

## ASTRONET Panel E — Education, recruitment/training & public outreach

**Robert Hill<sup>1</sup>, Rosa Maria Ros<sup>2</sup>, Robert Fosbury<sup>3</sup>, Lars Lindberg Christensen<sup>4</sup>, Leonarda Fucili<sup>5</sup>, Dirk Lorenzen<sup>6</sup>, Jose Carlos del Toro Iniesta<sup>7</sup>, Claus Madsen<sup>8</sup>, Andy Newsam<sup>9</sup>, Alan Pickwick<sup>10</sup> & Veselka Radeva<sup>11</sup>**

<sup>1</sup> Northern Ireland Space Office (rob@spaceconnections.net)

<sup>2</sup> Technical University of Catania (ros@mat.upc.edu)

<sup>3</sup> ESA/ST-ECF (rfosbury@eso.org)

<sup>4</sup> ESA/Hubble (lars@eso.org)

<sup>5</sup> SSIS, Universities of Lazio (l.fucili@itaca.com)

<sup>6</sup> German Public Radio (DLorenzen@compuserve.com)

<sup>7</sup> ESA (jti@iaa.es)

<sup>8</sup> ESO (cmadsen@eso.org)

<sup>9</sup> Liverpool Telescope/John Moore University (amn@astro.livjm.ac.uk)

<sup>10</sup> Manchester Grammar School/EAAE Secretary (Alan\_C\_Pickwick@btinternet.com)

<sup>11</sup> Astronomical Observatory and Planetarium (radevi@mnet.bg)

### Abstract

ASTRONET was created by a group of European funding agencies in order to establish a comprehensive long-term plan for the development of European astronomy. The objective of this effort is to consolidate and reinforce the world-leading position that European astronomy has attained at the beginning of this 21<sup>st</sup> century. This presentation concentrates on the work of Panel E.

### Introduction

Panel E is concerned with the relationship of our subject with society, from teaching in schools, training in universities, recruitment into astronomy related jobs to the process of communicating astronomy to the public. It also considers the relationship between cutting-edge research infrastructures with the industries that help build them, hopefully to the benefit of the overall economy of the continent. The panel members, both collectively and divided into several specific Task Groups, have investigated these issues and are generating a series of principal recommendations that are addressed to both national and European organisations. The panel members were assembled to represent a broad, Europe-wide experience in the fields of primary and secondary school education, university education and research, the relationship between astronomy and industry, the activities of planetariums and science museums, European public communication, outreach and science journalism and finally, in astronomical research using major observational facilities to promote astronomy to general audience.

ASTRONET Panel E have been requested to prepare a report highlighting their principal recommendations that arise as a result of the data gathering process and under the terms of reference stated below. This report is addressed to an audience that is expected to ultimately include: the ASTRONET Infrastructure Roadmap Working Group; funding agencies throughout Europe; politi-

cians with responsibility for science and education (and possibly technology as well); university directorates and science faculties; professional astronomers and organisations and individuals responsible for training school teachers.

The terms of reference provided by the ASTRONET Board to Panel E were to:

- Assemble information on initiatives to utilise astronomy and astrophysics to enhance school age education and assess their impact.
- Assemble information on postgraduate recruitment and training in Europe, including numbers of students in different areas (both science and technology development if possible).
- Assemble information on primary sources of publicity for our subject area and assess their impact (via international comparison if appropriate).
- Assess where greater cooperation, additional resources (including human resources) and/or better practise would significantly enhance the above areas in Europe.
- Highlight any areas of industrial relevance (particularly in training aspects).
- Compile a report (guideline for inclusion in the final report is ten pages plus figures) and any other relevant background information, to be passed to the working group.

To most efficiently achieve these aims, the full panel divided into Task Groups which focussed on data gathering and assessment in the areas of:

1. School education.
2. University education and research.
3. Science museums and planetariums.
4. Relationships with industry and on.
5. Public communication and outreach.

The five Task Groups were able to use knowledge of their field of interest and their existing contacts to produce a sufficiently detailed picture to expose and investigate many of the issues and problems that had been identified during the Panel's early deliberations. Each of the Task Groups made personal contacts and performed (mostly) web-based searches for existing relevant material and opinions with particular emphasis being placed on well-justified and quantitative data to support conclusions. In addition to existing material, the groups made selective distributions of questionnaires to follow up and expand on certain points.

## Initial findings

### **Task Group 1: Primary and secondary schools**

There are multiple motivations for teaching astronomy in schools, ranging from the scientific to the cultural. Of importance to our deliberations is that of using it as a vehicle for introducing the idea of a noble and grand scientific endeavour to the young mind.

The panel recognised a number of problems that beset the widespread and effective utilisation of astronomy in this. The principal one is the lack of specific training given to the teachers who would carry out this task. Strongly related to this is the place (or absence) of astronomy in the

school curricula in the different European countries. The presence of astronomy in the curriculum would do much to ensure the availability of teacher training in the subject.

The actual status of astronomy teaching in European schools is different from country to country. In general, astronomy appears in a few lessons associated with another course. Very little astronomy is taught in primary schools and it normally appears as part of environmental or general science. In secondary schools, astronomy generally appears as part of geography or physics. In the majority of European countries there are optional courses on astronomy for students aged around 16 or 17. In the other cases, astronomy appears only within a few lessons over the entire secondary schooling. Teachers do not usually have a specialist education in astronomical topics. In general they use the same school books as their students in order to prepare their classes. When teachers do not have the opportunity to participate in training courses, they tend to prepare their classes about astronomy using course books that are old-fashioned and fail to convey the excitement generated by modern topics that are the subjects of active research. Young people are very interested in real, living science but are uninspired by much of the “school science” that appears to them as a historical relic. Modern topics, such as exoplanets and black holes, give teachers the opportunity to experiment with other forms of “teaching” such as joint study or collaboration.

### **Task Group 2: Training and recruitment**

Task Group 2 was established to assess the question of postgraduate training and recruitment in astronomy in Europe. The panel identified the following specific questions:

- Are there enough young scientists now and for the future?
- Does astronomy attract students generally into science, technology, engineering and mathematics (STEM)?
- What are the career prospects and are they known?
- What are the wider benefits of training astronomers?
- Does sufficient funding go to support the excellent (peer-selected) projects — and does it go quickly enough to make these projects competitive worldwide?

Given the high level of interest amongst potential STEM graduates, it might be surmised that astronomy is in the fortunate position of being able to choose from a pool of graduates with a size in excess of its needs. As expected, at all stages (first degree, PhD, post-fellowship) the fraction of people staying in academic research rises. Nevertheless, at all stages some leave academic research for other fields (industry, education etc.). While there may be a variety of reasons why an individual chooses a particular career path, with job availability only being one aspect, these results imply that there is no obvious shortage of qualified people for the jobs in astronomy currently available.

It is widely accepted that astronomy attracts potential students towards the physical sciences, but there is little directly available evidence to back this up. However, a survey carried out by the Institute of Physics (2001) of the views of physics undergraduates showed that “fascination in astronomy/space” was a major motivating factor for students, even many who were not taking a directly astronomy or astrophysics related degree. In recent years a number of universities have attempted to make use of this attraction to halt a decline in recruitment onto physics degrees by

starting or significantly expanding their astronomy groups or departments. The Bologna process is a Europe-wide initiative set-up with the aim of harmonising graduate and postgraduate education across Europe. One of the aims of the Bologna Process is to make it easier for students to study for part of their degree at a separate institution. This will mean that those universities without astronomy groups will also be able to offer astronomy degrees by collaborating with another institution, which in turn this may lead to an increase in the number of astronomy (and physics) graduates.

### **Task Group 3: Science museums and planetariums**

The opinions of the museum and planetarium operators were polled with a questionnaire sent via existing network and contacts. This list includes various government funded organisations, non-governmental bodies and privately funded science outreach operations throughout Europe. From a total of 32 responses, the following general conclusions emerged:

- There is a lack of formal links with the European agencies involved with astronomy and space. Less than a tenth of respondents indicated that they had any link or direct communication with the agencies in Europe.
- The majority of respondents would welcome a central repository of visual material relating to astronomy and space. They are especially interested in images and videos.
- The relationship between planetariums and local amateur astronomical societies is common and should be better understood and utilised. Established relationships with professional astronomers are less common.
- Problems with curriculum integration and the sustainability of formal programmes clearly exist.

The responses exposed a richly diverse programme covering many aspects of classical and modern astronomy and there is some evidence that this has a direct effect on bringing pupils into science subjects in secondary school, although more tracking is required to verify this effect. Many of the facilities questioned offer a formal astronomy education package linked to the curriculum in their respective regions and it may be that the impact that these centres have on student choice should be further explored. The planetariums and science centres in Europe are the natural conduits through which the flow of astronomical information is disseminated to the wider public.

### **Task Group 4: Relationships with industry**

There has always been a close coupling between frontier scientific research and cutting-edge industrial development. The two activities feed off one another. At least in astronomy, however, it is difficult to get an overview of the process and to distil from this an idea about “best practice” methodologies.

From the responses, it is clear that the situation varies from country to country. Regionally, individual authorities or government agencies may host some data on individual projects and the industrial transfer to non-astronomy sectors. Also, individual groups or companies highlight how their own R&D has been successfully transferred outward and some websites and examples are given in the individual responses. However, it does not appear that many countries have a mechanism within their astronomical community to identify industrial relevance/transfer to other actors

or communities as an integral component of their R&D. Or it may be that individual companies, research groups, other actors, do not display or promote any results of this kind in their main scientific literature or websites. Further, due to copyright or possible intellectual property issues many actors may not publicise their work due to restrictions. As a result, even after successful transfer to other sectors, a follow-up public access programme to successful transfer may be overlooked. On the questions of the impact and successful commercial transfer on a regional or EC-wide level, there is strong evidence — even from this extremely limited sample — that there is no central bank or repository easily found or accessible to promote this culture. But note that ESO highlights and promotes its technology transfer.

### **Task Group 5: Public communication and outreach**

In addition to using the substantial hands-on public communication experience within TG5, the group has distributed its own questionnaire to over 40 of the major players in Europe (TG5Q, 2007) and also analysed the relevant answers in AFQ (2007). A vigorous activity in science public communication and outreach in Europe is an absolutely essential investment in the future health of the subject and, indeed, the economic and cultural life of the continent. Differences in attitude between scientists in the US and in Europe are often stark. The Panel has identified a real need to bolster public awareness of astronomy (and science in general) and to convince the scientists of its importance and to equip at least some of them with the knowledge and tools to participate actively in the process.

There is a strong need for syndication of the existing astronomy communication resources to increase their visibility and to collaborate better between the European main actors in the astronomy communication field.

One of the consequences of the Europe/US asymmetry in communication which is seen over and over again is that European journalists most frequently quote US sources. One response in TG5Q (2007) states: *European science often appears as second class in the press, even in fields where Europe is leading. The basic communication-cultural differences between the US and Europe are to blame.* There may be several reasons for this. Perhaps part of the reason is merely habit with journalists and editors? After all, the media know what they are getting from the US. Perhaps American science stories are more digestible and of a higher standard? Or there are more of them and they are simply more accessible and visible? Most likely all of the above apply, and the best strategy to improve the situation is to consistently produce interesting and high quality communication products in Europe.

What, from a modern point-of-view, can only be described as the underdeveloped communication culture and identity that prevails in European academia is undoubtedly rooted in its history and linked to the way scientific research has traditionally secured its financial support. European scientists have not been so strongly forced to justify their spending on research. The claim that Europe has a weak, or in some parts even absent, public communication culture, is strongly supported by literature and personal experience. As an example Banda (2005) states: *Despite several initiatives in recent years to improve Europe's performance, parts of the research community still do not believe that effective proactive media relations is a priority.*

Proper spending on public communication should not be seen as a “cost” but as an “investment” for the future. Returns on this investment may be high. The consequences of not making the investment may be disastrous!

## Timescale

Consideration of individual panel reports by the Working Group	October/November 2007
Meeting of the Working Group and (ASTRONET) agencies	January/February 2008
Release of draft road map to the community	Spring 2008
Roadmap Symposium Liverpool, UK	16–19 June
Publication of final version of the Roadmap	End of September 2008

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