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DE ENGENHARIA CIVIL

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RADE – Fourth and Fifth Experiences on Remote Access

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The participation of the following people in the 5th experience of this project, through their collaboration in testing the remote access as end-users of the system, is acknowledged:

Universities:

Claudio Freitas Neves – Federal University of Rio de Janeiro, Brasil

Ada Cristina Scudelari – Federal University of Rio Grande do Norte, Brasil

João Alfredo Santos – Lisbon Superior Engineering Institute, Portugal

Consultant companies:

Peter Wellens – Deltares, The Netherlands

Lucília Luís - Consulmar, S.A., Portugal

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RADE – Fourth and Fifth Experiences on Remote Access

1 INTRODUCTION

The present report describes two laboratory experiences on remote access to physical experiment tests for a 3D model, tested at the TOI2 tank on the 26th of September, and for a 2D model, tested at the COI3 flume on the 15th of October 2012. These are 4th and 5th 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. Previous tests were performed on the 27th of January, 27th April and 6th June of 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.

The main objective of these two laboratory experiences were to test the procedures previously presented in Capitão *et al.*, 2012, and in Fortes *et al.*, 2012, aiming to access a laboratory experience remotely both at a flume (2D model) and at a tank (3D model).

After the objectives (Section 2), Section 3 of the present report describes the experiences made at the TOI2 tank (for a 3D model) and at COI3 flume (for a 2D model). In Section 4, final comments and future work are presented.

2 OBJECTIVES

The objective of the 4th and 5th experiences described in the present report was to test and report the efficiency/weaknesses of the procedures previously presented in Capitão et al., 2012 and in Fortes et al., 2012. The 4th experience took place at the TOI2 tank while the 5th

experience took place at the COI3 flume. During the fifth test, five researchers from the Federal University of Rio de Janeiro, accessing from São Paulo (Brazil), from the Federal University of Rio Grande do Norte (Brazil), from the Lisbon Superior Engineering Institute (Portugal) and from the consultant companies DELTARES in Delft (The Netherlands) and CONSULMAR in Lisbon (Portugal) were invited to remotely access the experience. Figure 1 shows the location of each researcher.

Figure 1 – Map location of each researcher.

As described in previous reports, 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 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 sections we briefly describe the COI3 flume and the TOI2 tank that have been used in the present remote access experience.

3.1.1 COI3 flume

COI3 flume is a wave flume used for studying propagating irregular waves over a variable bed and their interaction with a maritime structure. It is approximately 32.4 m long and it has an operating width and an operating water depth of 1 m (Figure 2a). It is equipped with a piston-type wave-maker (Figure 2b).

a)

b)

Figure 2 - COI3 flume a) Overview. b) Piston-type wave-maker

3.1.2 TOI2 tank

TOI2 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 3.

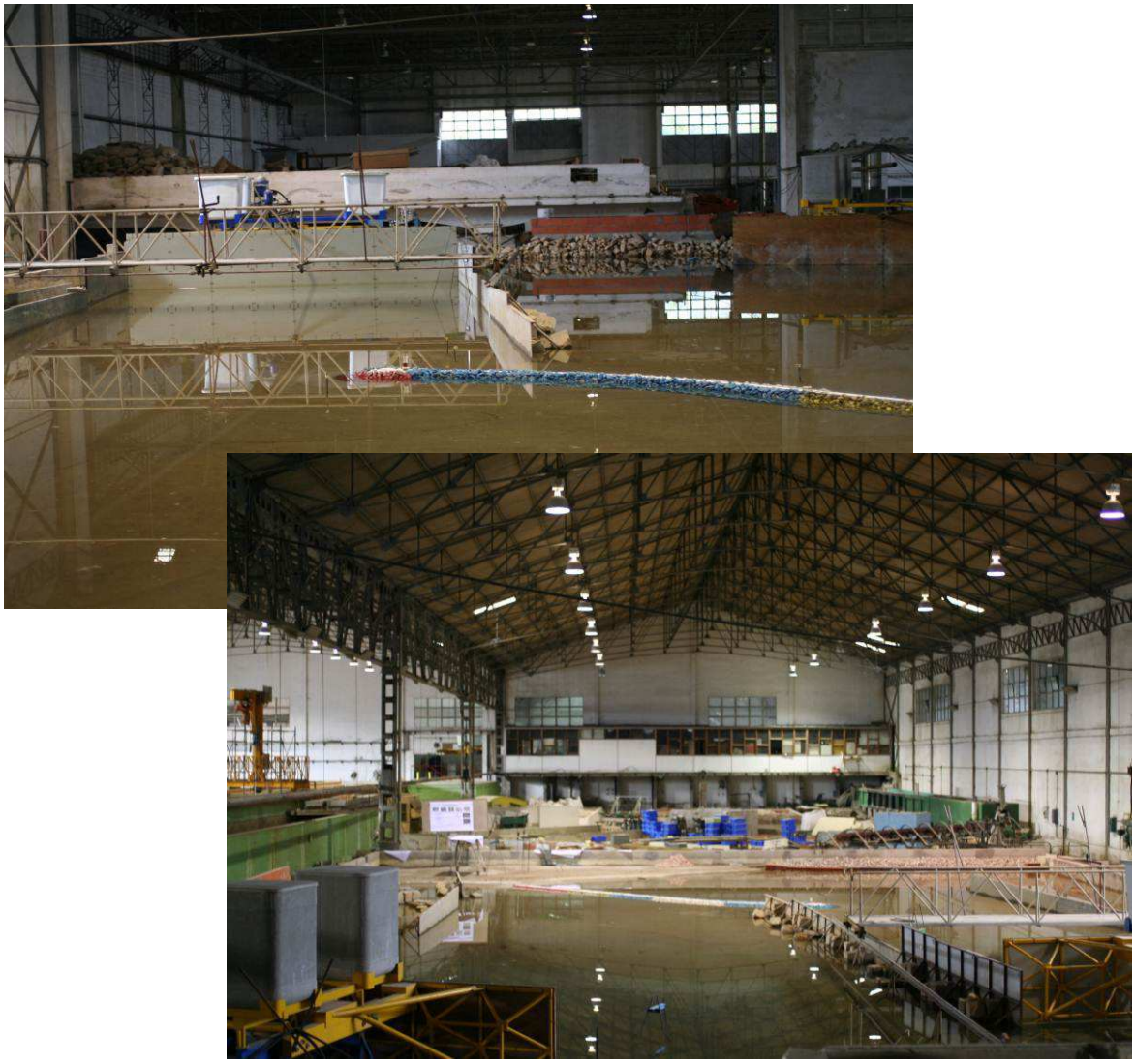


Figure 3 - Overview of the TOI2 tank

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.

3.2 Physical equipment used in the remote access experience

The equipment used in both experiences was, Figure 4 to Figure 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
  - Conceptronics CHVIDEOCR A/D Convertor DAQ board with provided cables
- Flexible tripod "Joby Gorillapod SLR Zoom"

Figure 4 - 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, the Gorillapod, cables (with USB-composite video adapter) and the "USB Conceptronics A/D Convertor DAQ board".

Figure 5 – COI3 flume. A side view from the installed setup.

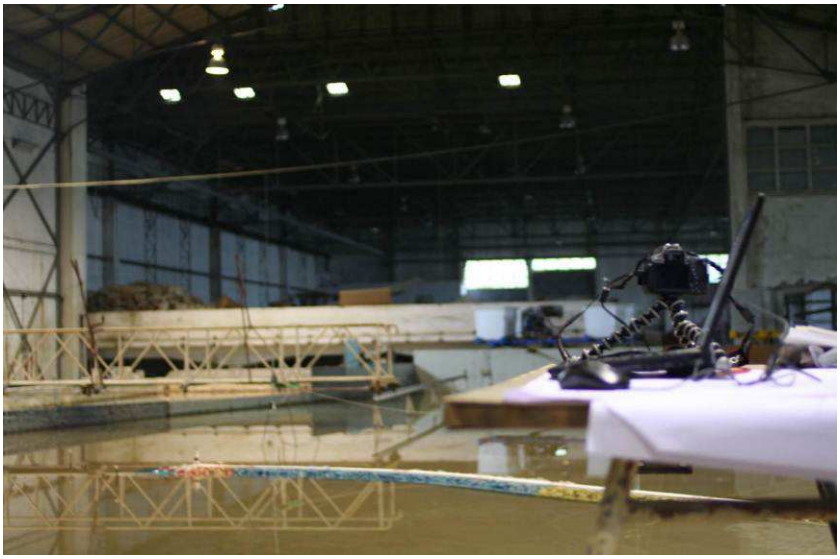


Figure 6 - TOI2 tank. A side view from the installed setup.

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)

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 all experiences (Figure 7).

Figure 7 - Software equipment.

3.4 Description of the remote access experience

In both experiences, the following steps were taken:

- Laptop PC Computer – near the flume;
- Installation of the equipment (Figure 8 and Figure 9):

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 8 – 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 Conceptronics A/D Convertor DAQ board.

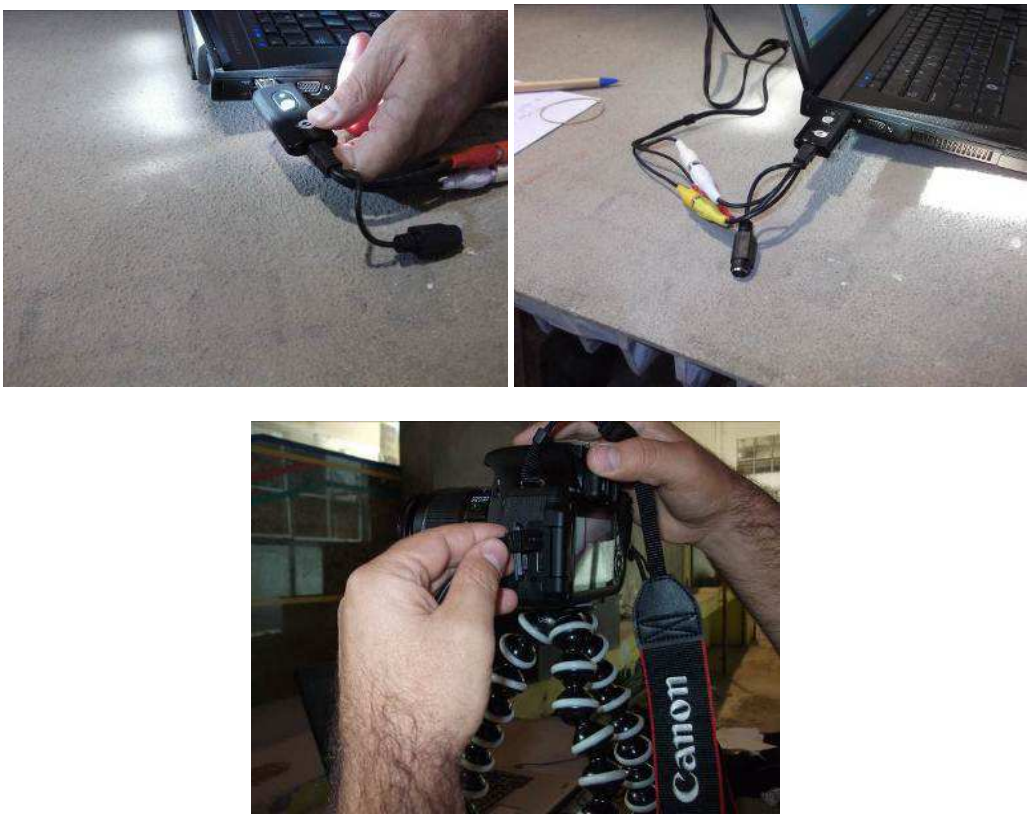


Figure 9 - Cable connections between camera and computer.

- 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 10);
    - Open file "Encode_LNEC_canal" to start job "LNEC_canal". (Figure 11);
    - A small window showing the active job (the video scene), will appear at the screen left upper corner (Figure 12).

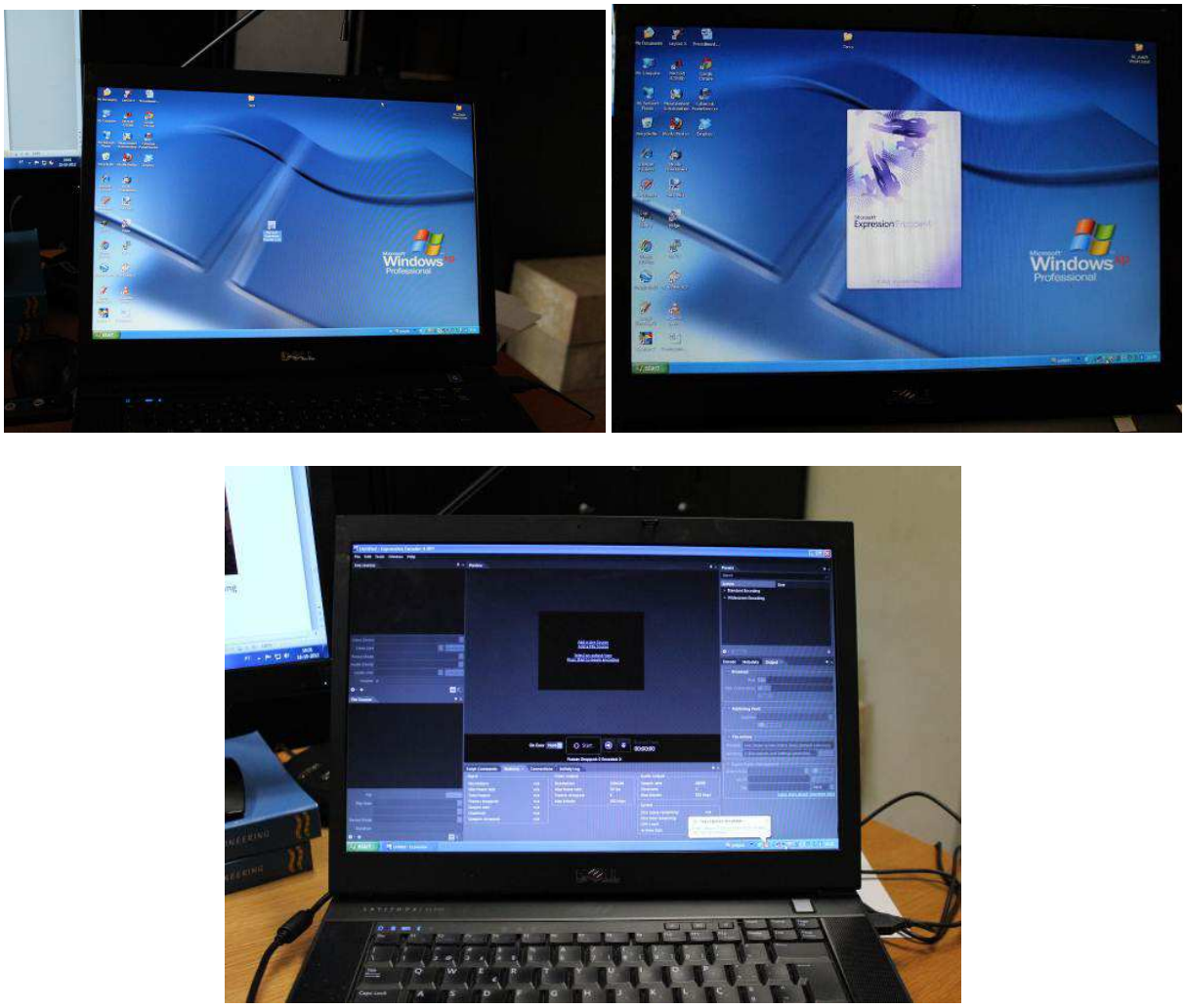
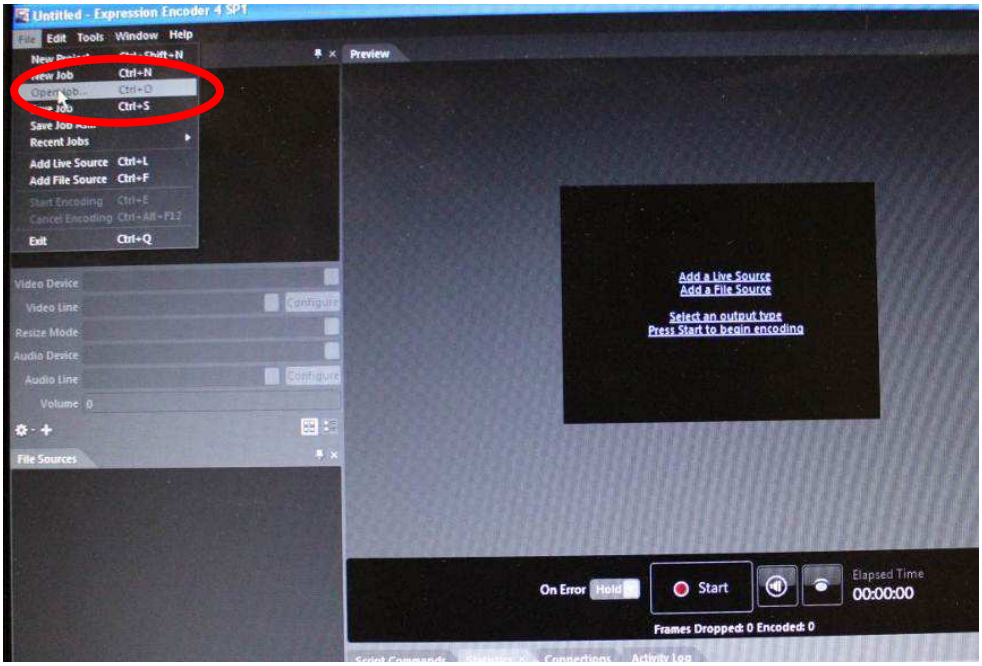


Figure 10 – Starting Microsoft's® Expression Encoder 4 software.



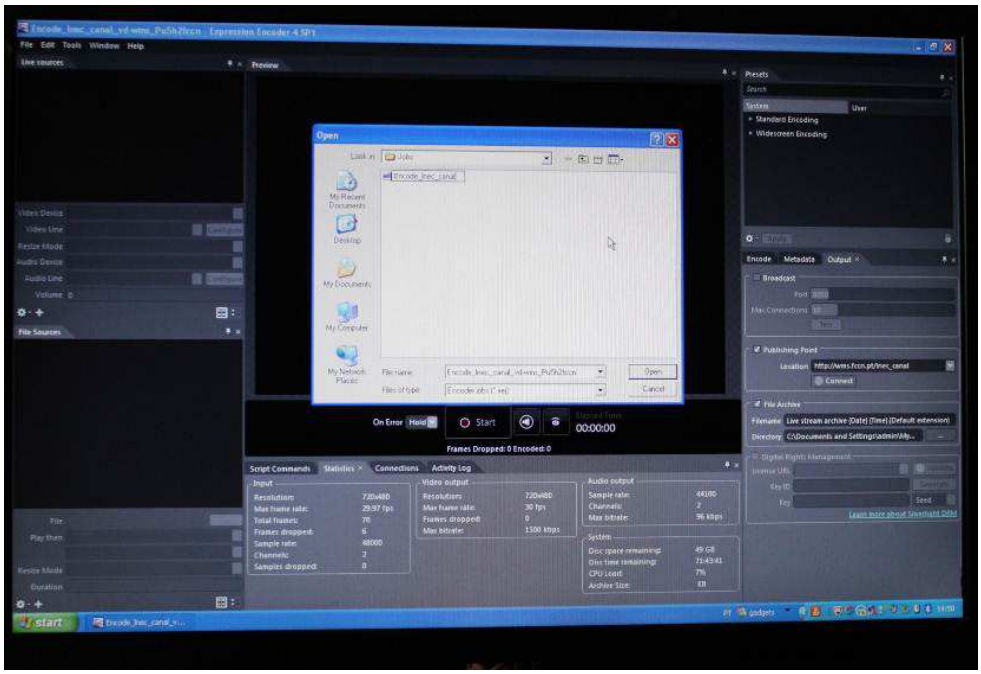


Figure 11 – Using Microsoft's® Expression Encoder 4 software: Open file "Encode_LNEC_canal".

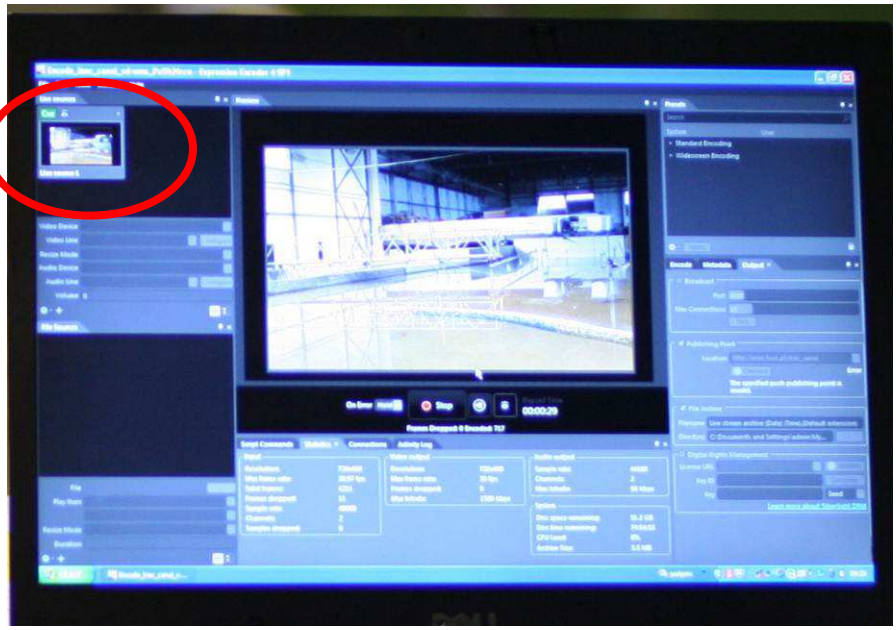


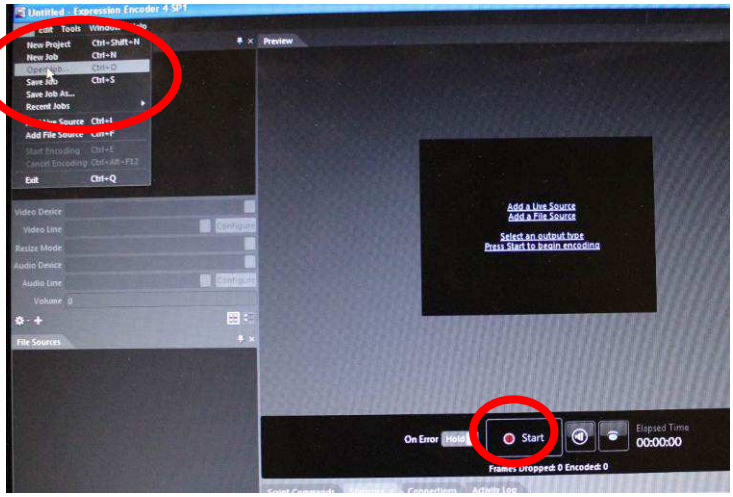
Figure 12 – Using Microsoft's® Expression Encoder 4 software: View of the active job "Encode_LNEC_canal".

- Activation of the wave generator at the flume to produce waves in the flume (Figure 13)

Figure 13 - Fourth and fifth experience. TOI2 tank and COI3 flume. General view of test operation.

- Click start button at Microsoft's® Expression Encoder 4 (Figure 14a). After a while, an authentication window appears where server's username and password should be provided (Figure 14b).
- This will begin the video streaming at the *http://wms.fccn.pt/lnec_canal* server (publishing point), Figure 15.

a)



b)

Figure 14 - Using Microsoft's® Expression Encoder 4 software: a) Click start button b) Authentication window.

Figure 15 - Video streaming on Microsoft's® Expression Encoder 4 software.

Broadband internet access is mandatory to guarantee high quality transmission. In the present experiences wi-fi network was used. During the video stream a video file is stored in the publishing point, as well as in the computer disk (Figure 16).

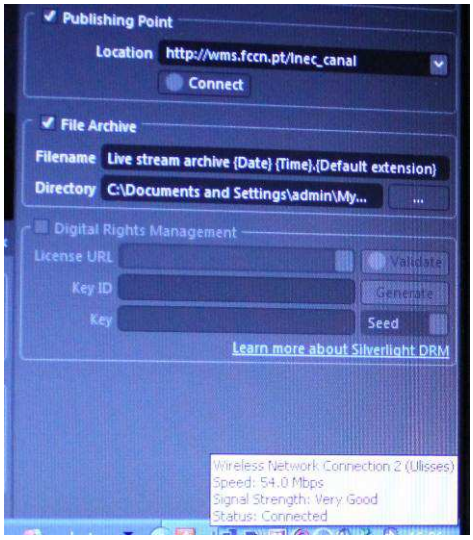


Figure 16 – Internet access using local 54 Mbps wi-fi network.

- Access to the web address: **http://wms.fccn.pt/lnec_canal** (Figure 18). During the 4th and 5th experiences, several computers were used to test the quality of the video images that were sent to the server, namely:
  - 4th and 5th experiences: computers from LNEC intranet network, i.e., at the offices of the harbour and maritime structure division;
  - 5th experiences: Outside LNEC's network, five institutions were invited to access the video transmission. Two of them were located in Portugal, one in Netherlands and the other two in Brazil;

  by using:
  - Windows media player (WMP) through Internet Explorer (IE), in a PC system;
  - Quicktime player through Safari browser if using a Macintosh computer (OS X), provided in this case that "flip4mac" plug-in is installed.

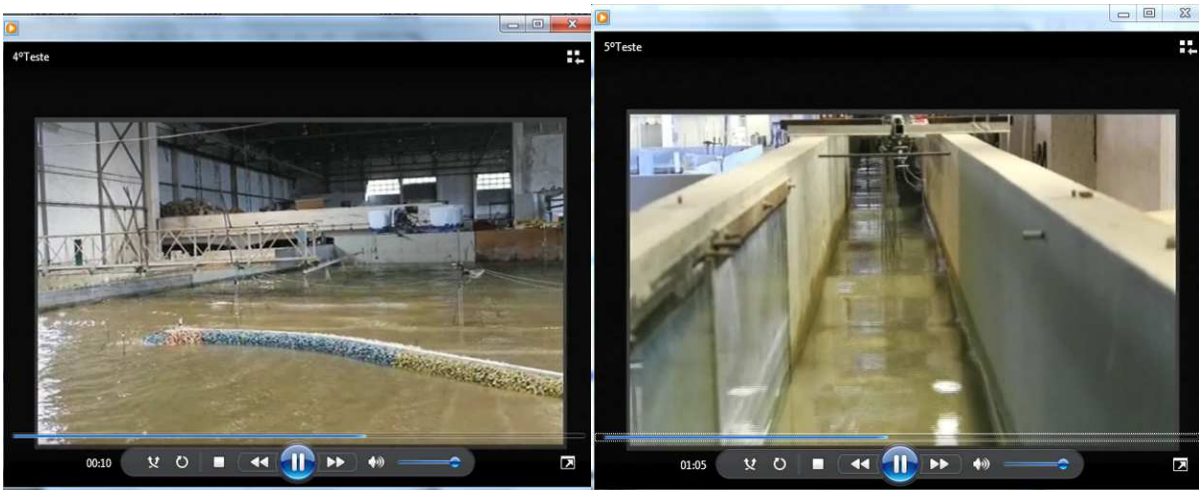


Figure 17 - 4th and 5th experiences. Windows Media Player playing video at 1600 Kbps at a user's terminal.

3.5 Results

The experiences produced video files of the whole experiences. From these results one may:

- Evaluate the performance of the video transmission.
- Identify the main problems.

In the 4th experience the main conclusions were:

- an adequate image quality of the video images;
- some image freezing has occurred. This is a typical network problem. LNEC's internal network speed should theoretically guarantee 100 Mbps but in reality, on some conditions (high traffic levels and users) a much lower throughput was sometimes available. A solution to this problem is to update existing network cables (coaxial) to optical fibre;
- a delay varying from 30 to 60 s, depending on the user´s location, was detected.

In the 5th experience, five different computers at different world location were used. The main internet and computer characteristics of each of them are presented at Table 1.

Table 1 – Internet and computer characteristics

INSTITUTION	LOCATION	USER	COMPUTER CHARACTERISTICS	INTERNET CHARACTERISTICS
ISEL	Lisbon, Portugal	João Alfredo Santos	Intel Atom CPU N270 @ 1,60 GHz RAM: 0.98 GB	Rede IPv6 Coaxial cable 1 GBps download 1 GBps upload
CONSULMAR	Lisbon, Portugal	Lucilia Luís	Intel Core i7 CPU 870 @ 2.93Ghz RAM: 8 GB, 64 bit	Optical Fibre Ethernet at 200MBps
UFRN	Rio Grande do Norte, Brazil	Ada Scudelari	Intel Core I7 RAM:8 GB, 64 bit	Coaxial cable Speed: 5 MBps wi-fi
UFRJ	São Paulo, Brazil	Claudio Neves	Core 2 Duo T5450 CPU @ 1.67 GHz RAM: 2GB, 32 bit	Optical Fibre Wi-fi
DELTARES	Delft, The Netherlands	Peter Wellens	Intel Core i7-2600 RAM: 16 GB, 64-bit	10 MBps download 10 MBps upload

Table 2 presents the main comments made during the experience by each of the users.

Table 2 – Main conclusions of the 5th experience

INSTITUTION	LOCATION	IMAGE FREEZING	IMAGE DELAY
ISEL	Lisbon, Portugal	no	30 s
CONSULMAR	Lisbon, Portugal	no	30 s
UFRN	Rio Grande do Norte, Brazil	yes	60 s
UFRJ	São Paulo, Brazil	no	30 s
DELTARES	Delft, The Netherlands	no	30 s

The main conclusions were:

- Some image quality problems of the video images were detected. At the beginning of this experience, the camera was located parallel to the flume. Due to a improper flume illumination, light was too strong and video images showed high levels of reflexion, besides being unclear. This was corrected during the experience by moving

the camera to a higher position on the flume. Then, the quality of the images improved significantly;

- Some image freezing has occurred, especially at the computer located at Natal, Brasil, since the internet provider was a local one and not a institution one; Also, for this case a non-reliable wi-fi connection was used.
- A delay of 30 to 60 s was detected, depending on the user's location (see Table 2). The longer delays were also identified at the computer at Natal, Brazil;

4 Conclusions

This report describes fourth and fifth set of experiences on remote access made both at the TOI2 tank on the 26th of September, and at the COI3 flume on the 15th of October 2012. The experiences took place on 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.

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

- Methodology is appropriate both for 2D and 3D scale model tests;
- Methodology is very simple and easily portable;
- Some of the problems identified during the previous attempts [1] and [2], as some image freezing occurrences and delays seemed to be enhanced with a better internet speed;
- The end-users who collaborated in this test testified a good image quality and almost no dropped frames or freezing images;
- 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.

[2] Capitão, R..; Fortes, J.; Lemos, R. (2012). "HYDRALAB IV – Remote Access to Experimental Facilities. RADE - Second and Third Experiences on Remote Access" - NPE, LNEC.

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Anexo I

Comments on the 5th experience, from the collaborators

CONSULMAR email: From Lucilia Luis

Cara Rute,

Com estava em reunião à hora do "teste" pedi aos meus colegas para fazer a ligação. Não sei quais foram as dificuldades que tiveram. No entanto, após a reunião vi a transmissão. A qualidade de imagem estava boa, boa luz e nitidez de imagem. Não houve interrupções na transmissão, parecendo que a velocidade teria sido a adequada.

Cumprimentos,
Lucília Luis

São Paulo email: From Cláudio Neves

Juana e demais,

1- A experiência do canal de ondas foi um sucesso: consegui ouví-la e ver o
canal sem problema, a imagem do canal não congelou, sua voz era contínua sem "soluços".

2- Para completar a experiência, seria importante que vocês nos fornecessem as velocidades de transmissão aí no LNEC, para que possamos estabelecer parâmetros mínimos de comunicação, tanto da internet, quanto dos computadores envolvidos.

3- Aproveitei a oportunidade para testar o Skype Premium que instalei no meu computador (por causa deste experimento!). Fizemos o teste de comunicação em grupo entre Ada (Natal), João Alfredo (ISEL), você (LNEC) e eu (São Paulo), todos com vídeo e voz.

4- A pior conexão de voz era do João Alfredo, bastante cortada, enquanto que a sua voz e imagem seguiam normais, e a voz da Ada ligeiramente defasada.

5- Vocês não conseguiram ver minha imagem porque quem está defasado tecnologicamente sou eu: ainda não consegui colocar a câmera do laptop funcionando.

6- Seria muito importante fazer testes com Edival (UNIFEI) e com Geraldo (UNESP/Ilha Solteira), por questões de velocidade de comunicação nas respectivas cidades.

7- Endres, podemos tentar uma comunicação semelhante, desta vez do IPH para o LNEC, ISEL, UFRN, UNIFEI e UNESP, na próxima visita minha? O mesmo desafio vale para o Daniel (UNIFEI) e Geraldo (UNESP) onde há experimentos sendo feitos.

8- O próximo desafio é incluirmos comunicação de dados e controle de instrumentos entre Brasil e Portugal. Para isso, a pessoa certa é Edival, que pertence ao Programa de Controle e Automação da UNIFEI, coordena nosso PROCAD e CAPES-FCT, projetos que incluíam este tipo de atividade que acabamos de fazer.

De resto, parabéns pela iniciativa. Fiquei imensamente contente. Foi a mesma emoção que tive ao ver o homem pôr os pés na Lua.

Abraços

Claudio

Natal email: From Ada Scudelari

Oi Juana,

Ai vão as observações...

Reprodução via windows media palyer.
Mensagens visualizadas:
A rede está muito ocupada para reproduzir no formato original.
Reproduzindo a entre 850 a 1600 kbps

No inicio estava bem, mas depois de aproximadamente 1 minuto começou a cortar.
Imagem cortando... congelando...
Imagem congelou.
O processo foi reiniciado, apresentando delay...
E voltou a congelar...

Acredito que boa parte dos problemas tenham sido devido a falhas de rede aqui...

O equipamento para recepção corresponde a core I7, com 8 GB de RAM, 64 bits

Acho que foi isso.

Abraços
Ada

Delft email: From Peter Wellens

I can keep track of what you are doing. It is working well, I have a perfect connection. No interruptions so far.