LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

HYDRALAB IV – Remote Access to Experimental Facilities

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RADE – Seventh Experience on Remote Access

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LABORATÓRIO NACIONAL
DE ENGENHARIA CIVIL

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The participation of Eng. Luiz Neto from the consultant company GestMarina – Luanda (Angola) in the 7th experience of this project, through his collaboration in testing the remote access as end-users of the system, is acknowledged.

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RADE – Seventh Experience on Remote Access

1 INTRODUCTION

The present report describes a laboratory experience on remote access to physical experiment tests for a 2D model, tested at the COI1 wave flume on the 3rd of June 2013. This is the 7th experience taken at the maritime hydraulic installations of the Harbour and Maritime Structures Division, of the Hydraulic and Environmental Department of the National Laboratory of Civil Engineering. Previous tests were performed on the 27th of January, 27th April, 6th of June and 26th of September, 15th October 2012 and 6th of March.

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.

The main objective of this laboratory experiences was to test the procedures previously presented in Capitão *et al.*, 2012, Fortes *et al.*, 2012, and Lemos *et al.*, 2012, aiming to remotely access a laboratory experience on a tank where a 3D model resides.

After the objectives (Section 2), Section 3 of the present report describes the experiences made at COI1 flume. In Section 4, final comments and future work are presented.

2 OBJECTIVES

The objective of the 7th experience described in the present report was to test and report the efficiency of the procedures previously presented in Capitão *et al.*, 2012, in Fortes *et al.*, 2012 and in Lemos *et al.*, 2012 . This experience took place at the COI1 wave flume, located at LNEC´s premises. During the test, Luiz Neto, an engineer from the consultant company GestMarina – Luanda (Angola), was invited to remotely access the experiment and to produce comments on the usability of that experience.

As described in previous reports, the methodology is based on the use of a fairly simple scheme composed of a video camera apparatus, installed at the flume, which is connected to a PC computer where the software "Microsoft Expression Encoder" resides and where video and images are decoded and sent to a web server for storage and sharing with selected guests. 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 EXPERIENCES

3.1 Maritime hydraulic experimental facilities of the Harbour and Maritime Structures Division

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. In the next section we briefly describe the COI1 flume, used in the present remote access experience. Those tests were performed at the COI1 wave 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 1.

wave flume COI1
Length : 49.4 m
Width : 1.6 m
Height : 0.7 m
wave generator
Piston-type (translation) wave board
Full stroke : 22''
Maximum velocity : 1.6 m/s
wave characteristics
Frequency range between f = 0.01 Hz - 5 Hz
Maximum regular wave height *Hmax* = 0.4 m
Maximum significant wave height *Hm0* = 0.25 m
features
Glass wall flume with three meter long observation window
Remote-controlled instrument carriage

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

Figure 1 - Overview of COI1.

3.2 Physical equipment used in the remote access experience

Figure 2 illustrates the equipment used during the test.

- Camera with the following characteristics:
  - A Canon 600D digital camera with the following video capabilities: PAL 720p, 25 fps
  - Lens: Canon EF-S 18-55mm 1:3.5-5.6 IS
- A laptop PC computer with the following characteristics:
  - Dell Latitude E6500 - Intel Core 2 Duo Processor T9600 (2.8GHz, 1066MHz FSB, 3GB RAM)
- Video acquisition hardware
  - Conceptronics CHVIDEOCR A/D Convertor DAQ board with provided cables
- Flexible tripod "Joby Gorillapod SLR Zoom"

Figure 2 - Laptop computer (Windows XP, 4 GB RAM) used to receive conveyed video signal from A/D Convertor DAQ board. Also shown are the Canon camera and zoom lens, the Gorillapod, cables (with USB-composite video adapter) and the "USB Conceptronics A/D Convertor DAQ board".

3.3 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)

Microsoft's Expression Encoder 4 is a commercial software program able 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 (although limited in its capabilities) version of this software was used in all experiences (Figure 3).

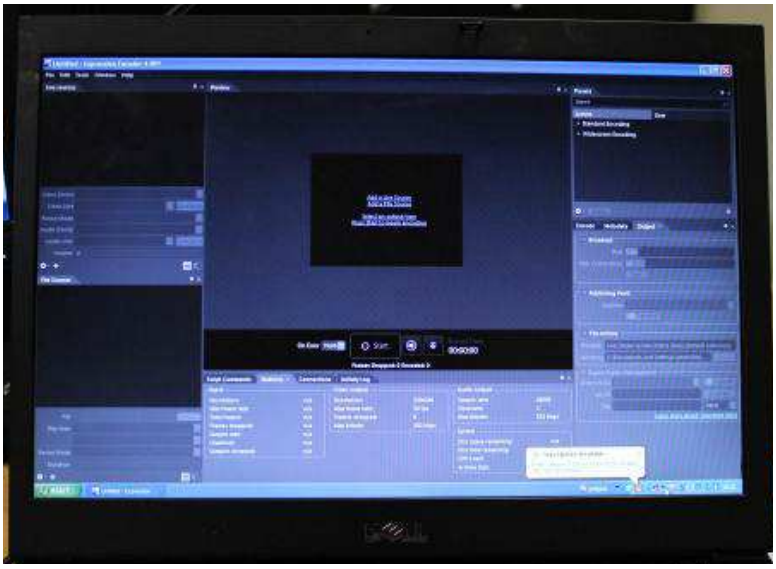


Figure 3 - Software equipment.

3.4 Description of the remote access experience

During the experience, the following steps were taken:

- Installation of a laptop PC Computer near the flume;
- Installation of the equipment (Figure 4 and Figure 5):
    1. Setup of the camera. Turn the camera on. On the top right dial, change operation mode to "Movie". Frame the subject and press shoot button

halfway to autofocus the subject. Then change the AF/M lens button from autofocus to manual focus.

Figure 4 – Setup of camera in the final position and video mode operation selection.

2. Connect camera to the computer. The connection between computer USB port and camera is made through use of a Conceptronics A/D Convertor DAQ board.

Figure 5 - Cable connections between camera and computer.

- Use of the free version of Microsoft's® Expression Encoder 4 software (http://www.microsoft.com/expression/products/EncoderPro_Overview.aspx);

- At desktop, click the shortcut for Microsoft's® Expression Encoder 4. The encoder program will start (Figure 6);
- Open file "Encode_LNEC_canal" to start job "LNEC_canal". (Figure 7);
- A small window showing the active job (the video scene), will appear at the screen left upper corner (Figure 8).

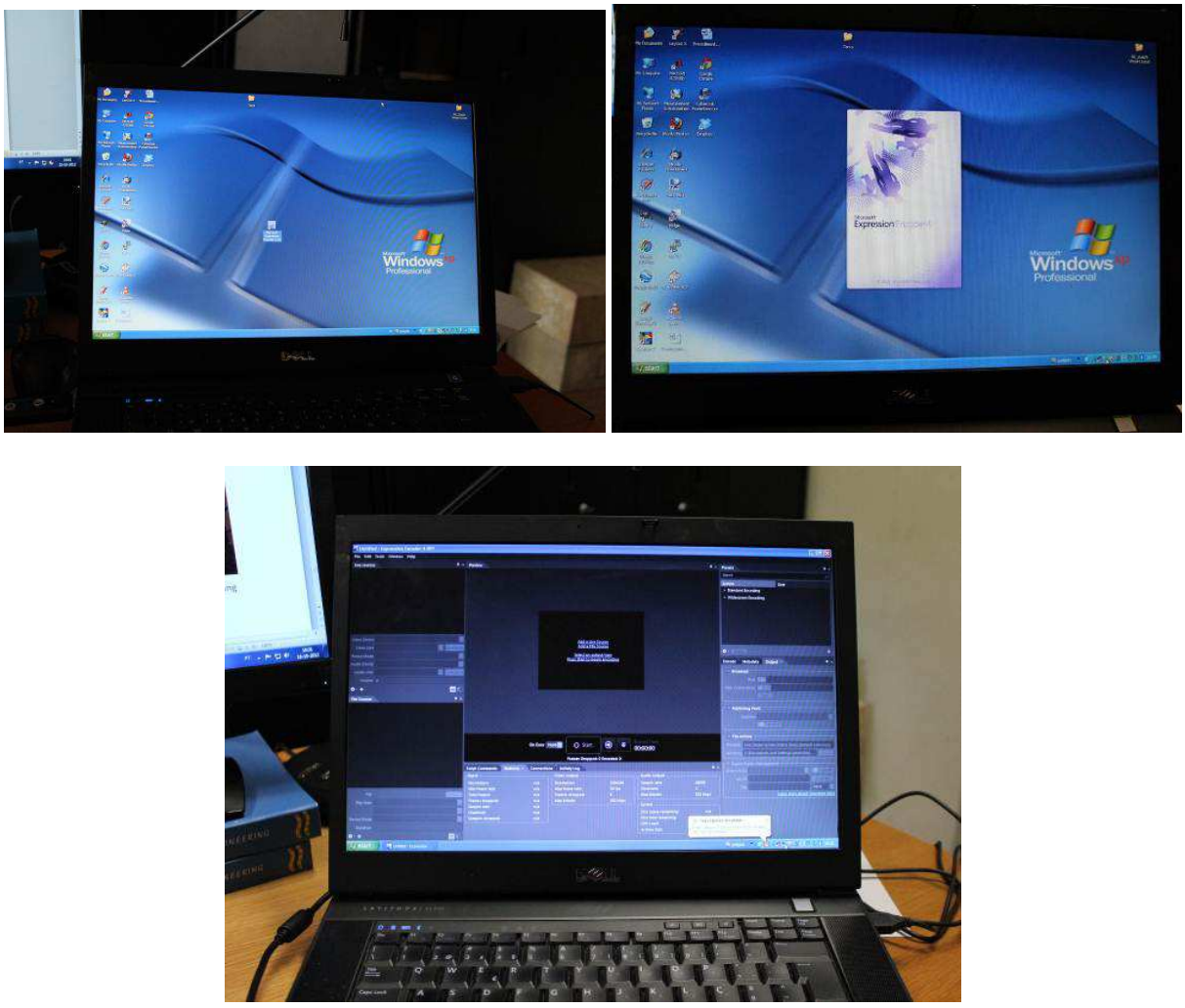


Figure 6 - Starting Microsoft's® Expression Encoder 4 software.

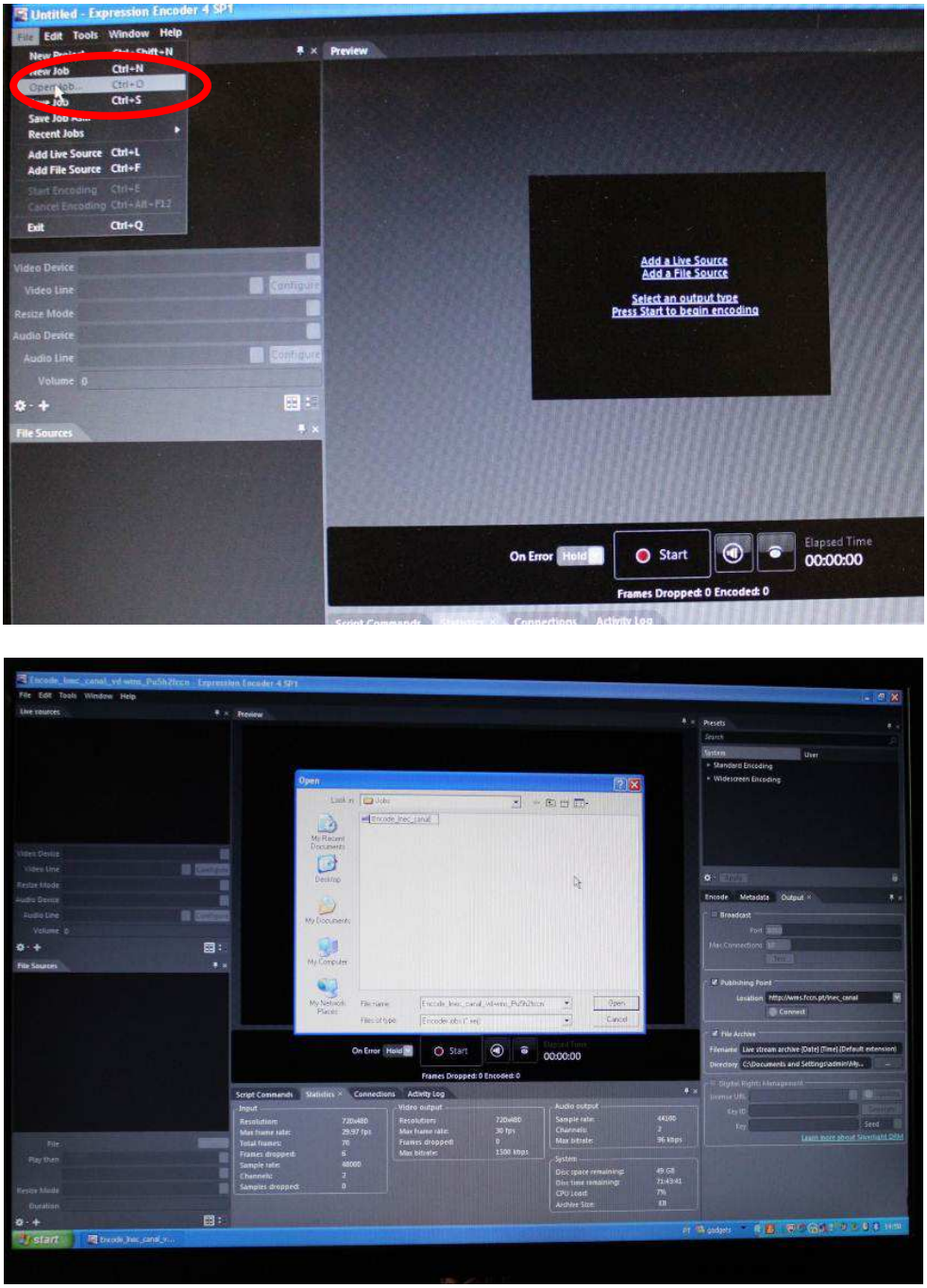


Figure 7 - Using Microsoft's® Expression Encoder 4 software: Open file "Encode_LNEC_canal".

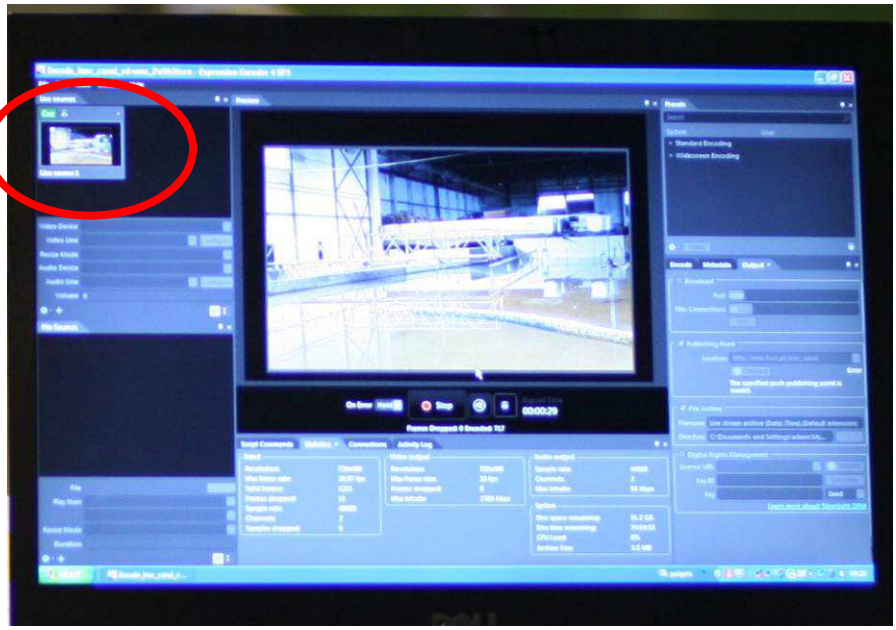


Figure 8 – Using Microsoft's® Expression Encoder 4 software: View of the active job "Encode_LNEC_canal".

- Activation of the wave generator at the wave flume to generate waves (Figure 9)

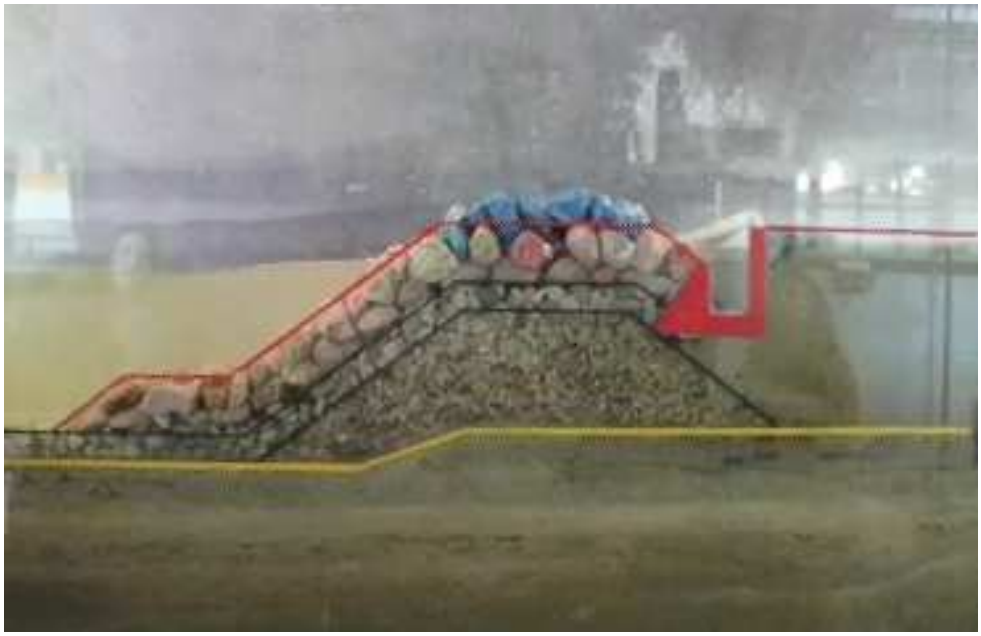
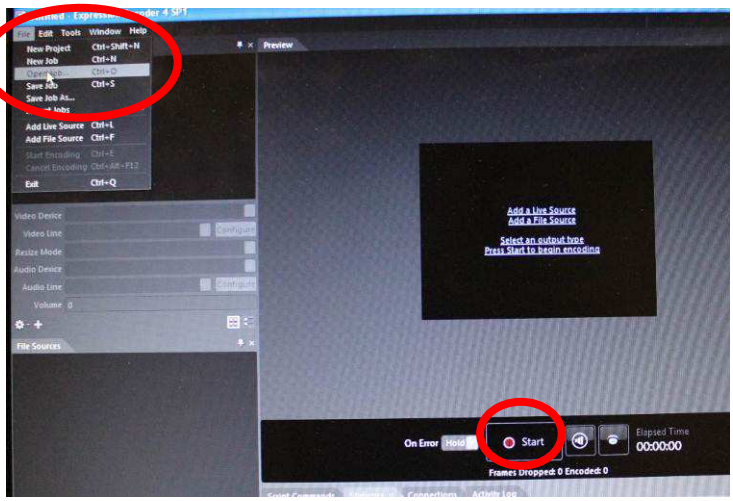


Figure 9 - COI1 flume. General view of test operation.

- Click start button at Microsoft's® Expression Encoder 4 (Figure 10a). After a while, an authentication window appears where server's username and password should be provided (Figure 10b).

- This will begin the video streaming at the *http://wms.fccn.pt/lnec_canal* server (publishing point), Figure 11.

a)



b)

Figure 10 - Using Microsoft's® Expression Encoder 4 software: a) Click start button b) Authentication window.

Figure 11 - Video streaming on Microsoft's® Expression Encoder 4 software.

Broadband internet access is recommended to guarantee high quality transmission. In the present experiences LNEC's "Ulisses" wi-fi network was used. During the video stream a video file is stored at the publishing point (for streaming), as well as in the computer disk (Figure 12).

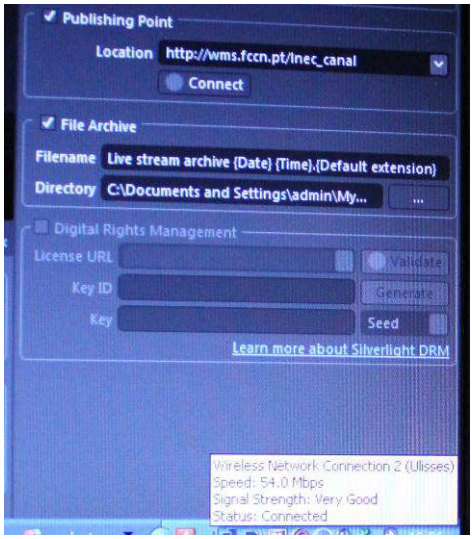


Figure 12 – Internet access using local 54 Mbps wi-fi network.

Access to the web address: **http://wms.fccn.pt/lnec_canal** (Figure 13). During the experience, a computer, outside LNEC's network was used by using MS Windows Media Player (WMP) through Internet Explorer (IE), in a Macintosh system. However, either Linux or PC systems are also possible.

Figure 13 - Windows Media Player playing video.

3.5 Results

Video files were produced during this experienecof the whole experiences. From these results one mayevaluate the performance of the video transmission oridentify other problems.

The main conclusions arising from the 7th experience were:

- An adequate image quality of the video images was attained at all times;
- No image freezing occurred. This could be a typical network problem that might have occurred, but in this experience that was not the case. Actually, although LNEC's internal network speed should theoretically guarantee 100 Mbps, on some conditions (high traffic levels and users) a much lower throughput might sometimes be observed. If this happens, a solution that may solve the problem is to update existing network cables (coaxial) to optical fibre;
- User Luiz Neto, from the consultant company GestMarina, located at Luanda (Angola), was using Internet speed of 1 Mbps. The computer used during the test was a Macintosh (Apple).
- A delay of around 2 minutes was apparent, probably due to low internet speed, since, according to previous test reports [1], [2], [3] and [4], the delay was around 20-60 s, depending mainly on the internet speed.

4 CONCLUSIONS

This report describes the seventh experience on remote access made at the COI1 wave flume on the 3rd of June 2013. The experience took place on the maritime hydraulic installations of the Harbour and Maritime Structures Division of the Hydraulic and Environmental Department of the National Laboratory of Civil Engineering.

The methodology used is based on the use of a video camera installed at the flume or tank, which is connected to a PC computer where the software "Microsoft Expression" 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.

The main conclusions arisen from this set of tests were the following:

- Methodology is very simple and easily portable;
- The end-user who collaborated in this test confirmed good image quality reception and almost no dropped frames or freezing images A delay of 2 minutes were observed;
- LNEC´s web page for RADE project can be accessed at

  http://www.lnec.pt/organization/dha/npe/estudos_id/RADE/index_html/?searchterm=RADE

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[1] Capitão, R.; Silva, C.; Fortes, J.; Lemos, R. (2012). "HYDRALAB IV – Remote Access to Experimental Facilities. RADE - First Results" - NPE, LNEC.

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[4] Lemos, R.; Fortes, J.; Capitão, R. (2012). "HYDRALAB IV – Remote Access to Experimental Facilities. RADE – Sixth Experience on Remote Access" - NPE, LNEC.

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Lisbon, June 2013

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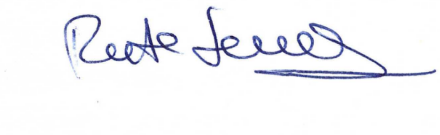

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APPENDIX I

Comments on the 7th experience, from the collaborator

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-------- Original Message --------
Subject: Re: Visualização dos ensaios em modelo físico
Date: Mon, 3 Jun 2013 09:06:58 +0000
From: Luiz Neto <LuizNeto@MarinaLuanda.com>
To: Juana Fortes <jfortes@lnec.pt>
CC: macedo.santana@sapo.pt <macedo.santana@sapo.pt>, Morim Oliveira <morim@wwsa.pt>, Raquel Magalhães <rmagalhaes@betar.pt>, Wilson Zacarias <WilsonZacarias@MarinaLuanda.com>, Manuel Paixao <ManuelPaixao@gestmarina.com>

Bom dia Engª Juana Fortes,

Peço desculpas por somente agora responder ao seu mail.

Logicamente que terei um enorme prazer em visualizar o ensaio em modelo físico da Marina Luanda!

Caso ainda seja possível programar este ensaio para hoje a tarde, estarei disponível, proponho que dentro da disponibilidade de sua estrutura, seja o mais tarde possível, sem ferir o normal funcionamento do LNEC.
Aguardo suas notícias.

Quanto as características técnicas de nossos equipamentos informáticos, sou a informar:
- Os computadores são Apple.
- A ligação a internet é por cabo de rede.
- A velocidade da internet é de 1 MB, o que é pouco mas temos conseguido fazer conferencias pelo Skype sem detetar qualquer anomalia significante.

Desde já envio os meus agradecimentos pela sua atenção disponibilidade.

Com os meus melhores cumprimentos,

Luiz Neto