Type 2 Liverpool Ringing Simulator

01 – Getting Started Guide

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Contents

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Document History

Version	Author	Date	Changes
0.1	A J Instone-Cowie	10/09/2018	First Draft.
0.2	A J Instone-Cowie	10/02/2019	Added link to documentation on GitHub.
0.3	A J Instone-Cowie	12/05/2019	Add support for Second PC Board.
0.4	A J Instone-Cowie	27/05/2019	Added link to ART Simulator Resources website.
1.0	A J Instone-Cowie	03/08/2019	First Release.
1.1	A J Instone-Cowie	01/10/2019	Multi-PC Options.
1.2	A J Instone-Cowie	18/08/2020	Minor update.
1.3	A J Instone-Cowie	22/07/2021	Add notes about Faculty Jurisdiction, remove references to COVID-19.
1.4	A J Instone-Cowie	19/06/2024	Update external links, general text updates.
1.5	A J Instone-Cowie	09/05/2025	Restyled MR sensors as "Magnetic Sensors" for consistency with Build & Installation Guide.

Cover photograph: Prototype magnet mount, Liverpool Cathedral treble.

Licence

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[1] https://creativecommons.org/licenses/by-sa/4.0/
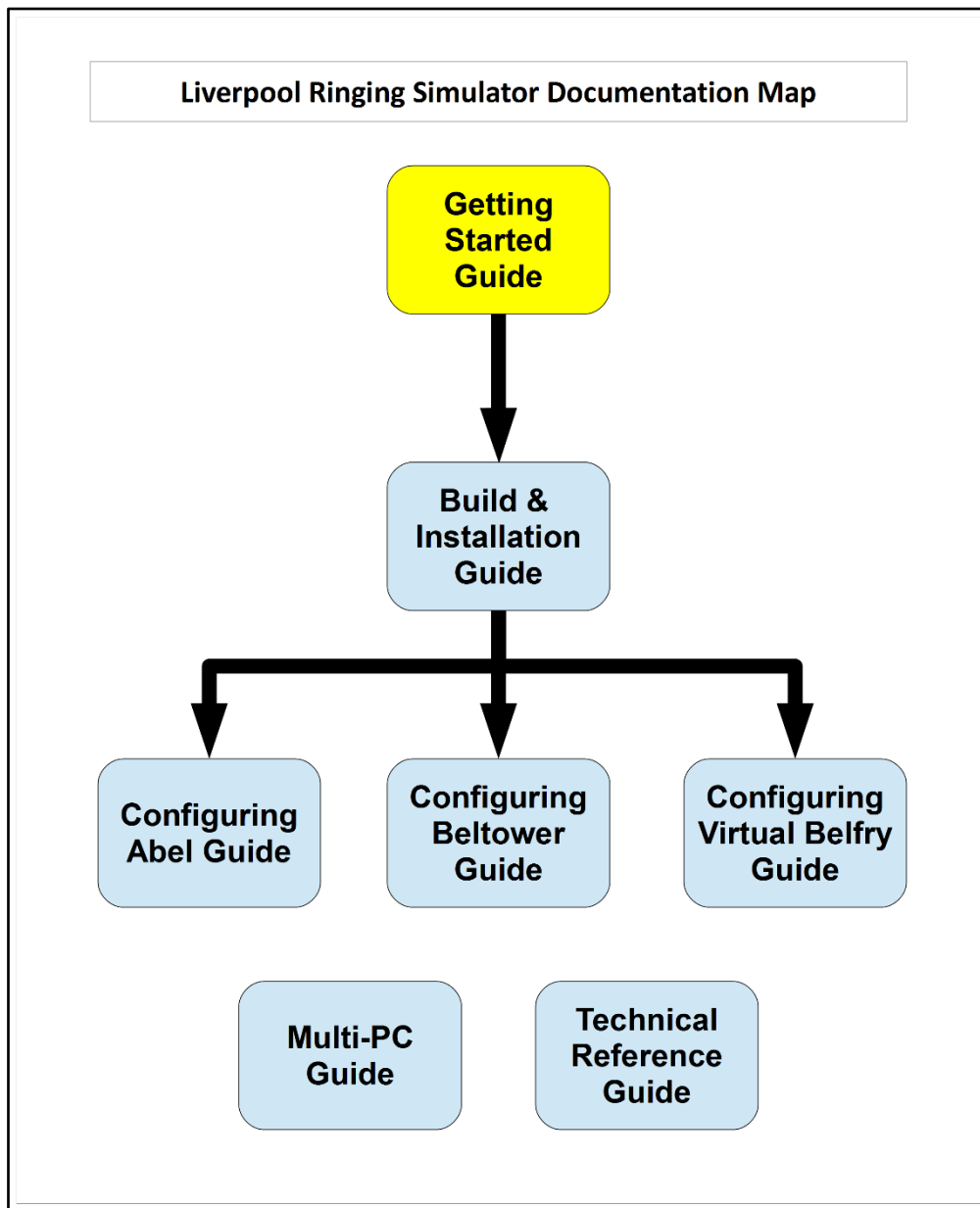
Documentation Map

Figure 1 – Documentation Map

About This Guide

The Type 2 Liverpool Ringing Simulator allows sensors, attached to one or more real tower bells or teaching dumb bells, to be connected to a Simulator Software Package such as Abel[2], Beltower[3] or Virtual Belfry[4] running on one or more PCs. This allows you to extend and augment the teaching and practice opportunities in your tower.

This **Getting Started Guide** introduces the Type 2 Liverpool Simulator and the Liverpool Ringing Simulator Project.

In this guide you will find:

- The background to the project.
- A brief introduction to the Type 2 Simulator hardware modules.
- Guidance on planning your simulator installation.

The other guides contain detailed information on how to build and install the simulator hardware modules and configure a selection of popular Simulator Software Packages. The other guides available are:

- **Build & Installation Guide**
- **Configuring Abel Guide**
- **Configuring Beltower Guide**
- **Configuring Virtual Belfry Guide**
- **Multi-PC Guide**
- **Technical Reference Guide**.

Please note that this is a Build-it-Yourself project. No pre-built hardware is available.

First Steps

This guide is your starting point for the installation of a Type 2 Liverpool Simulator. It provides guidance and suggestions of things you might want to consider when planning your simulator setup.

Next Steps

Once you have completed basic planning, move on to the **Build & Installation Guide** for guidance on building and installing the Type 2 Liverpool Simulator, and the **Technical Reference Guide** if you need more detailed information on a particular topic.

All the documentation for the Type 2 Liverpool Simulator can be found in the *docs* folder on the project GitHub repository:

- https://github.com/Simulators/simulator-type2/tree/master/docs

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[2] https://www.abelsim.co.uk/
[3] https://www.beltower.co.uk/
[4] https://www.belfryware.com/

Background

The Liverpool Cathedral Simulator

The Liverpool Ringing Simulator project was originally based on work undertaken at Liverpool Cathedral to provide a 12-bell simulator for demonstration and training purposes.

The tower of Liverpool Cathedral is open to the paying public during the day, except when ringing is taking place. During regular opening hours visitors can view the bells (which are usually left up) from a gallery above as they pass through the upper levels of the belfry but have no access to the ringing room or belfry floor. These paying visitors are an important revenue stream for the Cathedral, but during ringing the tower is closed to visitors for health and safety reasons.
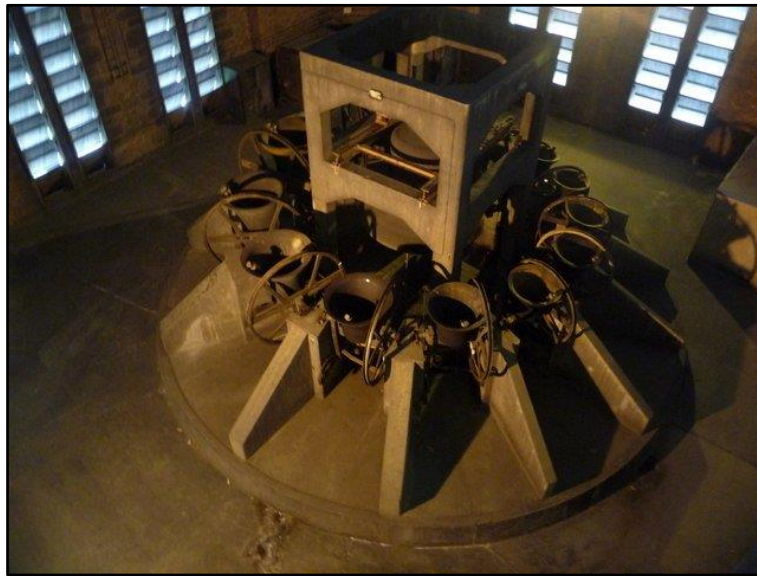
Figure 2 – Liverpool Cathedral Bells[5]

The Cathedral tower was also open weekly to the paying public during the summer months for evening *Twilight Tours*, and from 2012 this was supplemented once a month with guided access to the ringing room and belfry, under the supervision of the Cathedral ringers. Statistics showed that visitor attendances on the "with bells" nights were well above the average, and so the Cathedral were keen to develop this aspect. The Cathedral ringers were also keen to use these events as a means of promoting the work of the Cathedral ringers and ringing generally to the public[6].

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[5] Photograph: "Liverpool Cathedral Bells". © Chris Downer
[CC BY 2.0 (https://creativecommons.org/licenses/by/2.0)], via geograph.org.uk/p/2444012
[6] *Twilight Tours* were suspended because of the COVID-19 pandemic, and at the time of writing in 2024 have not restarted.

The original 12-bell Liverpool Ringing Simulator was developed and installed in time for the 2014 season, and was later expanded with an additional six bell Saxilby simulator set up in the ringing room.

Figure 3 – Saxilby Simulator Installation, Liverpool Cathedral

The Liverpool Ringing Simulator Project

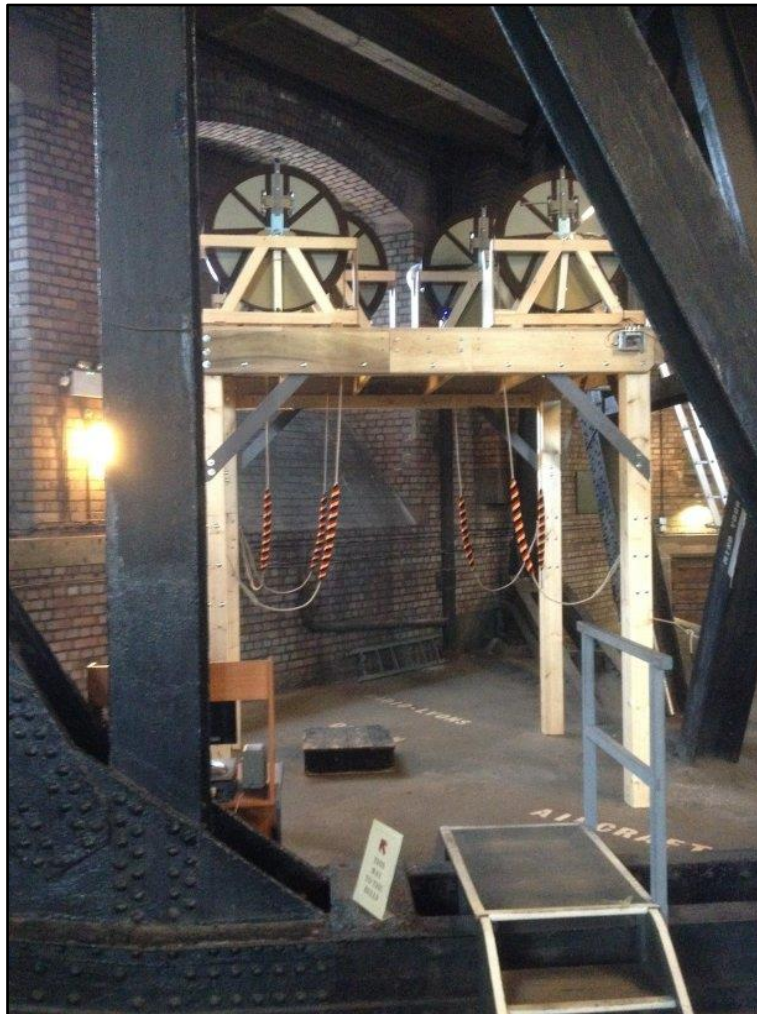From that beginning, the scope of the project has grown, with the aim of producing and publishing designs, software and documentation to enable other towers to build and install their own simulators at relatively low cost.

The objective is straightforward: More simulators in more towers means more time and opportunities for teaching and practice. Learners can spend more time on the end of a rope, leading to faster learning and better engagement. Established bands can extend and improve their capabilities with more opportunities to ring, including extended ringing such as quarter peals.

The use of simulators has great potential in the training of new ringers and the improvement of established bands, and therefore the Liverpool Ringing Simulator Project seeks to promote the installation and take-up of simulators in towers as a teaching aid.

In addition, the project makes all aspects of the design of the simulator available under a Creative Commons licence[7], and releases all software under the GNU General Public Licence (GPL)[8], making it the first fully Open Source Hardware simulator, freely available for re-use, adaptation and improvement by other ringers.

Although the original Liverpool Ringing Simulator worked well, and a number were built and deployed in other towers, it became clear from feedback received from builders and our own experiences, that the original simulator could be improved upon, and construction simplified[9].

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[7] https://creativecommons.org/licenses/by-sa/4.0/
[8] https://www.gnu.org/licenses/gpl-3.0.en.html
[9] All the technical documentation, code and design data for the original Liverpool Simulator remains available on GitHub at https://github.com/Simulators/simulator.

The Type 2 Simulator

Full design and construction details can be found in the ***Build & Installation Guide***, but in summary the general arrangement of a Simulator installation is shown in the diagram below.

The simulator is modular. Sensor modules in the belfry, on up to 16 bells, are connected to a Simulator Interface module. A single cable connects the Interface to a PC in the ringing room, running one of the commercially available Simulator Software Packages. The same cable powers the Interface and Sensors from a low voltage power supply.
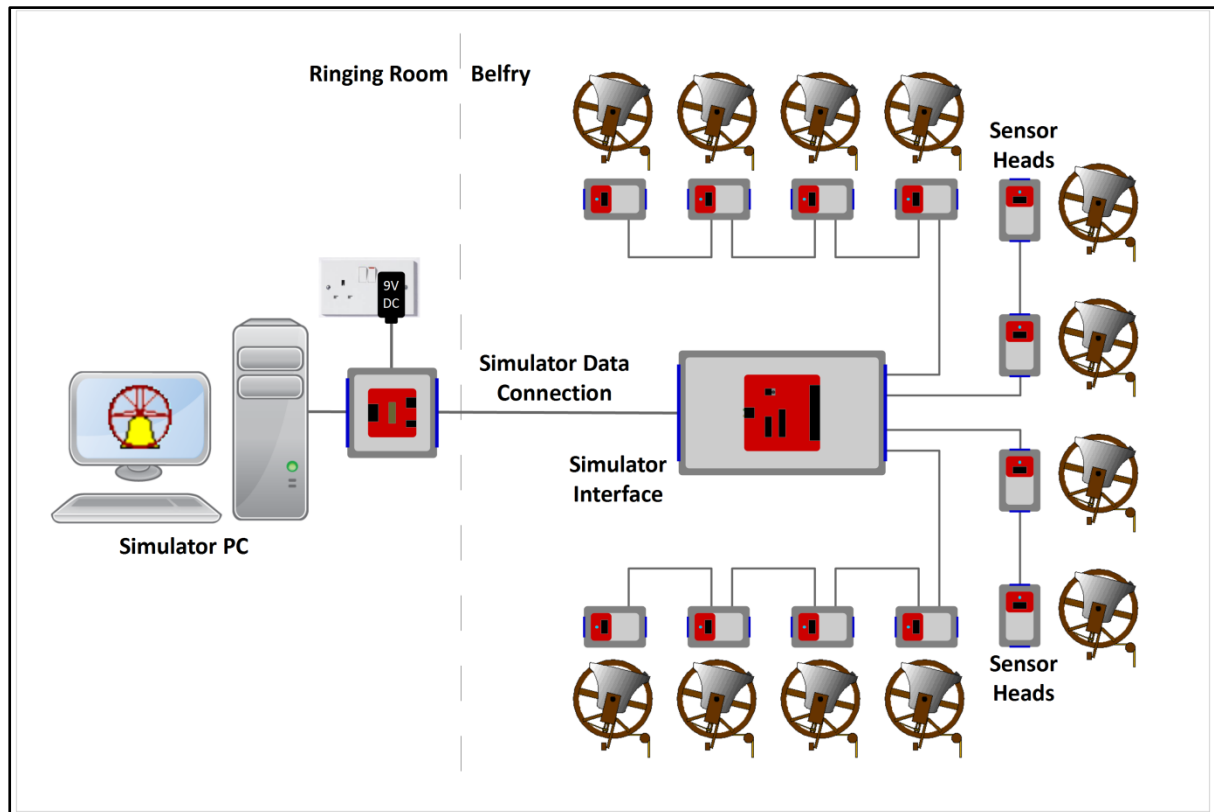
Figure 4 – Simulator General Arrangement

What's New?

The Type 2 simulator has been completely redesigned and updated.

Expanded Capacity

- The Type 2 Simulator now supports up to 16 sensors on a single interface module.
- These can be real tower bells, practice dumb bells, or any combination.
- The Type 2 Simulator supports multiple (up to 16) Simulator PCs used concurrently.

Redesigned PCBs

- The Simulator Interface module and Sensor module PCBs have all been redesigned for easier construction.
- The Interface PCB is larger, less crowded and has improved heatsinking for the voltage regulator – an additional heatsink will rarely be required.
- A Power module PCB simplifies connections between the PC, Interface and power supply in the ringing room.
- PCB header pins are replaced with RJ45 connectors, which are much easier to assemble.
- CAM files for PCB "panels" of Sensor and Power PCBs are available, reducing costs.

Simplified Enclosures

- Replaced the enclosures with readily available Really Useful™ boxes.
- Enclosure drilling and cutting are simplified, and much is eliminated altogether.
- Printable templates are supplied for marking out enclosures for drilling.
- Enclosure lids simply clip on, eliminating many tiny screws.

Off the Shelf Cables

- Uses off the shelf RJ45 network cables, eliminating making and soldering custom cables.
- Together with the redesigned PCBs and enclosures, this eliminates the need for a large number of wire-to-connector solder joints, and pin crimp joints.
- Simplified cabling in the belfry, with "daisy chains" of sensors.

New Guides

- The documentation has been re-written and reorganised into a series of Guides.
- The main **Build & Installation Guide** is easier to follow, with more supplier part numbers and sources, and focused more on assembly and installation.
- Separate guides for basic setup of Abel, Beltower and Virtual Belfry.
- A comprehensive **Technical Reference Guide** covering theory and design, and less frequently used technical details.

What Does It Look Like?

The following photograph shows a full set of module boards for a basic six-bell installation. The belfry Interface Board is top left, with the ringing room Power Board below it. On the right are six magnetic sensors.
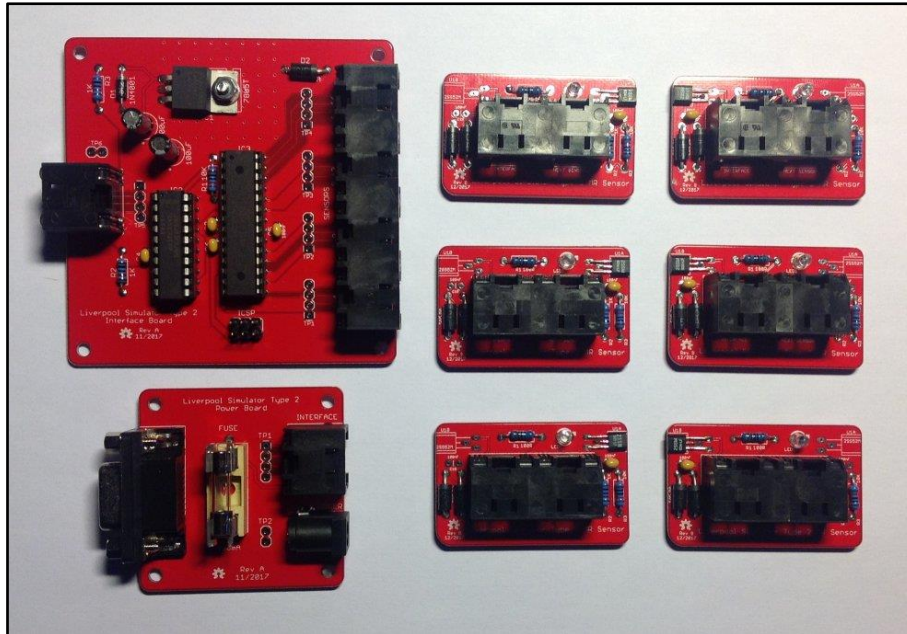

Figure 5 – A Six Bell Board Set

This photograph shows the completed Simulator Interface module in the suggested enclosure, ready for installation in the belfry.

Figure 6 – Completed Simulator Interface Module

This photograph (approximately to scale with the Interface picture above) shows a completed sensor module ready for installation.

Figure 7 – Completed Sensor Module

Available Modules

Designs for the following modules are currently available:

- Power Module
- Interface Module
- Magnetic Sensor Module
- Infra-Red/Generic Sensor Module
- Second PC Module
- Basic Serial Splitter Module

Planning Your Simulator Installation

Before launching in to sourcing parts and building a simulator, spend some time planning the details of the installation, and, equally importantly, how, when and by whom it will be used. A simulator is an important asset – there are many simulators which are under-used or unused because these aspects have not been adequately considered.

What

- What will you need to build your simulator? Read through the **Build & Installation Guide** – Skills, parts, PCBs and installation are all covered.
- What Simulator Software will you use? Review the available Simulator Software Packages and decide which one best meets you needs[10] - there are links in this Guide. You will need to obtain your own licenced copy of the software. If possible, test drive the software before you buy.
- You will also need to source a suitable PC and speakers.
- If your tower falls under the Church of England Faculty Jurisdiction Rules, then from 1st April 2020 you will need the Archdeacon's approval for the installation. There is more information about this in the installation section of the **Build & Installation Guide.**

Where

- Where will the PC and speakers will be sited in the ringing room? You will need access to power sockets for the PC, the power supply for the Simulator Interface, and possible the speakers.
- Where will be Interface module will be located in the belfry? Somewhere out of the way is best, but handy for running cables to the sensors.
- Where will the power/data cable run between the Interface module and PC?

How

- How will the sensor modules will be mounted on the bell frame? There are some suggestions in the **Build & Installation Guide**.
- If you are fitting sensors to real tower bells, how will the bells be silenced – for example clapper stays or ties?
- How will the Simulator be used? For guidance in this area the ART[11] publication **Teaching with Simulators** is recommended, available from the ART shop[12].
- How many PCs do you want to use? Read through the **Multi-PC Guide** for information on connecting and using multiple PCs with the Second PC module or the Basic Serial Splitter module.
- The ART website also has a dedicated **Simulator Resources** section[13].

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[10] The Liverpool Ringing Simulator Project is agnostic about your choice of Software. Configuration Guides are available for all the leading packages which have been tested with the Simulator – currently Abel, Beltower and Virtual Belfry.

[11] Association of Ringing Teachers

[12] https://shop.bellringing.org/

[13] https://ringingteachers.org/simulator-resources

Who

- This a Build-it-Yourself project. Who will source the parts, and who will assemble the electronics?
- Who will install the finished Simulator in the tower?
- Who will use the Simulator, and when? Will you run additional bell-handling practices using the simulator?
- If it's a shared resource for a group of towers or a guild district, who will coordinate its use?
- If applicable, who will handle any application for Archdeacon's approval under the Faculty Jurisdiction Rules?

Licensing & Disclaimers

These are the standard licences used by the Liverpool Ringing Simulator Project. The licences chosen, and their implications are covered further in the **Technical Reference Guide**.

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All original manuals and other documentation (including PCB layout CAD files and schematics) released as part of the Liverpool Ringing Simulator project are released under the Creative Commons Attribution-ShareAlike 4.0 International License (CC BY-SA),[14] which includes the following disclaimers:

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Acknowledgements