Title	Type	Network Link	Local Link	Printed?	Relevant
GLO_T10NR05W_ORIG_PLAT	JPG	http://www.blm.gov/nils	c:\temp	Yes	No
GLO_T10NR05W_ORIG_NOTES	XML			No	

Query 3					
Title	Type	Network Link	Local Link	Printed?	Relevant
GLO_T10NR05W_ORIG_PLAT	JPG	http://www.blm.gov/nils	c:\temp	Yes	No

SM 1.02 Create or Open Survey Project

High Level Description	
Purpose	Open, create, or modify a <i>survey project</i> .
Actors	Surveyor, Supervisor
Precondition	Actor needs to define a survey project and set up default parameters
Postcondition	A survey project has been defined as the current project either by creating a new survey project or opening an existing survey project. Default parameters have been specified.
Description	Actor can open and modify an existing survey project, or create a new survey project.
Cross reference	<i>All MM and SM Use Cases</i>
Development Implications and Considerations	
Data considerations	
Requirements addressed	

Primary Scenario	
Actor Action	System Response
1. This use case begins when the actor chooses to open/create/modify a survey project.	2. Display choice of survey projects. User can browse for location of available survey projects and templates.
3. Actor selects survey project	4. Retrieve and display <i>survey project parameter form</i>
5. Actor edits <i>survey project parameter form</i> and saves.	6. System updates the display [Save] Saves file [Save as] Save as new file name or template [Cancel] Cancels save

Secondary Scenario	
Actor Action	System Response
Templates unavailable	System notifies user and opens a new project.

Survey Project Parameters

Name of Project

Audit data

- User Name
- Created By
- Creation Date
- Date modified

Description

Unit of Measurement in Display

- International feet
- Survey feet
- Meters
- Chains
- Native Units – Units that the data was stored in

Default Error estimates for

- Bearing
- Angles
- Distances
- Control

Datum

UTM Zone

State Plane Zone

Project Elevation

Project_Name

- Survey 1
 - Field Setup File
 - Data

SM 2.01 Field Survey Setup

High Level Description	
Purpose	Process to retrieve or create a <i>field survey setup file</i> to manage the collection of <i>readings, observations, and measurements</i> .
Actors	Surveyor, Supervisor
Precondition	Actor needs to compile information, generate a <i>field survey setup file</i> and configure a <i>data collection device</i> and/or a <i>computation device</i> in preparation for a <i>field survey</i> .
Postcondition	A <i>field survey setup file</i> is created. The <i>data collection device</i> and/or a <i>computation device</i> are configured for a <i>field survey</i> . Available supporting data is copied to the survey project.
Description	<p>User prepares a <i>survey project</i> to be taken into the field. This includes, setting up parameters for collection devices, templates for different survey types, and adding data to a <i>survey project</i>.</p> <p>(An example <i>data collection device</i> is a hand-held device configured with NILS field survey software. An example <i>computation device</i> is a laptop configured with NILS field survey software. Data collection devices and/or computation devices are distinguished from measuring devices such as a total station.)</p>
Cross reference	<i>SM-01 Survey Research; GC-03 Submit Event</i>
Development Implications and Considerations	
Data considerations	Remote databases/datasets may be necessary to provide data
Requirements addressed	

Primary Scenario	
Actor Action	System Response
1. This use case begins when the actor launches the Field Survey Setup process	2. Display choice of <i>field survey</i> types. Example <i>field survey</i> types include: Boundary survey Site Survey Resource Mapping Right-of-way survey Transect survey Administrative survey Densification of control corners Topological survey Engineering/Construction survey Real-time data collection (GPS) ALTA Custom Vertical Control survey Astronomic Observation
3. Select survey type.	4. Retrieve and display <i>field survey setup file template</i> , based on selection. [survey type is "custom"] Assist in constructing and

	optional saving of a custom template.
5. Input to <i>field survey setup file template</i> as appropriate.	6. System creates <i>field survey setup file</i> based on responses to prompts (in #2 and #4). [required template fields not filled in] Advise actor and return to #5. Prompts user to save or upload <i>field survey setup file</i>
7. User selects appropriate action	8. Process input from actor. [Save] Saves <i>field survey setup file</i> [Upload] Uploads <i>field survey setup file</i> to <i>data collection device</i> [Cancel] Cancels operation

Secondary Scenario	
Actor Action	System Response
Hardware configuration error; System out of storage space.	Step #8. System notifies actor.

SM 3.01 Import Non NILS survey data

High Level Description	
Purpose	To import measurement data from other non NILS survey software packages or non NILS <i>data collection devices</i> .
Actors	Surveyor, Supervisor
Pre-Condition	Digital data exists, but not in NILS format. Survey Project exists.
Post-Condition	Data is integrated into survey project.
Description	This process reads a variety of file formats then uses a template to convert the data into the NILS data structure. The user is prompted to provide attributes to bring the data set to NILS content standards. The user may need to construct a custom template and save for reuse. This process includes importing observations collected into <i>data collection devices</i> while not connected to the NILS system. (See table in footnotes)
Cross-Reference	Uses: Extends:
Development Implications and Considerations	Templates must be formed to translate from common survey software packages or <i>data collection devices</i> .
Data considerations	
Requirements addressed	

Primary Scenario	
Actor Action	System Response
1. This Use Case begins when the actor chooses the SM-03_01 Import Non NILS SurveyData procedure.	2. Display the list of available survey file types to be read. Display a file browsing interface. Note: The default survey file type is stored in the <i>survey setup file</i> [Data is on device accessed through an i/o port] Provide access to port through interface.
3. Select a survey file format. Select a file or set of files.	4. Convert non NILS data files into NILS data structure using pre-formed templates for each survey file type. Prompt user to save or cancel.
6. User selects appropriate action	[Save] Save data to current <i>Survey Project</i> . [Cancel] Leaves import process.

Secondary Scenario	
Actor Action	System Response
Survey file type is not listed or unknown.	Step #2 - System should prompt actor to construct/save a custom <i>survey file template</i> .
Non NILS data does not contain needed attributes.	Step #4 - Prompt user for additional attributes that were not collected in non NILS software. Examples include error estimates, auditing data, rule-based point ID numbering schemes.

List of survey software packages known by SM/MM NILS core team

<u>Name</u>	<u>Source</u>	<u>Used by</u>	<u>Comments</u>
CEFB	public domain	Some BLM, some USFS, some private	
CMM	public domain	Some BLM, some USFS, some private	
Traverse PC	private	Some BLM, some USFS, some private	
TDS	private	Some BLM, some USFS, some private	
Trimble Office	private	Some BLM, some USFS, some private - Trimble GPS hardware	
Columbus	private	Some BLM, some USFS, some private - Various GPS hardware	

* Not a complete list.

List of data collection devices known by SM/MM NILS core team

<u>Name</u>	<u>Source</u>	<u>Used by</u>	<u>Comments</u>
Rockwell Plugr	private	Some BLM, some USFS, some private - Rockwell	

Not a complete list.

Definitions:

Measuring device – the device where the reading value first appears. The device can be electronic (GPS, Total Station, EDM) or non-electronic (transit, tape)

Data collection device – the electronic device that stores the measurements and can reduce a set of readings, i.e. mean angle, mean horizontal distance, GPS coordinate.

Computation device – the electronic device that can combine measurements from multiple stations into a survey traverse.

SM 3.02 Import NILS Survey Project or Survey

High Level Description	
Purpose	To import the data for a <i>Survey</i> from another location.
Actors	Surveyor, Supervisor
Pre-Condition	Need to import (copy, merge or append) a <i>Survey</i> from one location into a <i>Survey Project</i> .
Post-Condition	A <i>Survey</i> has been integrated into a <i>Survey Project</i> .
Description	This is a process for ensuring that a <i>Survey</i> is transferred from one location into a <i>Survey Project</i> without losing data. Location of <i>Survey</i> can be either on a different device or a different <i>Survey Project</i> Data is never overwritten or deleted for legal reasons. (Versions) Delete means to flag (in the database) that a record is not used by subsequent computations.
Cross-Reference	Uses: All SM use cases. Extends:
Development Implications and Considerations	
Data considerations	
Requirements addressed	

Primary Scenario	
Actor Action	System Response
1. This use case begins when the user starts the <i>SM 3.02 Import NILS Survey</i>	2. Assist the user in selecting a <i>Survey</i> to append to the current <i>Survey Project</i> .
3. Chooses <i>Survey</i> to import into the current project.	4. Integrates the data to the current <i>Survey Project</i> . Note: Data from another project is always identified as originating from its original <i>Survey Project</i> .

Secondary Scenario	
Actor Action	System Response
Part or all of imported data exists in the survey project.	Step 4. System recognizes duplication and does not append duplicate records into the survey.
Duplicate record in one survey has a different flag value	System prompts user for behavior for each of the three flags (delete, use in adjustment, visible): <ul style="list-style-type: none"> • Use imported value • Use value in current record • Prompt always • Always set flag on • Always set flag off

SM 3.03 Export NILS survey data

High Level Description	
Purpose	To export <i>NILS survey project</i> data to a file for use by a Non NILS survey software package or to devices outside of NILS data system.
Actors	Surveyor, Supervisor
Pre-Condition	Non NILS <i>data collection device</i> or non NILS software needs data from a NILS Survey Project.
Post-Condition	Data from NILS Survey Project is stored in non NILS data structure at specified location.
Description	This process writes a variety of file formats using a template to convert the data into a non-NILS data structure. The user may need to construct a custom template and save for reuse. This process is used when the <i>data collection device</i> is not connected to the NILS environment during data collection. This includes exporting data into <i>data collection devices</i> and exporting data to locations on <i>computing devices</i> for use by non-NILS software packages.
Cross-Reference	Uses: Extends:
Development Implications and Considerations	Templates must be formed to translate to common survey software packages and to <i>data collection devices</i> .
Data considerations	
Requirements addressed	

Primary Scenario	
Actor Action	System Response
1. This Use Case begins when the actor chooses the <i>SM-03_03 Export NILS Survey Data</i> procedure.	2. Display the list of available survey file types to be written. Display a file browsing interface. Note: The default survey file type would be saved in the <i>survey setup file</i> . [Data to be written to device accessed through an i/o port] Provide access to port through interface.
3. Select a survey file format. Select a file or set of files.	4. Convert NILS data files into non-NILS data structure using pre-formed templates for each survey file type. Prompt user to save or cancel.
5. User selects appropriate action	6. [Save As] Save data in specified format and to specified location or device. [Cancel] Leaves export process.

Secondary Scenario	
Actor Action	System Response
Survey file type is not listed or unknown.	Step #2 - System should prompt user to construct/save a custom <i>survey file template</i> .

List of survey software packages known by SM/MM NILS core team

<u>Name</u>	<u>Source</u>	<u>Used by</u>	<u>Comments</u>
CEFB	public domain	Some BLM, some USFS, some private	
CMM	public domain	Some BLM, some USFS, some private	
Traverse PC	private	Some BLM, some USFS, some private	
TDS	private	Some BLM, some USFS, some private	
Trimble Office	private	Some BLM, some USFS, some private	- Trimble GPS hardware
Columbus	private	Some BLM, some USFS, some private	- Various GPS hardware

* Not a complete list.

List of data collection devices known by SM/MM NILS core team

<u>Name</u>	<u>Source</u>	<u>Used by</u>	<u>Comments</u>
Rockwell Plugr	private	Some BLM, some USFS, some private	- Rockwell

Not a complete list.

Definitions:

Measuring device – the device where the reading value first appears. The device can be electronic (GPS, Total Station, EDM) or non-electronic (transit, tape)

Data collection device – the electronic device that stores the measurements and can reduce a set of readings, i.e. mean angle, mean horizontal distance, GPS coordinate.

Computation device – the electronic device that can combine measurements from multiple stations into a survey traverse.

SM 4.01 Collect Field Survey Data in Real Time

High Level Description	
Purpose	To store a <i>set of readings</i> from a <i>measurement device</i> on a <i>data collection device</i> and compute and store <i>measurements</i> , direction, horizontal distance and coordinates of a new <i>survey point</i> . Also, to collect <i>survey point</i> attributes. Save to survey project.
Actors	Surveyor
Precondition	<p>Configuration of equipment must be that the collection device and computation device may communicate with each other. (See table in footnotes)</p> <p>The user needs to determine <i>measurements</i> by observing <i>readings</i> with a <i>measurement device</i>, collecting those <i>readings</i> into a <i>set of readings</i> on a <i>data collection device</i>, reduce the <i>set of readings</i> to <i>measurements</i> with a <i>computation device</i> and then compute the direction and horizontal distance to a <i>survey point</i>, compute the coordinates of a <i>survey point</i>, and attribute the <i>survey point</i>.</p> <p>The <i>measurement device</i>, <i>data collection device</i> and the <i>computation device</i> may have to be configured for transferring, storing and computing <i>readings</i>, the <i>set of readings</i> and <i>measurements</i>.</p>
Postcondition	The attributes and <i>set of readings</i> have been stored. <i>Measurements</i> , direction, horizontal distance, coordinates have been computed and stored.
Description	A measurement device is used to determine the direction and horizontal distance to a survey point, by the actor observing the readings from a measuring device and collecting the readings into a set of readings on a data collection device, which are used by a computation device to compute the direction, horizontal distance and coordinates of a new survey point. Also allows user to input attributes for survey point.
Cross reference	SM-2.01 Field Survey Setup; SM-3.01; SM-3.03
Development Implications and Considerations	<p>The <i>measurement</i>, <i>data collection</i> and <i>computation devices</i> can be totally independent or they may be combined in various configurations. For instance a total station may be used to observe the <i>readings</i> and collect the data, but can not do the computations or is only capable of a limited number of computations. Or the measurement device is not electronic and data is collected by manual entry to a laptop that serves as both a collection device and a computation device.</p> <p>Some measurement devices may be able to store data and perform computations and some data collection devices may be able to perform computations.</p> <p>(See table in footnotes)</p>
Data considerations	<i>Readings</i> are by direct observation of values from a measurement device. Observed <i>readings</i> are stored on a <i>data collection device</i> and organized into a <i>set of readings</i> , which can be used by the <i>computation device</i> to compute a measurement.
Requirements addressed	

Primary Scenario	
Actor Action	System Response
1. This use case begins when the actor launches the process to Collect Field Survey Data in Real Time.	<p>2. Open and display appropriate <i>data collection form</i> for a <i>survey type</i> as defined in the <i>field survey setup file</i>.</p> <p>Populate <i>data collection form</i> and subforms (e.g. metadata) as appropriate. (May be to reference station identifiers-new, occupied, backsight or foresight; may be RTK (Real-Time Kinematic) survey station information.)</p> <p>Provide choice for when user completes the form.</p> <p>[<i>input manual</i>] Go to 3 [<i>measuring device</i> is electronic] Go to 5</p>
3. Input <i>readings</i> to <i>data collection form</i> (manual entry) and inform system that form is complete.	<p>4. Update <i>readings</i> on <i>data collection form</i>. Perform necessary computations depending on survey type in the <i>survey setup file</i>. Compare input <i>readings for tolerance</i> with current set of <i>readings</i>.</p> <p>[<i>readings not complete</i>] goto 3</p> <p>[<i>readings outside of defined tolerance</i>] Notify user and return to 3.</p> <p>Provide choices to accept, reject or repeat current <i>readings</i>, Go to 7.</p>
5. Operate the <i>measuring device</i> , obtain a <i>reading</i> (i.e., sight, measure and poll) and interact with <i>data collection device</i> (i.e. inform system to read from measuring device)	<p>6. Display <i>readings</i> on <i>data collection form</i>. Perform necessary computations depending on survey type in the <i>survey setup file</i>. Compare input <i>readings</i> with current set of <i>readings</i>.</p> <p>[<i>readings not complete</i>] goto 5.</p> <p>[<i>readings outside of defined tolerance</i>] Notify/return to 5.</p> <p>Provide choices to accept, reject or repeat current <i>readings</i>, Go to 7.</p> <p>Note: automated <i>readings</i> cannot be modified (Read-Only).</p>

<p>7. Choose to accept, reject or repeat current readings.</p>	<p>8. Update, <i>readings, set of readings</i> and computed <i>measurements</i> fields on <i>data collection form</i> and on graphics display, based on user action. Computes <i>measurements</i> according survey type.</p> <p>[accept] Update data collection form with appropriate metadata(i.e. next survey point ID, backsight, etc.), computed <i>measurements</i> and save to current <i>set of readings</i> to survey project.</p> <p>[reject] Set delete flag for current <i>set of readings</i> and Go to 3 or 5.</p> <p> of readings not complete] goto 3 or 5 [<i>readings</i> outside of defined tolerance] go to 3 or 5.</p> <p>Provide choices to accept, reject current <i>set of readings</i>.</p>
<p>9. Choose to accept or reject current set of readings and to end a session.</p>	<p>10. Process users choice</p> <p>[accept] Update data collection form with appropriate metadata(i.e. next survey point ID, backsight, etc.) and save current <i>set of readings, the computed direction, horizontal distance, coordinates, and attributes to the survey project</i>.</p> <p>[reject] Set delete flag for <i>set of readings</i> and Go to 5.</p> <p>[close session] Exit with save options.</p>

Secondary Scenario	
Actor Action	System Response
Real time collection not possible	Step 2 Go to Import Non-NILS Data

Footnotes:

computation = bearing, direction, horizontal distance

Table of equipment configurations.

Equipment Configuration during measurement.	Measuring Device	Connected	Collection Device	Connected	Computation Device	Connected	Survey Management	Use Case
Direct connection to NILS	Polls	Yes	Store	Yes	Compute	YES	NILS	Collect Field Survey Data in Real Time
Manual device, i.e. tape or chain, compass	Manual Input	Input	Stores	YES	Compute	YES	NILS	Collect Field Survey Data in Real Time
No direct connection between Collection device and NILS Computation Device	Polls	YES	Stores	NO	Compute	YES	NILS	Import Non-NILS Data
No direct connection between computation device and NILS	Polls	YES	Store	YES	Compute	NO	NILS	Import Non-NILS Data

Poll means to capture readings electronically.

SM 4.02 Point Search and Point Layout

High Level Description	
Purpose	Provide field instructions for getting to a physical point position
Actors	Surveyor, Supervisor
Pre-Condition	Surveyor needs instructions to locate a point on the ground from an occupied survey station. Coordinates exist for the point to locate, the occupied station and, if needed, any backsight point coordinates.
Post-Condition	Instructions for locating the point have been displayed, saved or printed.
Description	This process translates coordinates and lines in the adjusted survey network to derive a set of instructions to give a surveyor. These instructions may be a simple direction and distance from a traverse point or may be a sketch showing occupied station, the point to locate and an angle to turn from each possible backsight point, along with a number of redundant processes to check for blunders.
Cross-Reference	Uses: Extends:
Development Implications and Considerations	
Data considerations	
Requirements addressed	

Primary Scenario	
Actor Action	System Response
1. This Use Case begins when the actor chooses the SM-04_03 Point Search and Point Layout procedure.	2. Prompt for point to set or search for. Prompt for general type of report: display, sketch, textual instructions, angles. The last point set or searched for is the default point.
3. Select a survey point to set or search for by point ID or through spatial display.	4. Highlight point. [Point to set or search for is not on display] Center display on point then zoom to include nearby point and traverse lines connecting to that point.
5. User selects features that are needed in the solution. Examples: station to occupy, possible backsight stations. [Same point to search or set from previous selection] Previous features are default selection.	6. Derive distance from occupied station to point to set or search for. Derive direction to point to set or search for. Display instructions in various formats, sketch and textual. [Backsight points are selected] Derive an angle to turn from each possible backsight. [Blunder detection option] Derive a redundant set of instructions used to detect data or procedural blunders. Prompt user for type of output or cancel.
7. User selects appropriate action	8. [Save sketch] Save in format that can be accessed.

	<p>Examples: JPG, BMP, DXF, SHP</p> <p>[Save textual instructions] This could be also export to <i>data collection device</i>.</p> <p>[Print] Prints Sketch and directions</p> <p>[Cancel] Leaves export process.</p>
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Secondary Scenario	
Actor Action	System Response
Test Shot to temporary survey point	<p>Prompt for measurement data, calculate temporary point position. Could be polled (total station) or manually input (Disconnected GPS unit).</p> <p>Display direction and distance from temporary survey point to survey point being located. The direction and distance is not stored in the measurement network.</p>
Point to set is not visible from occupied station	<p>Prompt for measurement data to a traverse point from where the point to set is visible. The measurement data is stored in the measurement data network.</p>