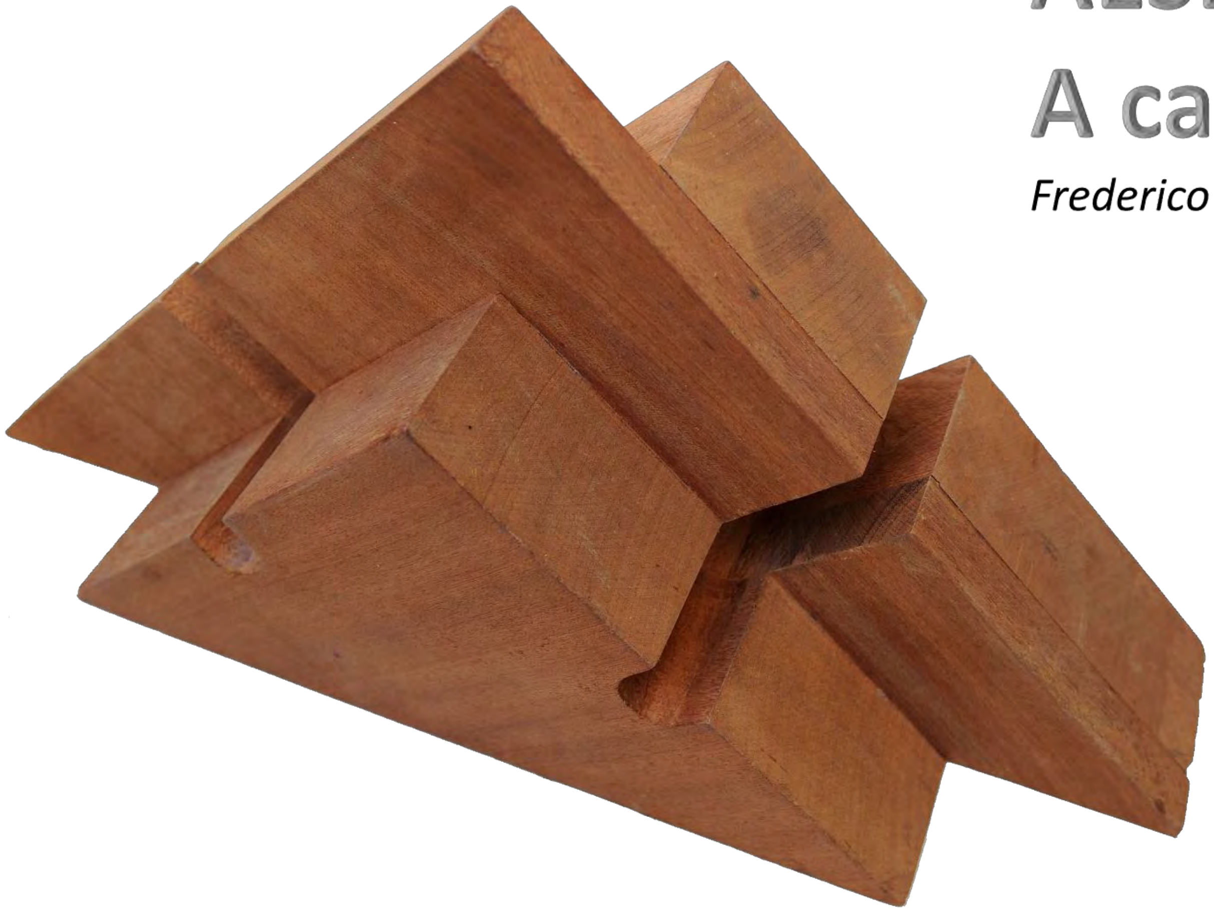
AESDA – Calib
A calibrator for DistoX/X2

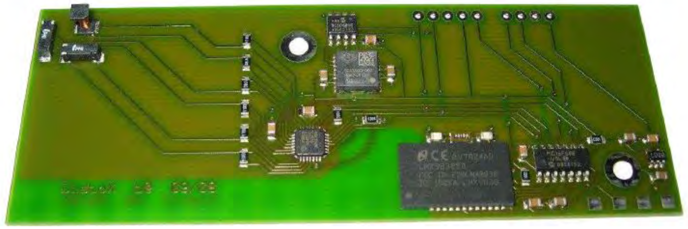
Frederico Tátá Regala



This document is an adapted version of the presentation held in:

13-20 AUG 2016 • YORKSHIRE • UK
Euro Speleo
5th European Speleological Congress

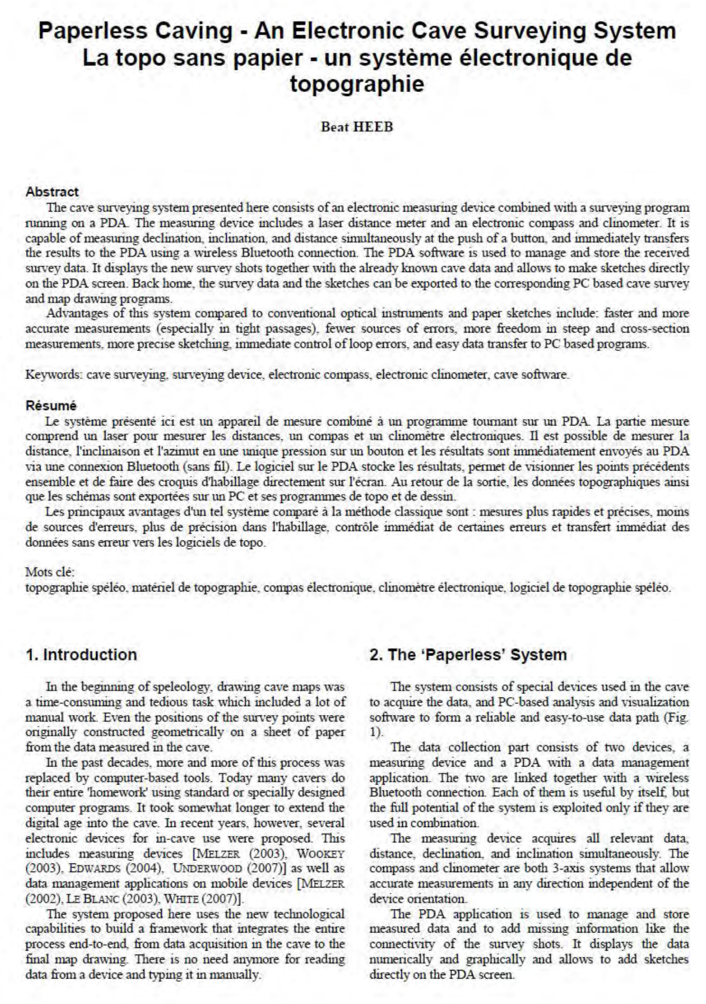
AESDA
Associação de Estudos Subterrâneos
e Defesa do Ambiente



Replacement board for DistoX
(Heeb 2009)

Leica Disto A3

The Paperless Cave Surveying System was created by Beat Heeb in 2007-2008



Paperless Caving - An Electronic Cave Surveying System
La topo sans papier - un système électronique de topographie

Beat HEEB

Abstract

The cave surveying system presented here consists of an electronic measuring device combined with a surveying program running on a PDA. The measuring device includes a laser distance meter and an electronic compass and clinometer. It is capable of measuring declination, inclination, and distance simultaneously at the push of a button, and immediately transfers the results to the PDA using a wireless Bluetooth connection. The PDA software is used to manage and store the received survey data. It displays the new survey shots together with the already known cave data and allows to make sketches directly on the PDA screen. Back home, the survey data and the sketches can be exported to the corresponding PC based cave survey and map drawing programs.

Advantages of this system compared to conventional optical instruments and paper sketches include: faster and more accurate measurements (especially in tight passages), fewer sources of errors, more freedom in steep and cross-section measurements, more precise sketching, immediate control of loop errors, and easy data transfer to PC based programs.

Keywords: cave surveying, surveying device, electronic compass, electronic clinometer, cave software.

Résumé

Le système présenté ici est un appareil de mesure combiné à un programme tournant sur un PDA. La partie mesure comprend un laser pour mesurer les distances, un compas et un clinomètre électroniques. Il est possible de mesurer la distance, l'inclinaison et l'azimut en une unique pression sur un bouton et les résultats sont immédiatement envoyés au PDA via une connexion Bluetooth (sans fil). Le logiciel sur le PDA stocke les résultats, permet de visionner les points précédents ensemble et de faire des croquis d'habillage directement sur l'écran. Au retour de la sortie, les données topographiques ainsi que les schémas sont exportées sur un PC et ses programmes de topo et de dessin.

Les principaux avantages d'un tel système comparé à la méthode classique sont : mesures plus rapides et précises, moins de sources d'erreurs, plus de précision dans l'habillage, contrôle immédiat de certaines erreurs et transfert immédiat des données sans erreur vers les logiciels de topo.

Mots clé:
topographie spéléo, matériel de topographie, compas électronique, clinomètre électronique, logiciel de topographie spéléo.

1. Introduction

In the beginning of speleology, drawing cave maps was a time-consuming and tedious task which included a lot of manual work. Even the positions of the survey points were originally constructed geometrically on a sheet of paper from the data measured in the cave.

In the past decades, more and more of this process was replaced by computer-based tools. Today many cavers do their entire 'homework' using standard or specially designed computer programs. It took somewhat longer to extend the digital age into the cave. In recent years, however, several electronic devices for in-cave use were proposed. This includes measuring devices [MELZER (2003), WOOKEY (2003), EDWARDS (2004), UNDERWOOD (2007)] as well as data management applications on mobile devices [MELZER (2002), LE BLANC (2003), WHITE (2007)].

The system proposed here uses the new technological capabilities to build a framework that integrates the entire process end-to-end, from data acquisition in the cave to the final map drawing. There is no need anymore for reading data from a device and typing it in manually.

2. The 'Paperless' System

The system consists of special devices used in the cave to acquire the data, and PC-based analysis and visualization software to form a reliable and easy-to-use data path (Fig. 1).

The data collection part consists of two devices, a measuring device and a PDA with a data management application. The two are linked together with a wireless Bluetooth connection. Each of them is useful by itself, but the full potential of the system is exploited only if they are used in combination.

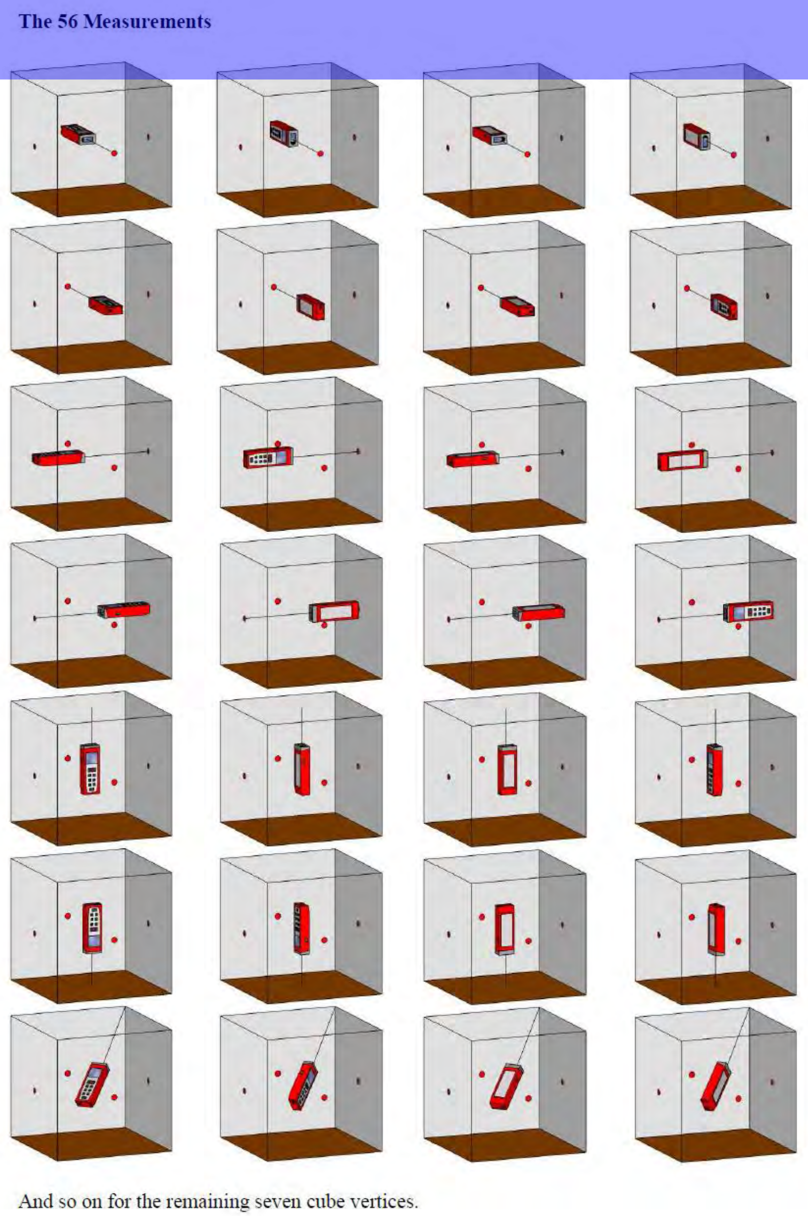
The measuring device acquires all relevant data, distance, declination, and inclination simultaneously. The compass and clinometer are both 3-axis systems that allow accurate measurements in any direction independent of the device orientation.

The PDA application is used to manage and store measured data and to add missing information like the connectivity of the survey shots. It displays the data numerically and graphically and allows to add sketches directly on the PDA screen.

Leica Disto X310

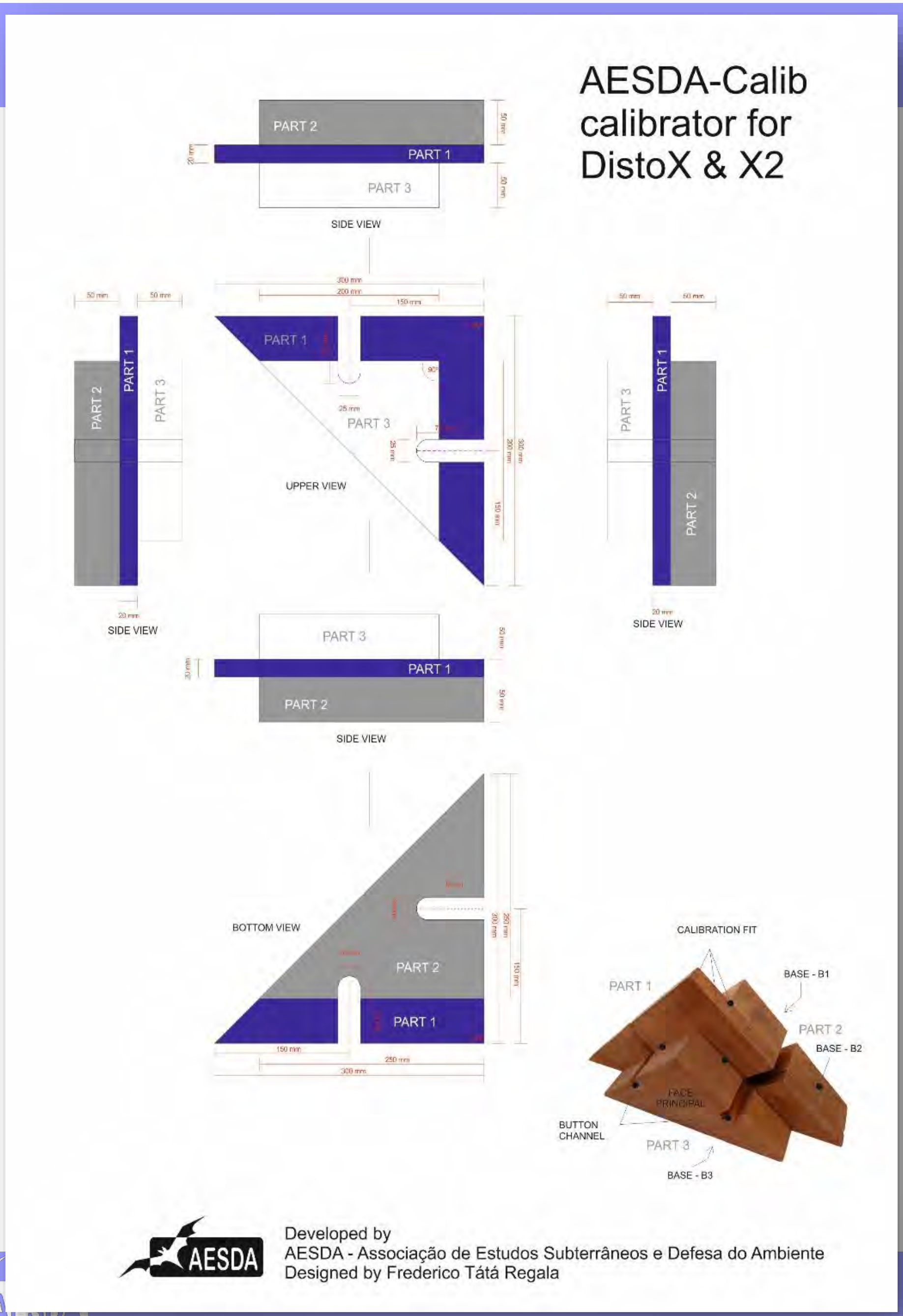
Calibration procedures scheme according to Heeb (2008)

All information in:
http://paperless.bheeb.ch/



AESDA – Calib: manufacturing

- Made of solid material without magnetic properties (wood, acrilic, etc.)
- Without nails, screws or other parts able to disturb the magnetic field
- Flat and straight surfaces, with accurate angles
- Displayed size is the minimum for DistoX, but can be reduced for DistoX2
- Button channels are not needed for DistoX2 because it can be remotely operated



Calibration procedures with *AESDA – Calib*

It is highly recommended to read the Calibration Manual in:
http://paperless.bheeb.ch/

- Before calibration remove the hand strap
- Disto and calibrator mus be clean
- Set the calibrator horizontally
- It must be in a very steady placement, any slight movement during the following procedures will geopardize the calibration!

Calibration procedures with
AESDA - Calib

Phase 1 – the initial 4 horizontal measurements

Remember to rotate the Disto always in the same direction

Calibration procedures with
AESDA - Calib

Phase 1 – the 12 folowing horizontal measurements

Remember to rotate the Disto always in the same direction in each set of 4 measurements

Calibration procedures with
AESDA - Calib

Phase 2 – The 8 vertical measurements
Note: wedge the calibrator properly

Remember to rotate the Disto always in the same direction in each set of 4 measurements

Calibration procedures with *AESDA - Calib*

Phase 3 – 16 diagonal measurements


Measurements 25 to 28


Measurements 29 to 32


Measurements 33 to 36


Measurements 37 to 40

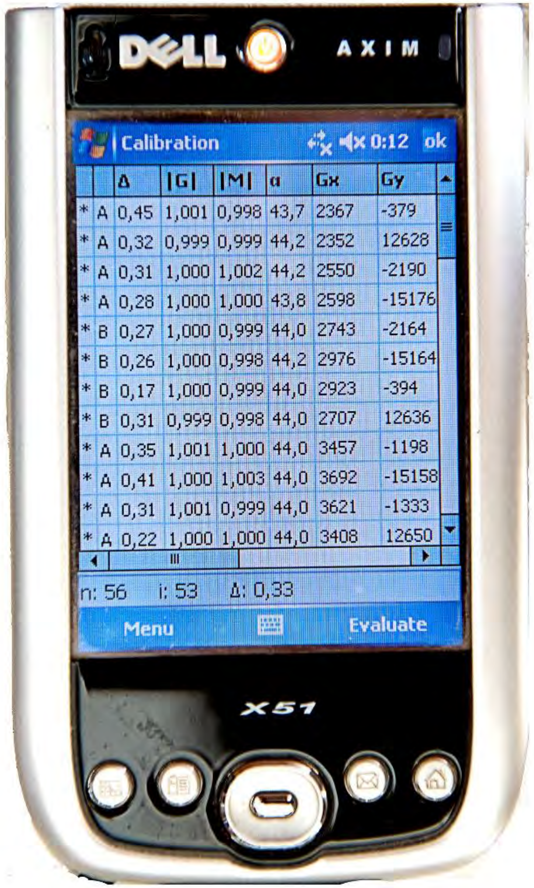
Remember to rotate the Disto always in the same direction in each set of 4 measurements

Calibration procedures with *AESDA - Calib*

Phase 4 – 16 diagonal measurements with the calibrator set in perpendicular position from previous

Remember to rotate the Disto always in the same direction in each set of 4 measurements

- Evaluate the measurements – remember that a good calibration is Δ < 0,50
- Update the DistoX/X2



Nice calibrations and hands on surveying!

☺