

## **Conclusions and Recommendations for the European Research Balloon Programme**

The understanding of the atmosphere and outer space has improved greatly in recent decades, and research balloons have made a major contribution to this progress. In Europe, the CNES research balloon programme has led the way in operations and in technological development. Recently, a number of new factors have emerged which will have a great influence on the future uses of research balloons. First, changes in the application of safety measures have resulted in much tighter constraints on mid-latitude flight planning and operations. Second, long-duration flights have opened new research possibilities for several disciplines. Third, new platforms, most notably unmanned aircraft, have been developed which can be seen as both complements and rivals to research balloons in some lower-altitude applications. Fourth, the scientific rationale for the research continues to evolve with a new generation of important issues emerging.

In response to this, the European research balloon community and CNES have reviewed the rationale for the balloon programme for the next 5-10 years. After wide consultation a document “the future for research balloons in Europe” was prepared by atmospheric scientists who met with astrophysicists and planetologists, and balloon experts from CNES and other operators at a workshop in Pau in September 2008. This document lists the main conclusions and recommendations from this process. It is intended to inform all interested in a productive balloon research programme, whether from the scientific community, balloon operators, space agencies or funding agencies.

### ***Atmospheric Science***

1. Scientific ballooning still has a major role to play in European research on atmospheric science. The range of challenges is still great and balloons have some unique characteristics that justify their place alongside other platforms in a scientific research programme. Balloons provide access to parts of the atmosphere that cannot otherwise be reached; they could fill the gap in a period of declining satellite measurements; and they provide a distinctively European capacity.
2. As climate issues remain at the forefront of scientific challenges, there is likely to be an increased demand for regular measurements to be using research balloons at low, mid- and high latitudes. This implies that, for all types of balloons, a launch capability should be consolidated in the Tropics, that the mid-latitude site in France should be re-invigorated and that a high latitude site should be maintained.
3. There is currently no issue as over-arching as polar ozone depletion has been. Assuming that no similar issue emerges, future campaigns will be more focussed on specific topics. The preparation of these campaigns needs to be tackled jointly by scientists and balloon operators with early planning and a flexible approach to including local assistance and collaboration.
4. The atmospheric observation programmes of ESA and the national European space agencies show strong common interests with the atmospheric research balloon community, and close contact and co-operation should be maintained. Balloon flights can be used as Pathfinder missions for future satellite instruments, to validate the measurements from existing satellite instruments, and to study atmospheric phenomena in conjunction with satellite measurements.

## ***Astrophysics/Planetology***

5. A number of balloon projects within the fields of astrophysics and planetology fit nicely scientifically and programmatically into a bigger “satellite-dominated” picture. As well as conducting unique and competitive scientific observations the projects can be used as Path Finder Missions (scientific as well as technical) for more ambitious missions or scientific Gap fillers. In view of this synergies and complementarity with the ESA Science Programme should be identified and appropriately addressed.
6. Balloon projects can still open new “astrophysical windows”– in very much the same way as was done in the early times of ballooning. However, compared to the beginning it has become hard to come up with simple and cheap projects.
7. For some projects the latitude of the launch site doesn’t play any role, but for some it does. The position in the sky of a specific, high-priority target may influence the choice of launch site. Sky surveys (covering significant portions of the sky) naturally require more than one site. In other cases the need for either sunlight or darkness is the determining factor.
8. Long Duration Flights with heavy payloads producing large data volumes are often requested. This requirement demands appropriate capabilities as regards infrastructure of the involved launching sites.

## ***General conclusions and recommendations***

9. Cooperation and communication between scientists and balloon operators as well as between the balloon operators themselves should be substantially improved if the best use is to be made of the overall European capability in balloon science.
10. A common feature of all the above issues is the need for early planning of future coordinated balloon activities. The implied need is for a standing committee (with flexible membership) involving scientists and representatives from balloon operations to develop ideas for the campaigns and plans for raising the necessary funding. This committee should have good communication with the relevant research funding agencies. Without such a planning mechanism, it is hard to see how European campaigns will actually occur given the long lead times involved in taking a scientific idea through to a campaign and eventually analysis and interpretation of the measurements. Of central importance here is a much greater clarity about the application of appropriate and relevant safety rules as early in the planning process as possible.
11. A clearer focus is needed on the relative benefits of the various technical developments that are being considered. This should maximise the considerable synergies that could exist between the different operators and to avoid unnecessary duplication of effort.
12. In parallel a clear and efficient mechanism is needed to assess how the recommendations in this strategy are put into practice and to evaluate the effectiveness of any changes made. This mechanism should involve balloon operators, scientists and possibly funding agencies.
13. The establishment of a balloon infrastructure at European level would provide much better and more secure facilities to the scientists who use balloons for their research. Any proposal should involve European balloon operators and atmospheric and space scientists as partners. The European balloon operators should immediately and jointly investigate the possible sources of support at European level with a view to developing a European infrastructure. A deep and joint involvement of operators and users is a necessary condition of success.