SWGDE Best Practices for Portable GPS Device Examinations

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1. Purpose

The purpose of this document is to describe the best practices for portable global positioning system (GPS) device examinations.

2. Scope

This document provides basic information on the logical and physical acquisition of data from portable GPS devices.

3. Limitations

This document only addresses portable devices with GPS as its primary function. Some examinations are limited by the ability of the software used to extract the data. Manual examination may be needed if software is unsuccessful. This does not address GPS devices that do not store the data locally, considerations may be needed to collect data from cloud storage.[1]

Some limitations encountered are as follows:

- **Cables** – Data cables are often proprietary and difficult to obtain.
- **Circular Memory** – New data overwrites old data once the on-board memory capacity has been exceeded under a first in / first out storage configuration.
- **Condition of the Evidence** – Commercially available tools may not provide solutions to deal with physically damaged devices.
- **Equipment** – Equipment used during examinations may not be the most recent version due to agency verification requirements of hardware, firmware, and/or software.
- **Memory Cards** – Processing these cards inside the device poses risk (e.g., not obtaining all data including the deleted data, altering date/time stamps, etc.).
- **Passwords** – Some devices may be protected by user-applied passwords.
- **Training** – The individual copying data from a mobile device should be trained to ensure the integrity of the data.
- **Unallocated Data / Deleted Data** – Many forensic tools may only acquire a logical copy of the data. Deleted data may only be recoverable from a physical acquisition[2].

[1] For best practices on acquiring the data contained within infotainment and telematics systems installed in motor vehicles, see *SWGDE Best Practices for Vehicle Infotainment and Telematics Systems* at https://www.swgde.org/documents.

[2] Physical acquisition implies a bit-by-bit copy of an entire physical store (e.g., a memory chip)

4. Evidence Collection

4.1 Seizing Evidence

Immediately upon seizure of a GPS device, document the on-screen data, power down the device and document the on-scene weather conditions. If available, document the GPS position with a secondary device. Disconnect all cables and antennas. Collect all power, data cables and memory cards directly connected to the device. If possible, acquire PIN or passcode information from user.

Note: Some GPS devices utilize subscriber identity module (SIM) cards, frequently embedded into the power cable or in the body of the device, to receive firmware, mapping & POI updates through a cellular data network. These SIM cards contain microprint on their exterior (ICCID) and data within (IMSI) that may be used to retrieve extensive historical network transactional data (e.g. cell site location information or multilateration estimates) from the SIM card's service provider pursuant to consent, exigency or legal process.

4.1.1 Handling Evidence

- Evidence should be handled according to agency policy while maintaining a chain of custody.
- Network isolation of the GPS device should be maintained by keeping the device turned off until processing in the laboratory setting. This isolation should include GPS, Wi-Fi, cellular, and Bluetooth networks.
- Additional forensic analysis – Occasionally, there may be a need to conduct traditional forensic processes on a GPS device (DNA, latent prints, etc.). These are case dependent and should be discussed with the investigator about the need for such evidence as well as the order in which they should be performed. Contact appropriate crime lab personnel for guidance on processing order to avoid the destruction of forensic evidence.
- Biological contaminants and physical destruction provide unique challenges to the recovery of data. Universal precautions should be utilized to protect the health and safety of the examiner.

4.2 Equipment Preparation

"Equipment" in this section refers to the non-evidentiary hardware and software the examiner utilizes to conduct data extraction and analysis of the evidence.

- Equipment and software applications should be verified[3] to ensure proper performance.
- Current information (e.g., user's manual) describing the manufacturer's software/hardware and other relevant documentation should be recently reviewed and accessible.
- Data Cables are often proprietary and difficult to obtain. Some cables are specific to a single device while others support multiple models.

[3] The validation process is discussed in *SWGDE Recommended Guidelines for Validation Testing*, available at https://www.swgde.org/documents.

4.3 Data Acquisition

Prior to data acquisition, the examiner should conduct a thorough review of the device's features/functions related to the storage of user data as outlined in user manual and remove any connected antennas. Obtain appropriate power/data cables and memory cards.

- During data acquisition, isolate the GPS device from Wi-Fi, GPS, cellular and Bluetooth networks.
- GPS devices and their media cards should be protected with some form of hardware or software write-protection.
- Associated media cards, if any, and the GPS device, where possible, should be forensically imaged using an acquisition tool.

4.4 Data Analysis

Analysis of data can be conducted using various tools. Data of importance may include:

- Device configuration settings (Bluetooth pairing)
- Maps
- Tracks/archived tracks
- Waypoints
- Routes/journey
- Saved locations
- Favorites
- Owner information
- "Home" location
- Recent destinations
- City and state history
- Contacts/addresses
- Points of interest (POI)
- Last GPS fix
- Pictures (including Geotags)
- Text messages
- Text files
- Call logs (incoming, outgoing, missed calls)

4.5 Documentation

Documentation should meet the requirements of the examiner's agency and applicable policies.

Evidence handling documentation should include, but not limited to:

- Copy of legal authority;
- Chain of custody;
- Detailed description and/or photographs of the device (make, model, serial number and condition), including an inventory of cables or other accessories seized;
- Photographs or documentation of any visible damage;
- Information regarding the packaging and condition of the device.

Examination documentation should:

- Contain sufficient detail to allow another examiner, competent in the same area of expertise, to identify what has been done and to access the findings independently.
- Include communication notes regarding the case.
- Be preserved according to the examiner's agency policy.

4.6 Archive

Depending on agency policy, acquisition case files should be archived.

- Maintain archives according to departmental policy and applicable laws.
- GPS device acquisitions may capture data using proprietary formats and archiving the tool version used may be required.
- Identify hardware, software and version control numbers and cables or other accessories provided or used by the agency to conduct the examination.

5. Report

Reports should:

- Contain a graphical representation of the data acquired;
- Seek to address case specific requests from the investigator;
- Provide the reader with all the relevant information in a clear and concise manner;
- Be reviewed according to agency policy.

6. Reference Sites and Publications

The below listed resources provide information that may prove helpful to the examiner:

- Garmin and Delorme – https://www.garmin.com
- Lowrance – https://www.lowrance.com
- Navigon – https://www.navigon.com
- Mio – https://www.mio.com
- TomTom – https://www.tomtom.com
- PC Planner – http://lightmarine.c-map.com/it/chart-plotters/pc-planner
- GPS Utility – http://www.gpsu.co.uk
- Magellan – https://www.magellangps.com
- TomTology – https://www.forensicnavigation.com
- Google Earth – https://www.google.com/earth/
- GPS Visualizer – http://www.gpsvisualizer.com
- GPSBabel – https://www.gpsbabel.org
- AVMAP GPX Converter – http://www.avmap.us/index.php?swt=0601&id=514
- EasyGPS – https://www.easygps.com
- Free GPS Software – http://www.maps-gps-info.com/fgpfw.html
- GPSForensics.org – http://www.GPSForensics.org

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History

Revision	Issue Date	Section	History
1.0 DRAFT	2012-06-04	All	Release for Public Comment
1.1	2012-09-12	All	Incorporated general edits and voted to release as an Approved document, version 1.1.
1.2 DRAFT	2018-06-14	3; 4.1; 4.3; 4.6; 6	Reviewed as part of SWGDE 5-year review process and the following updates were made: Added further clarification and "Circular Memory" to *3. Limitations*; Added a note to *4.1 Seizing Evidence*; Expanded *4.3 Data Acquisition*; Expanded *4.6 Archive*; Updated content/links in *6. Reference Sites and Publications*. Voted by SWGDE for release as a Draft for Public Comment.
1.2 DRAFT	2018-07-17	--	Formatting and technical edit performed for release as a Draft for Public Comment.
1.2	2018-09-20	--	No changes were made following the Public Comment period. SWGDE voted to publish as an Approved document.
1.2	2018-11-20	--	Formatted and published as Approved version 1.2.