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RADE – Second and Third Experiences on Remote Access

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RADE – Second and Third Experiences on Remote Access

1 INTRODUCTION

The present report describes two laboratory experiences on remote access to physical experiment tests for a 2D model, made at the COI1 flume on the 27th of April 2012 and for a 3D model, made at the TOI1 tank on the 6th of June 2012. This is the second set of experiences taken at the maritime hydraulic installations of the Harbour and Maritime Structure Division, of the Hydraulic and Environmental Department of the National Laboratory of Civil Engineering. The first one was on 27th of January 2012

This work is made on the framework of the project RADE a Joint Research Activity of HYDRALAB IV – More than Water. RADE (Remote Access to Data and Experiments) will develop a robust set of information systems to improve access to experiments and data through the innovative use of modern data management, curation and communication technologies.

Traditionally, the hydraulic research community is accustomed to exchange the results of their experiments through papers and conferences. The direct exchange of data is limited to partners cooperating in projects. The objectives of RADE are to allow research partners to access and input to laboratory experiments remotely, thereby saving on costs and the environmental impacts of long distance travel, and to make the results of our experiments more easily accessible for researchers beyond the HYDRALAB community, thus realizing synergy between different partners in Europe and worldwide and creating a climate for further innovations.

The main objective of this laboratory experience is present the procedures to access a laboratory experience remotely both at a flume (2D model) and at a tank (3D model).

Both HYDRALAB IV project and, in particular, RADE project were already described in the first report of this series (Capitão *et al.*, 2011). A description of the experiences made at the COI1

flume (for a 2D model) and at TOI1 tank (for a 3D model) is presented here. Final comments and future work is presented at the final section.

2 OBJECTIVES

The objective of the work reported in this document is to improve the methodology of remote access of laboratory experiences taken at wave flumes and tanks of the maritime hydraulic installations of the Harbours and Maritime Division (NPE).

The methodology is based on the use of fairly simple scheme composed of a video camera installed at the flume, which is connected to a PC computer where the software “Microsoft Expression Encoder” capture video resides and where video are images and decoded and sent to a web server. This server will then enable real-time streaming over the internet, enabling a direct, quasi-real-time, access to the video from web users.

3 DESCRIPTION OF THE REMOTE ACCESS EXPERIENCE

A testing hall for hydraulic tests with an area of 6,500 square meters was used. This hall is mostly occupied with testing flumes and basins for hydraulic model studies. Basins are used for three-dimensional studies of structure stability and wave penetration. Flumes are used for stability and overtopping tests of maritime structures.

3.1 COI 1 flume

COI1 flume is a wave flume used for studying propagating waves over a variable bed and their interaction with a maritime structure. It is possible to construct all kind of foreshore bathymetries in this flume, both fixed bed and mobile bed foreshores, to ensure the wave behaviour in the model will be accurately reproduced according to the prototype. The flume is capable of generating both regular (periodic) and irregular (random) waves. The wave generator is equipped with a real-time active wave reflection absorption system. This means that the wave field reflected by the model structure that propagates towards the wave board is measured and the incident wave field that produced by the wave board is compensated for those unwanted reflected waves. In this way, undesired waves do not re-

reflect towards the model and do not disturb the measurements. Table 1 shows the technical characteristics of COI1 flume. An overview of this flume is shown in Figure 2.

<p>wave flume COI1</p> <p>Length : 49.4 m</p> <p>Width : 1.6 m</p> <p>Height : 0.7 m</p>
<p>wave generator</p> <p>Piston-type (translation) wave board</p> <p>Full stroke : 22"</p> <p>Maximum velocity : 1.6 m/s</p>
<p>wave characteristics</p> <p>Frequency range between $f = 0.01$ Hz - 5 Hz</p> <p>Maximum regular wave height $H_{max} = 0.4$ m</p> <p>Maximum significant wave height $H_{m0} = 0.25$ m</p>
<p>Features</p> <p>Glass wall flume with three meter long observation window</p> <p>Remote-controlled instrument carriage</p>

Table 1- Technical data of LNEC's COI1 wave flume.



Figure 1 - Overview of COI1.

3.2 TOI1 tank

TOI1 is a wave tank used for studying directional irregular waves over a variable bed and their interaction with a 3D maritime structure. As in the case of the flumes, it is possible to construct all kind of 3D foreshore bathymetries in this tank, both fixed bed and mobile bed foreshores, to ensure the wave behaviour in the model will be accurately reproduced according to the prototype. Mobile, 6.0 m long, irregular wave generators for use in the wave basins are available and may produce either regular (periodic) and irregular (random) waves. Passive absorption of wave reflections is provided. An overview of this tank is shown in Figure 2.

In the testing hall there is a Control Room where a centralised control of the entire irregular wave flumes and basins resides. This Control Room also receives all electric signals that convey information from models (resistive probes, force and movement sensors, video, intercoms). Also in the Control Room resides a computer software package, named SAM, which includes a set of methods for the characterization and numerical and physical simulation of sea waves (including wave groups) and processing wave data either from nature or from the wave flumes and tanks.

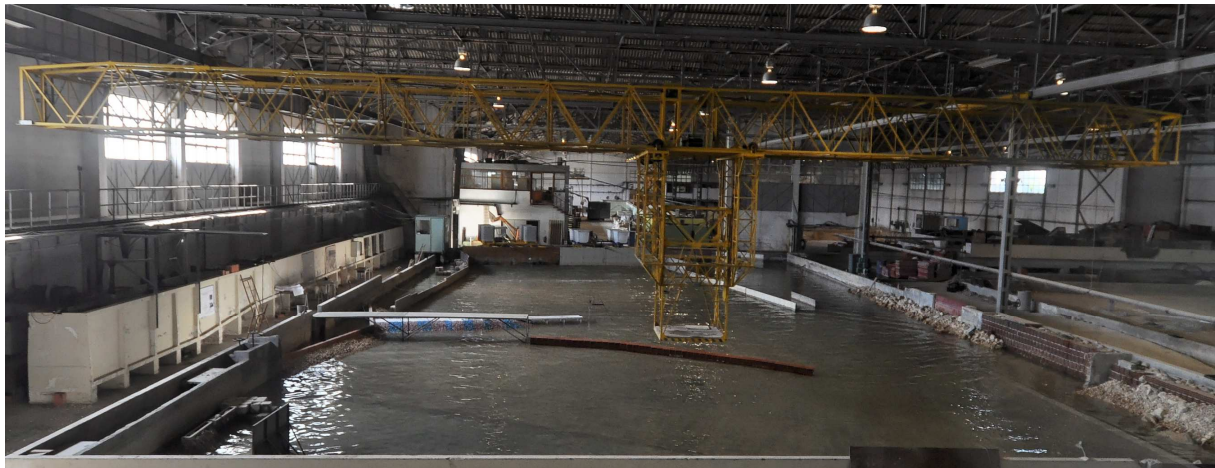


Figure 2 - Overview of TOI1. A Mobile wave generator can be seen at the back of the tank.

3.3 Physical Equipment used in the remote access experience

The equipment used in both experiences was, see Figures 2 to 6:

- Camera with the following characteristics:



- A Canon 600D digital camera
- Camera video capabilities: PAL 720p, 25 fps
- Lens: 50 mm 1.5 f Aspherical
- A laptop PC computer with the following characteristics:
 - Make and model: Dell Latitude E6500 - Intel Core 2 Duo Processor T9600 (2.8GHz, 1066MHz FSB, 3GB RAM)
- Video acquisition hardware
 - Conceptronic CHVIDEOCR A/D Converter DAQ board with provided cables
- Flexible tripod “Joby Gorillapod SLR Zoom”



Figure 3 - CO11 flume. Camera held in position using a “Joby GorillaPod® tripod” on a platform in front of the flume.



Figure 4 - COI1 flume. Laptop computer (Windows XP, 4 GB RAM) used to both receive conveyed video signal from A/D Converter DAQ board. Also shown are the Canon camera, the Gorilapod, cables (with USB-composite video adapter) and the “USB Conceptronics A/D Converter DAQ board”.



Figure 5 - COI1 flume. A side view from the installed setup.



Figure 6 - TOI1 tank. A side view from the installed setup.

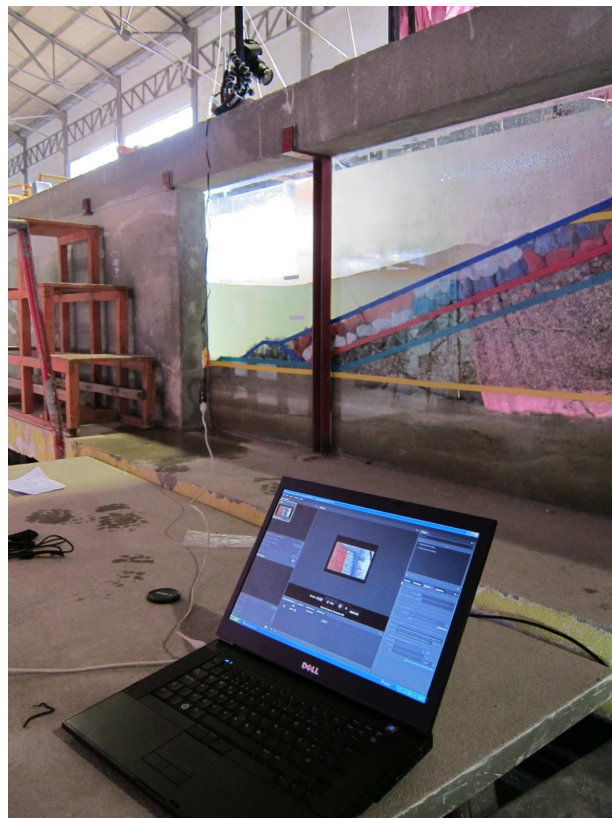


Figure 7 - CO11 flume. General view of test operation.

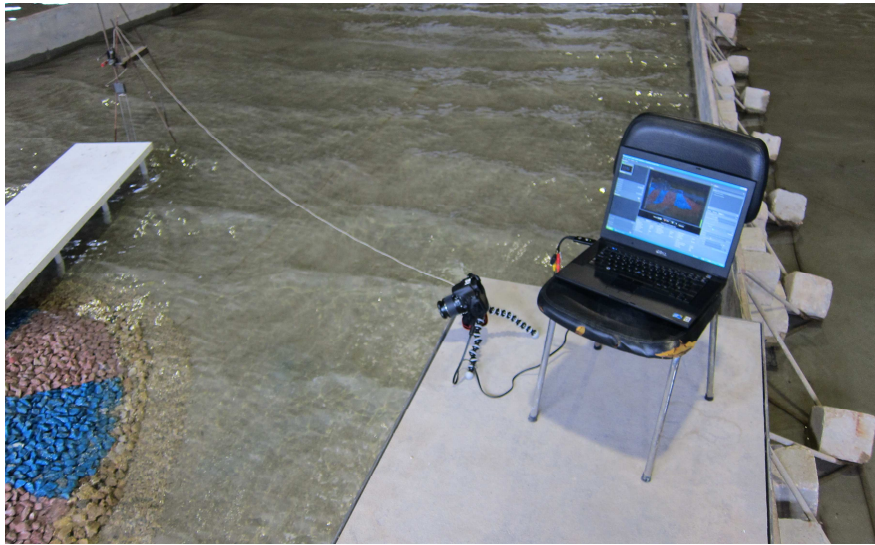


Figure 8 - TOI1 tank. General view of test operation.

3.4 Software Equipment

The software used in the video decoding and streaming was, again, the Microsoft's Expression Encoder 4 (free version). Encoding was established with the following video and audio characteristics:

- Video 25 fps, 1000 Kb/s
- Audio 128 Kb/s (2-channel 16-bit 48 kHz)

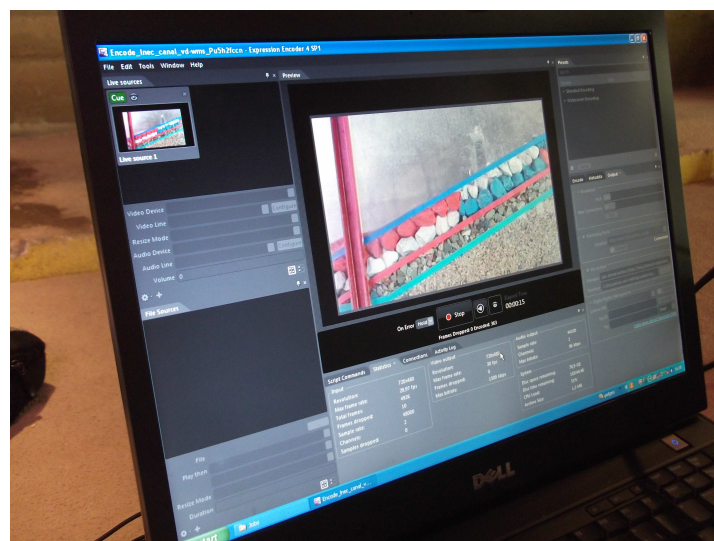


Figure 9 – Software equipment.

This is a commercial software program to encode a wide array of video file formats, stream live from webcams and camcorders or screen capture from PC's. It also enables making simple edits to video files and enhancing available media with overlays and advertising. A free version of this software was used in this first experience.

3.5 Description of the remote access experience

In both experiences, the following steps were taken:

- Laptop PC Computer – near the flume - Turn on



Figure 10 – Turning the computer on and software loading.

- Installation of the equipment:
 1. Setup of the camera. Turn the camera on. On the top right dial, change operation mode to “Movie”. Press shoot button halfway to autofocus the subject. Change the lens from autofocus to manual focus.



Figure 11 – Setup of camera in the final position and video mode operation selection.

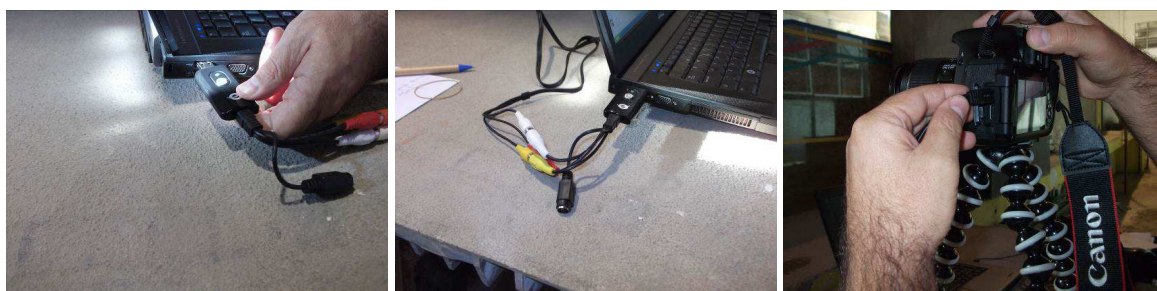


Figure 12 – Cable connections between camera and computer.

2. Connect camera to the computer. The connection between computer USB port and camera is made through use of Conceptronics A/D Converter DAQ board.
- Use of the free version of Microsoft's® Expression Encoder 4 software (http://www.microsoft.com/expression/products/EncoderPro_Overview.aspx);

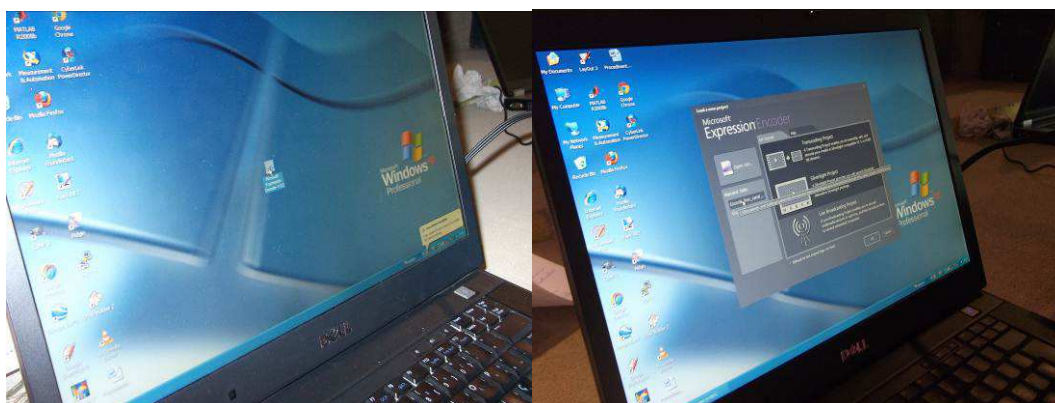


Figure 13 – Starting Microsoft's® Expression Encoder 4 software.

- At desktop, click the shortcut for Microsoft's® Expression Encoder 4. The encoder program will start.
- Open file "Encode_LNEC_canal". The job "LNEC_canal" will start at <http://wms.fccn.pt/lneccanal> server location.

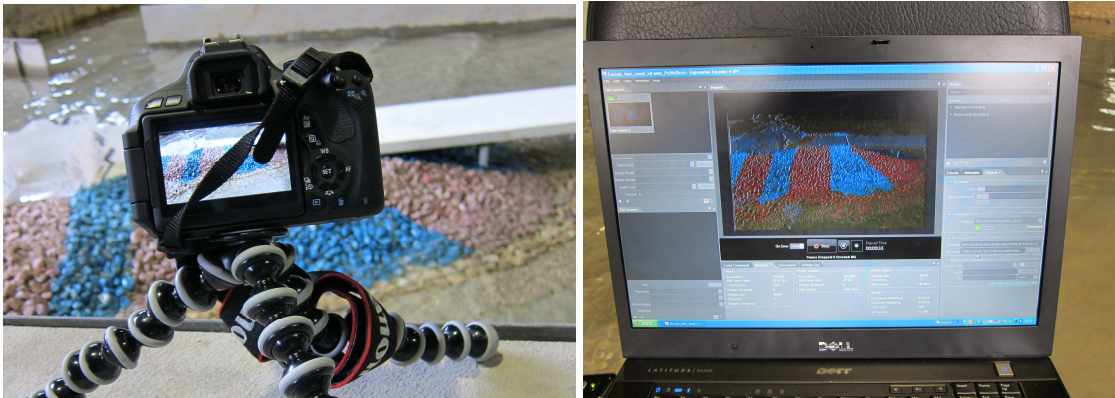


Figure 14 – Camera and computer.

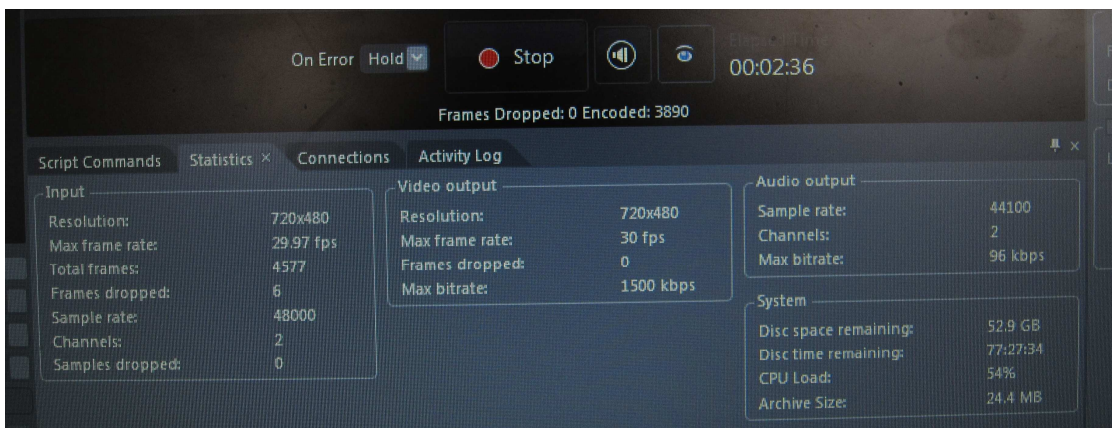


Figure 15 – Using Microsoft's® Expression Encoder 4 software.

- Click start button. After a while, an authentication window appears where server's username and password should be provided. Broadband internet access is mandatory to guarantee high quality transmission. Here a WIFI network was used.

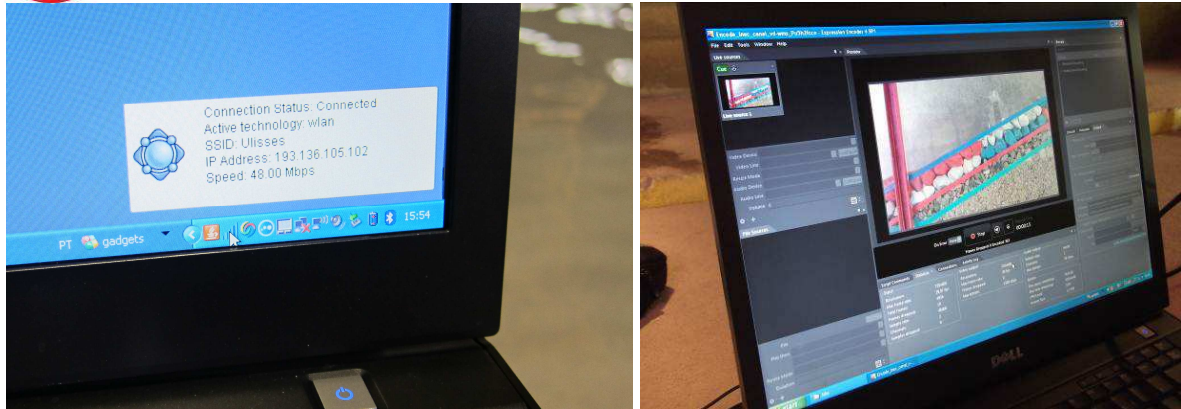


Figure 16 – Internet access using local 48 Mbps wifi network and streaming video using Microsoft's® Expression Encoder 4 software.

- Activation of the wave generator at the flume to produce waves in the flume;
- Accessing the web to the video transmission in different computers (both in the LNEC intranet network, i.e., in the offices of the harbour and maritime structure division, and outside LNEC's network), by using:
 - Windows media player (WMP) through Internet Explorer (IE), in a PC system, or
 - Quicktime player through Safari browser if using a Macintosh computer (OS X), provided in this case that "flip4mac" plug-in is installed.
 - Entering at the browser of choice (IE or Safari) the following web address: <http://wms.fcn.pt/lneccanal>.

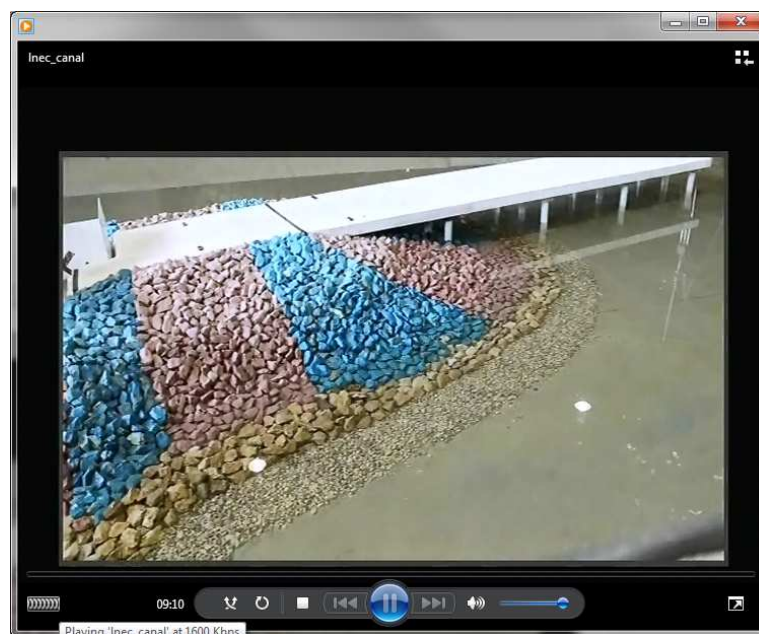


Figure 17 – Windows Media Player playing video at 1600 Kbps at a user's terminal.

4 Conclusions

This report describes a second set of experiences on remote access made at both the COI1 flume, for a 2D model, on the 27th of April 2012 and the TOI1 tank, for a 3D model, on the 6th of June 2012. The experiences took place on one the maritime hydraulic installations of the Harbour and Maritime Structure Division, of the Hydraulic and Environmental Department of the National Laboratory of Civil Engineering.

The methodology used is based on the use of a film camera installed at the flume or tank, which is connected to a PC computer where the software “Microsoft Expression” capture video resides and where video are images and decoded and sent to a server via HTTP. This server will then enable real-time streaming over the internet, enabling a direct, quasi-real-time access to the video from web users.



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