CALL FOR AN ADDITIONAL PROJECT PARTNER

Project contract number - FP6-IST-507336
Project acronym - **PrestoSpace**
Project full name - Preservation towards storage and access. Standardised Practices for Audiovisual Contents Archiving in Europe
Instrument type – Integrated project
Call identifier - IST-IP-507336-PrestoSpace-CALL2
Language in which proposal should be submitted – English
Date of close of call - 30/6/2006
Time of close of call - 17h00 Paris time (GMT+2)
Web address for further information (call webpage) - http://www.prestospace.org
Mail address for further information (Project coordinator) - prestospace_contact@ina.fr

1. Introduction

The PrestoSpace project, currently active in the *Sixth Framework programme of the European Community for research, technological development and demonstration activities contributing to the creation of the European research area and to innovation (2002-2006),* invites companies working in the field of industrial vision and audio, to apply to become a full partner in the PrestoSpace project.

The PrestoSpace project's objective is to provide technical solutions and integrated systems for digital preservation of all types of audiovisual collections.
The project intends to provide tangible results in the domain of preservation, restoration, storage and archive management, content description, delivery and access. Economic factors supporting preservation services will be addressed.
The principal aim is to prepare the way for preservation factories providing affordable services to all kinds of collection custodians in order to manage and to allow access to their assets.

The specific focus of PrestoSpace Call 2 is intended to implement an innovating tool for playing back optically 78 rpm audio disks.
Before the invention of the magnetic tape recorder in the early 50's, recording on discs was the only way to preserve audio information. National audio archives and radio stations have important collections of historical interest obtained by direct recording. There are millions of such disks, most of them unique, that are waiting on shelves for an efficient digitisation tool. A working prototype has already been implemented by INA It currently demonstrates performances equivalent to a conventional playback, and is still improving.
The project is launching this Call to identify an additional Project Partner that will be funded to take in charge the development of the final equipment for optical digitisation of 78rpms discs, and will be able of ensuring the commercial distribution of such equipment.

Please note that the EC conditions for FP6 projects (Integrated Project) will apply and the funding for your contribution will be up to 50% of your full project costs (get more information: www.cordis.lu/fp6/ist.htm or contact your National Contact Point for more information: http://www.cordis.lu/fp6/ncp.htm).

2. Requested contribution

2.1. Summary

The selected Project Partner will have access to all the information collected by INA during the development of the optical prototype for audio disk playback. The target will be to develop an industrial version, that will be used by the project partners, and that should be distributed as a commercial product, suitable for massive digitisation plans of large collections of discs, in Europe and worldwide.

This device will be able to digitise the discs that are direct cut (acetates) as well as shellacs (pressed disks), present in archives in large quantities (over 100 000 units in most of the major national broadcasters in Europe)

A contactless, optical player is required for the following reasons :

No friction interaction with the groove, and therefore no record wear, and no requirement for stylus choice and stylus replacement.
The direct cut discs are particularly fragile, since they are soft enough to be modified by the cutter during the engraving. A few playbacks with heavy pressure can irreversibly destroy the audio signal. This in turns require skilled experts to choose the most suitable cleaning steps and appropriate stylus and pressure.
Lower surface noise (crackle) : a particle present on the surface will push the stylus off the right trajectory, and there is no indication when this happens. An optical apparatus will keep track of the large particles and provide tools for interpolation, and ignore the smaller ones, thus increasing the quality of the output signal, or reducing the need for a cleaning step.
Lower non linear distortion : In the traditional way of playing with a stylus, the difference of shape between the cutting gouge and the playback stylus causes a non-linear distortion. Optical methods can avoid this difficulty completely.
Ability to play fragmented discs : The material of acetate disc is a lacquer of nitrocellulose put down on an aluminium core. The loss of plasticiser causes the fragmentation of the lacquer into disjoint pieces, and the retraction of each of these pieces.
The implied deformation makes the groove impossible to track with existing devices. It is expected that a software matching of displaced pieces is achievable, as well as interpolation in the audio domain of missing parts.

A first working prototype developed by INA is already operational and is able to decode an audio signal from a disc, with a satisfying quality (patent FR2874280, EP1626402, US2006044988). This prototype is innovative with respect to the already known optical recovery methods, in that it does not require costly photographic processes, or high-end imaging solutions. A very simple lighting apparatus is the key to the process, and allows the use of conventional imagery tools.

The additional Project Partner will undertake the development of the industrial version of this device. Through the PrestoSpace project, the European Commission will fund the additional Project Partner for this development.

2.2. Brief summary of the process

The engraved groove of 78 rpm discs is obtained by the action of a fixed shape cutter on a blank disc. This is producing a rounded V shape, composed of two reflecting walls, oriented at about 45 degrees. The signal to record is translated into the radial velocity of the cutter,

expressed in cm/sec. Knowing the constant 78rpm rotation of the disk, there is a very simple relationship linking the signal, the groove angle, and the radius. When observed from a direction close to 45 degrees, the groove walls (which are very smooth), act as mirrors, and reflect to the camera the light coming from a direction which is linked to the groove angle, and to the signal. The principle of the system is to illuminate the observed area through a condenser that provides an angle-dependent lighting colour.
This results in images such as the following one, where the colour of a given position on one groove, codes for the audio signal value that has to be reproduced.

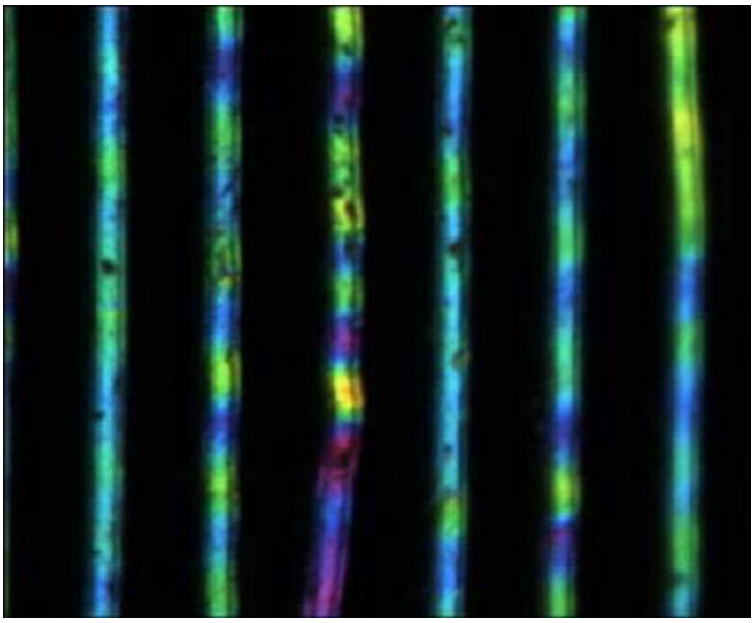

Figure 1 : a sample picture of a dusty disk

Instead of measuring the position of the groove and differentiating it to recover the signal, direct access to an image of the orientation of the groove is allowed by colour coding. Since the recovered signal is rendered independent of the reflected intensity and dependant only on the colour (hue), there is a moderate tolerance to occlusion by dust. When the reflected intensity is too low, it is used as a trigger to interpolate the signal in the missing sections. Small pieces of dust can be corrected by image processing before signal extraction.

The following picture shows the mechanical and optical set-up used for acquiring the picture of figure 1 :

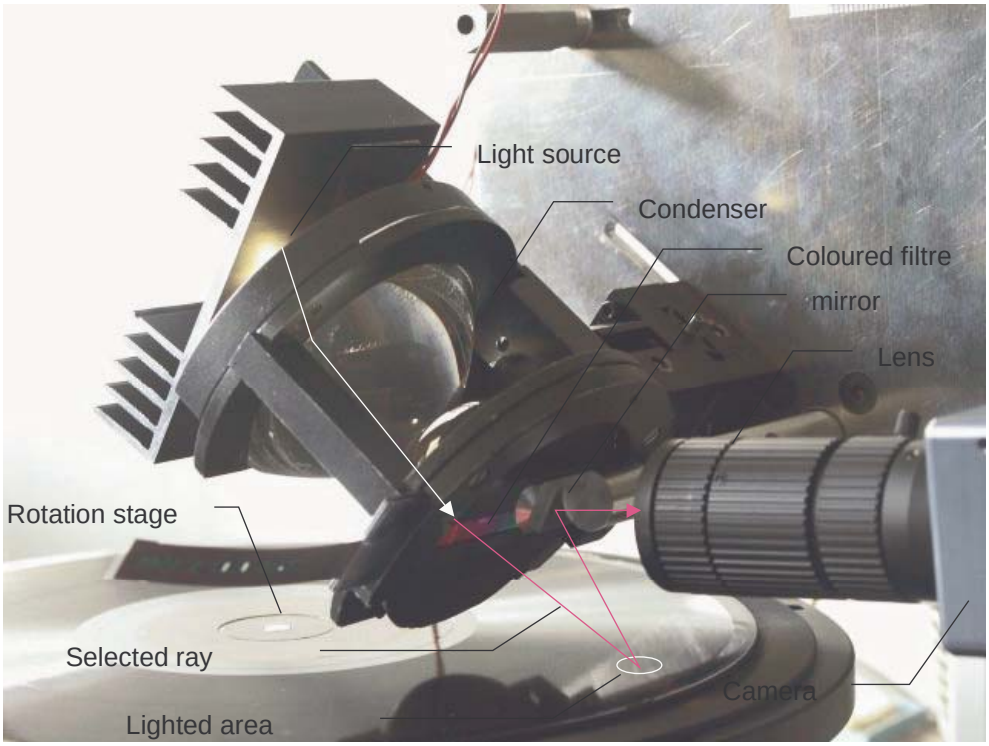

Figure 2 : The acquisition device for Figure 1

Ad-hoc software was written to translate the thousands of pictures into audible signals. Further details on the current state of development are given in Annex II of this document.

2.3. Advantages of the PrestoSpace Prototype

The advantages of the developed prototype over the currently existing methods for disc playback are :

Advantages over the physical (conventional) mechanisms :

- No wear of the disk
- No requirement for choosing and replacing the adequate stylus or cartridge
- Lower requirements for disk cleanup
- Ability to play disks with lacquer cracks

Advantages over other optical playback mechanisms :

- No photographic consumables are required.
- Required resolving power is relatively low : 10 micron is enough. The tools that only measure the lateral deviation of the grooves require a very high picture definition (lower than 1 micron, in general), which in turn requires expensive and slow acquisition tools.
- The images can be used to detect regions where the signal is unreliable due to scratches and dust. This allows to reconstruct the signal where it is missing or unreliable, hereby reducing plops and crackle without the need for blind de-clicking. The tools that use a laser beam to measure the reflected angle, are know to be very sensitive to the cleanliness of the discs.
- Easy adjustment of the acquisition (one manual combined control for focus and reflection angle)

Advantages over all playback mechanisms :

- Since there is no physical motion and since the measurements are made on angles and not on deviations, there is no limitation in the frequency response, and SNR is good up to over 20kHz.
- Non-linear distortion is kept to a minimum, even at high signal levels.

2.4. Description of the operation of the industrial system to be implemented by the new partner

The goal of the new partnership is to develop, based on the technology described above, a system for digitisation of 78 rpm disks that can be reproduced and distributed commercially.

It is foreseen that this industrial system will have two parts:

- The first part consists of the mechanical, optical, and digitisation setup, and interfaces for acquiring the pictures and files associated with each side of the disk.
- The second part will be software-only, and will produce audio signals from the pictures and files, generated by the first part.

Acquisition setup :
The device performs the raw digitisation of the disc using a computer controlled turntable, a structured light special illumination device, and a 1D or 2D colour camera. Setup is done manually, but acquisition is autonomous. When the disc is rotating, a ring is digitised. A radial motor then shifts the disc, and the system runs for the digitisation of another ring.

The device is therefore composed of :

- A condenser subsystem, for the structured illumination of an area of the disc.
- A camera subsystem for the acquisition of the images.
- A transport subsystem moving the disc, and allowing for the complete digitisation.

Several design choices can be made (light source, reflective or refractive condenser, 1D or 2D camera, synchronisation modes…). The final choices will be decided in agreement with INA, taking into account the available technologies and the desired performance level (speed of acquisition, picture quality…).

Signal processing setup :
The software processing tool will generate the audio signals (.wav files) using the series of images generated by the acquisition tool. This will include :

- Tracking of the grooves on each images corona
- Matching of parts of signals separated by cracks, and automatic abutting.
- Detection of dirt, cracks, and scratches.
- Averaging of the valid pixels, compensation of colour distortion, and conversion to audio signal.
- Interpolation of missing parts.
- Joining of signals extracted from different coronas
- Application of the appropriate frequency correction curve (choice from several available).

This tool will have its own user interface, probably built around an existing audio editing tool, to allow the validation of the results by the operator.

3. Requested qualification

It is expected from the Proposers to already have a relevant experience in :

- Optical design for illumination devices and general imaging
- Industrial vision
- Motion control
- Audio technology
- Hardware and software integration, software development

The capability of the partner to have access to a commercial distribution circuit will be highly appreciated. A highly motivated team in the domain of audio playback will be a plus.

The candidate must satisfy the eligibility criteria detailed in the Guide for Proposers ftp://ftp.cordis.lu/pub/fp6/docs/guide_competitive_ip-final_ep_en.pdf (briefly summarised, companies having a justifiable legal existence within one of the Member States of the EU, or in a state associated with the Sixth Framework programme, are eligible).

4. Available Funding

Expected duration of participation in project: from 09/2006 to 1/2008

Estimated costs and funding for the tasks :
Research costs: € 406 540 (to be supported by Commission funding of up to 50%)
Demonstration costs: €0 (to be supported by Commission funding of up to 35%)
Training costs: €0 (to be supported by Commission funding of up to 100%)
Consortium management costs €3000 (to be supported by Commission funding of up to 100%)
Total Commission funding available € 206 080

Please take into account that this is only an indication of the funding available for this task. Proposers are invited to provide different figures, reflecting their actual estimation of the costs. The consortium will then negotiate directly with the Proposers if an adjustment in the effort or of the funding is necessary.

5. Submission procedure

5.1. Paper submission procedure

It is recommended that Proposers use the paper submission procedure, as described in the Guide for Proposers ftp://ftp.cordis.lu/pub/fp6/docs/guide_competitive_ip-final_ep_en.pdf. However, to simplify the submission effort, it is not required that all the details required within the Guide for Proposers are fully detailed : please consider section 'Structure of the Proposal', below.

Caveat : It is highly recommended that Proposers get in touch well in advance with prestospace_contact@ina.fr, to be registered as a potential Proposer. Potential Proposers will receive a proposer's kit, will be informed of complements of details, and possible changes in the organisation of the selection. The PrestoSpace CALL2 team will do their best effort to provide the relevant information to the Proposers. As a general rule, questions will be accepted, but regardless of the source of the request, information will be provided to all Proposers simultaneously using email, and respecting a strict anonymity. The project will not be able to satisfy requests for assessment of preliminary versions.

Please submit your proposal as one complete recto only unbound copy and three recto-verso bound copies.
Please print your proposal on white A4 paper, 80g/m2. You are strongly advised to securely retain an additional complete copy of your proposal.
The complete set of proposal should be placed in an envelope marked “Commercial-in-confidence” and with the following information:

PrestoSpace
Competitive Call 2

The envelope(s) should then be sealed within an overall packaging, which should be addressed to :

Philippe Poncin
Direction Recherche et Expérimentation
PrestoSpace Call 2
Institut National de l'Audiovisuel (INA)
28 avenue des Frères Lumière
94366 Bry sur Marne
France

The proposal may be sent by mail, by trusted delivery service or delivered by hand, but must (in all cases) arrive at the specified address no later than 30/6/2006, 17:00, Paris time (GMT+2).

If you feel that your delivery may arrive late, you may send in advance a preliminary paper version. The newer versions (clearly labelled as *Version No XX, takes precedence over earlier versions*), will be taken into account in replacement of the preliminary versions, only if they are delivered before the deadline.

5.2. Structure of the Proposal Document

The paper submission should be in the following form :
A cover page should be placed as the first page of the proposal (paper proposal). It should clearly identify :
Project contract number - FP6-IST-507336
Project acronym - PrestoSpace
Call identifier - IST-IP-507336-PrestoSpace-CALL2
Date of close of call - 30/6/2006
Time of close of call - 17h00 Paris time (GMT+2)
Date of preparation of your proposal -_____
Your organisation name -_____
Name of the coordinating person -_____
Coordinator telephone number -_____
Coordinator email -_____
Coordinator fax -_____

Part A (Administrative and Financial Information)
The Guide for Proposers ftp://ftp.cordis.lu/pub/fp6/docs/guide_competitive_ip-final_ep_en.pdf provides templates for forms A1, A2, A3.
A1 Form (Project Summary) should be replaced by a short summary of your proposal.
A2 Form (Information on Participant) should be completed as instructed. Proposers are invited to report first to the Proposer's Guide and then get advice from prestospace_contact@ina.fr.

A3 form (Financial Information) should be completed. Only one line is required, but Proposers are invited to provide more details on their costs in section B.3 Project Resources.

Part B (Technical Information)
The Guide for Proposers ftp://ftp.cordis.lu/pub/fp6/docs/guide_competitive_ip-final_ep_en.pdf provides a template for part B. Please note that it is not required that the proposal be as detailed as required in the Guide for Proposers.
The evaluation will concentrate more on technical excellence, than on the compliance to the guidelines set in the Guide for Proposers. The Proposers are invited to reorganise the plan for Part B, to result in a short, clear and appealing proposal.

The Proposers are invited to follow the recommendations hereafter :
Section B.0 Tasks Addressed should be a simple re-statement of section 'Requested Contribution', of this *Call for an additional project partner,* above. It will be usefully completed by comments, for example mentioning the capacity of the Proposer to the Task, or a proposed adjustment to the Task
Section B.1 Outline Implementation Plan should **concentrate the essence of the proposal** (recommended length : 5-8 pages). More specifically, you are invited to describe technically your proposal for the system with respect to the 'Requested Contribution' criteria, above. Proposers are not required in section B.1 to mention references to Demonstration, Training, or Consortium management activities. All the described effort, by default, will be considered as Research, Technological development, and Innovation activities, and funded at 50%.
Section B.2 Description of Participant may be extracted from existing documents, and can be reduced to 1 or 2 pages.
Section B.3 Project resources may be detailed using the IP Project effort Form from the Proposer's guide, but alternative presentations may be preferred. Do not include too many sub-activities. In any case, section B3 should also include a simplified estimation of the costs, based on efforts and average man-months costs, and subcontracting if necessary. Other cost categories such as Travel, Equipment, Consumables, and Subcontracting, may be mentioned at this point if significant.
Section B.4 Other issues : Given the area of research, it is not anticipated that the Proposer's participation involve sensitive questions such as ethical issues, or gender issues. However, if it is the case, Proposers are required to include Table A and B checklists, as per the Guide for Proposers, p30. If no such problem arises, Section B.4 may be left as a simple statement, or completed by the relevant references.

6. Evaluation of proposals

The evaluation procedure will take place from 1/7/2006 to 20/7/2006, the selected candidate will be notified immediately. A negotiation phase will take place during August 2006, and it is expected that the chosen partner will access to the PrestoSpace Contract before the end of August 2006, allowing the development effort to start as early as September 2006.

7. References

The PrestoSpace project public Web site http://prestospace.org/

The Guide for Proposers ftp://ftp.cordis.lu/pub/fp6/docs/guide_competitive_ip-final_ep_en.pdf

The section on competitive Calls on Cordis http://www.cordis.lu/fp6/find-doc-management.htm#competitive

The ISTweb home page http://www.cordis.lu/ist/

PrestoSpace Call 2 help desk : prestospace_contact@ina.fr

8. ANNEXES

8.1. Annex I : Specifications of 78rpm disks

(Sources : Carl Haber, LNLN, Sylvain Stozer , EIF)

Attribute	*Value*
Revolutions/minute	68 to 84 rpm
Groove Width at Top	100-200 microns
Tracks/mm	3.78-5.35 tracks per mm
Track spacing	175-250 microns
Fixed Groove depth	40-80 microns
Reference level peak velocity @1kHz	7cm/s
Maximum groove amplitude	100-125 microns
Noise level below ref, S/N	17-37 dB
Dynamic Range	30-50 dB
Groove max amplitude at noise level	1.6 – 0.16 microns
Max min radii mm	120.65-47.63 mm
Groove V angle	82-98 degs
Radius at bottom	38-58 microns
Diameter	10-12 inches

8.2. Annex II : The current status of development of the prototype :

Figure gives an overall view of the mechanical and optical system :

Figure 3 : An overall view of the acquisition system

On this general view, the translation and rotation stages are clearly visible. The lighting sub system, the camera and its lens, are positioned on a plate that can be adjusted with one hand to correct the focus and the lighting+observation angle.

The specifications of the system are, in the current status of development :

- Lighting apparatus can cast the structured illumination through the coloured filter with an angle of about 70 degrees, which is enough to track radial velocities above 30cm/sec.
- The light source is a LED that is flashed to reduce motion blur to acceptable levels.
- The Macro zoom lens is set to get a zoom ratio of 3:1
- The camera is a 2D 1200x1600 Bayer CCD C-mount camera, only 400x400 pixels are used for the moment.
- The overall weight of the system (without computer) is 20kg.
- Acquisition is made through IEEE1394 to a Linux computer running the open-source Coriander interface.
- This allows us to digitise one ring of some 6 tracks in one pass (2 minutes).
- Post-processing of the several rings is made through Octave scripts and specific C/C++ code. This post-processing includes de-clicking when the track signal is occulted by dust, compensating the non-linearities due to the imperfections of the colour transmission chain. Equalisation is made through the open-source Audacity audio editing tool.
- Although the requirement for non-contact 33rpm(Vinyl) disks is less acute, early promising tests have been made to play 33rpm stereo disks (LP).

This setup described above, is enough for acquiring a 3 minutes disc in 1 hour, with a high enough quality to achieve equivalent performances to a conventional playback. For the industrial version, efforts will be necessary to reduce the acquisition time closer to real-time (as acquisition runs unsupervised, full real-time is not absolutely necessary). The tracks for achieving this goal will be evaluated together with the project with the selected partner. Among others, compromises will be chosen between the acquisition camera (lens/speed/resolution/noise), the light source power and flashing capability, the motorised rotation stage, taking into account the cost of the different elements.