

GENERAL OBJECTIVES AND RESULTS OF THE 2008 CNES BALLOONS WORKSHOP

Didier Vassaux⁽¹⁾ and Richard Bonneville⁽¹⁾

⁽¹⁾ CNES, 2 place Maurice Quentin, F-75039 Paris CEDEX 01. Didier.vassaux@cnes.fr,
Richard.bonneville@cnes.fr.

ABSTRACT

In order to define a set of guidelines with the European scientific community for its balloon activities during the next 5 to 10 years, CNES has organised a workshop that has been held on **September 22-24 th, 2008, in Pau, France**.

The overall objective of the workshop is to provide CNES and other Agencies, with the largest review of scientific needs for experiments flying with balloons. This objective is very similar to the previous “Balloon Workshop” organized by CNES, in December 2005 at the “Observatoire de Paris”.

The first step of the workshop preparation took the form of a call for ideas published in February 2008. Based on the results of this call (23 proposals have been received), for each of the three thematic fields (Atmospheric sciences, Planetary sciences, Astronomy and fundamental sciences), a panel of International experts has prepared a “pre position” paper. These three papers were presented to the entire community during the workshop. The subsequent discussions as the reactions to the presentations of the updates of the European Balloons infrastructures and techniques, with some emphasis on the operational constraints linked to security issues, allowed the preparation of sound outcomes in terms of Scientific interests and technical implementation.

Invitations to participate to the workshop were sent to scientists, representative of funding agencies and operator of balloon flights. Finally more than 150 people, from EU, Russia and Japan did attend the workshop.

By the way, this workshop allowed the organizing committee to develop a vision of the role of the balloons in the next decade in order to help the scientific communities to have a long term vision taking into account this kind of vehicle. In addition, a set of recommendations addressed to the operators and an overall list of actions has been released that should enable operators to better satisfy the future scientific needs.

BACKGROUND, PREPARATION AND IMPLEMENTATION

Since 2004, the background of the utilisation of Scientific balloons in Europe has been faced to new scientific orientations and more difficult safety rules. These evolution implies to use new systems with some consequences in terms of complexity of the preparation of the campaigns and the increase of costs. Faced to this situation a wider utilisation by the European scientific

community, and a better cooperation in Europe, has been looked for. These were the outcomes of a first workshop held in Paris in 2004.

Faced to this background, the European programme committee decided that the main objectives of the balloon workshop would be:

- (i) to confirm the mid term scientific orientations in all the domains interested in balloon utilization: atmospheric sciences, astrophysics, planetary missions,
- (ii) to identify the needs of the European science community interested in balloon utilization: what are the quantities to measure ? what are the required tools (types of balloons, gondolas, instruments, launch sites, season, duration, etc) ?
- (iii) to precise the place of balloon activities in the global context (in particular vs satellites and ground & airborne devices),
- (iv) for CNES, to improve the efficiency of the CNES balloon programme and the satisfaction of the users.

Preparation : the first step has been to send a call for ideas to scientists all over Europe. Following this call, 23 responses have been received. The distribution by thematic is the following :

- 13 proposals concerning atmosphere sciences (including 1 proposal common with Astronomy)
- 8 concerning Astronomy (including 1 proposal common with Atmospheric Sciences)
- 2 concerning Planetology
- 1 proposal is common to all the thematics.

13 of these answers were given by French scientific teams, the other were presented by or in association with teams from Brazil, Denmark(2), Italy(2), Germany or Sweden(3) and USA.

To progress on the elaboration of the scientific vision, the programme committee decided that a thematic paper for the Atmospheric sciences should be prepared with the scientists who answered to the call and presented and submitted for discussion with :

- two projects in Planetology : balloons in Venus and Titan/Saturn system
- four projects in Astrophysics : Gerbes 3D (High energy particles entering into the atmosphere), PICARD-Balloons (The form and the diameter of the Sun), CIDRE (Deuterium in interstellar space), GAMMA RAY POLAMIMETER (detector of electrons in a tank filled with liquid argon)

To progress on the optimisation of the operations, all the European operators were invited to present their strategies. And to complement the agenda, a presentation of the new approach for the management of the safety during the campaigns and their impact on the preparation was asked to the CNES relevant office.

Finally, around 100 participants did attend the workshop, they were from : France (75) Germany (7) ESA/EC (5) Sweden (4) Italy (3) and Nederland, United Kingdom, Spain, Russia, Japan and USA.

OUTCOMES

The outcome of the workshop have been gathered by the organizing committee within three papers.

The first paper is to be extensively presented by Neil Harris and Hermann Oelhaf within the same session of the ESA PAC symposium. This paper presents a strategic analysis of the Future for Research balloons in Europe prepared by the Atmospheric research community. Their recommendations, added to the recommendations in the field of Astrophysics/Planetology and to a set of general conclusions and recommendations constitute the second paper. Finally CNES has released a description of its own conclusions of the workshop.

The second paper confirm the value of the scientific experimentation with balloons and describe the main orientations that the activities should follow in the coming years. In addition it gives the following *General conclusions and recommendations*:

1. 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.
2. 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.
3. 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.
4. 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.

5. 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.

The third paper presents the main conclusions of CNES to the Pau Workshop. These conclusions aim at answering to the conclusions and recommendations of the Scientific community, as expressed in the relevant papers and describe the tentative road map to be followed by CNES. These conclusions have been presented and welcome by the CNES management committee.

CNES considers that the objectives (i), (ii) and (iii) have been achieved. The paper prepared under the coordination of Niel Harris and Hermann Oelhaf describe the needs of the Atmospheric community as the projects presented during the workshop are examples of the needs in the field of Planetary sciences and Astrophysics. With respect to objective (iv), the paper “conclusions and recommendations of the Scientific community” indicates that the objective has been achieved even if some progress have to be made by the operators.

In the field of atmospheric sciences, balloons are a unique experimental tool to probe the high atmosphere (e.g. stratosphere at 15-45 km), they provide a complement to satellite observations on the one hand, to ground and airborne measurements on the other hand, they are used for the calibration & validation of satellite data. To do so, the users need to have launch possibilities at every latitude, in the polar zones (Kiruna, Svalbard, Antarctica), in the tropical areas (Teresina, Kourou?), and in the mid latitudes (Trapani, Aire/Adour, Gap). A serious problem has been underlined: the question of safety constraints (see below).

In the field of space sciences and exploration, balloon flights represent opportunities rather than systematic research tools. In astrophysics, they allow precursor experiments so as to validate an experimental technique while providing valuable science data (Boomerang, Archeops). The users need to have launch possibilities at various latitudes depending on the portion of the sky they wish to observe. Planetary missions are a very peculiar domain, with very diverse environments and specific deployment techniques, whereas the safety constraints are replaced by the planetary protection rules.

The workshop had been planned for a long time and it was open to European users and operators. It came in a special context since the scientific users have been made dissatisfied by the development of recent campaigns (bad information transfer chain, shorter flights than expected, and finally poor results). In 2005, in a similar context,

there had been a review of the CNES balloon programme chaired by G. Debouzy, then followed by a first European workshop held at Paris Observatory in December 05.

Nevertheless three years later a major part of the recommendations presented at that time were still in the news. The Pau workshop was organized on 1 ½ day and a large amount of time was reserved for discussions, which had not been the case in the Paris workshop. It appears to CNES, that the conclusions of this second European workshop pave the way to a really efficient activity of the Balloons operators, but after a temporary phase of transition, at least for CNES.

After having recalled that the success of a campaign is measured by the scientific results which have been obtained, some very general recommendations (see the relevant paper for extended description) came out and are welcome by CNES:

- from the beginning of the preparation of their proposals, the users shall be provided in due time with all the relevant information and they shall be involved in the critical decision making process (e.g. campaign design, campaign postponement, shortening or cancellation),
- the technical and scientific teams shall not be allowed to go for a campaign as long as all the necessary information is not available (flight authorisations, safety analysis, weather forecast, etc) ...
- ... with adequate schedule margins (too often the campaign is at the limit of its schedule when the operations start),
- it is necessary to improve the communication with the scientific users; to that end, a new position has been created at CNES (recent nomination of T. Lam-Trong) ...
- ... and to re-enforce a rigorous management of the planning.

As it has been said above, the safety constraints have been discussed and sometimes criticized. It is exact that quite often they are known very late but the encountered problems find their origin less in the safety rules themselves (derived from those of civilian air traffic) than in their implementation. It is important to realize certain types of flights from some mid-latitude launch sites are getting more and more constrained, mainly due to the increasing density of population, and of the related increasing air and ground traffic.

A new strategy for solving safety issues has to be implemented. Today, balloon architectures are not compliant with Failure & Safety requirements. FS waiver will no longer be accepted after June 09 except for flights above loosely populated areas. The safety authority is presently reviewing the BPS Balloon configuration and BPS Balloons could be classified as lethal objects (a decision is expected by mid March 2009). As a matter of fact, the probability of a victim for a flight above inhabited areas is calculated with a dedicated algorithm called "Larri". Resulting figures are too high and cannot be accepted by safety authority. But "Larri" is too much simple and needs to be improved in order to give more reliable figures. That will be undertaken.

In parallel the development of new tools allowing a better control and monitoring of the flight has been decided in order to make the balloon systems compatible

with FS requirement (NOSYCA project) and to improve the landing accuracy (PAROR).

The possibility of using alternative launch sites at mid-latitude, e.g. French Military zones, Trapani, will be investigated, and also the possibility of flying over oceans and seas (recuperation devices, mission analysis). In addition not only the safety issues will be addressed in the near future but also the science capacity will be upgraded: the feasibility of a Kourou launch site will be studied and balloon upgrades will be undertaken: Large Pressurized balloons 16m (TBC), Aeroclipper improvement, BPCL/NANO adaptations.

In order to recover a full launch capacity, we are thus entering a 3 to 4 year transition phase (2009-2012). We have to manage that transition phase so as to start successfully a routine phase by 2012 with a new generation of balloon systems. During that transition phase we will continue making science. The missions which are already in the pipeline (STRAPOLETE, CONCORDIASI, FIREBALL & PILOT) will be performed. Though no further flight opportunity in France will be possible due to the FS waiver restriction and to the limited amount of resources (financial and human) available for campaigns while the new tools are under development, a couple of "Short Term Deliveries" will be identified to fly in 2010 and 2011 above low populated areas (polar or equatorial). To that end, no AO will be released; we will look among the recent experiments, scientifically evaluated, whose payload is available without major change (provided the PI expresses his interest for a re-flight). In parallel, the post-2012 missions will be prepared (STRATEOLE II, BAMED); in 2009 or 2010 an AO for the futures experiments that could fly beyond 2012 will be released.

In complement we also propose to re-examine the overall organisation of the balloon programme:

- at the national level, the co-operation with CNRS-INSU must be re-enforced and formalised (see below),
- at the European level, the co-operation with the other operators must also be better structured (see below).

At the French level, a model is provided by the air-borne experiments. SAFIRE (Service des Avions Français Instrumentés pour la Recherche en Environnement) is a joint venture (« Unité Mixte de Service ») between INSU (Technical Division) + Météo-France (Meteorological Research Centre) + CNES (funding support). SAFIRE gathers the technical, human and financial resources that the partners dedicate to air-borne experiments, and it is in charge of the maintenance of the fleet (3 planes), of the development of the onboard instruments, and of performing the flight campaigns.

Our proposal is to build along the SAFIRE model a joint effort between INSU and CNES in view of managing the balloon programme:

- the campaigns would be operated by the CNES personnel,
- the instruments would be developed by the laboratories with the technical support of INSU's Technical Division and the financial support of CNES,
- the programme would be managed by a steering committee INSU + CNES + representatives of the users,
- the selection process of the experiments would be simplified and harmonised at the French level; there are

today several channels (INSU\LEFE, CNES\TOSCA, ANR) which would leave the floor to a single selection procedure based on specific AOs jointly issued by INSU and CNES.

- a scientific and technical committee would be set up with the duty of reviewing the proposals and to propose an implementation plan to the steering committee.

This proposal is currently under review at CNRS/INSU.

At the European level, it has to be acknowledged that the existing CNES European programming committee does not work as it should. A first proposition is to implement a non binding co-ordination committee between the European operators and/or funding agencies so as to

- exchange information and co-ordinate activities,

- re-enforce the inter-operability of the hardware,

- harmonize the safety procedures.

The draft terms of reference of that so-called committee or group, European Balloon Activity Working Group (EBWAG) are attached to this presentation and have been distributed to the organising committee of the workshop and to the present CNES European programming committee. The EBWAG could decide to set up ad hoc working groups on either scientific or technical issues and could be supported by experts as needed. These terms of reference have been welcome by these committees.

A goal could be to have European integrated teams whenever possible in order to reduce the costs and to gradually set up a true European balloon activity: the promoters of a balloon campaign launched from a given launch site would be supported by the local teams.

A second proposition is to create a European research infrastructure dedicated to balloons within the framework of the FP 7 of the European Commission. Once again, the model is provided by the air-borne experiments and the EUFAR network (European Fleet for Airborne Research). EUFAR aims at co-ordinating the operations of the European fleet dedicated to research in Earth and environment sciences and to facilitate the access to the airborne facilities for the scientific community. However, even if an operator agency such as CNES is needed to be the motor of the project, it is also necessary to have a motivated scientist, or a group of scientists, to defend it in front of the European assessment organs.

DISCUSSION

Most of the objectives of the Pau workshop have been achieved and the preparation of a road map for balloon activities in Europe may be drafted.

Nevertheless, the full impact of the implementation of the safety regulations is still to be measured. At least some time will be necessary to allow the smooth

preparation and implementation of campaigns on all the launch bases.

But, the results of the Pau workshop are in some way looking like to the “conclusions” of the Paris workshop held in 2004 and this similarity may generate a negative feeling of no progress. In fact, during these years a lot of efforts have been made with balanced but inhomogeneous results.

As already said, the upgrade of technical tools (servicing gondolas, balloons envelopes) for supporting smooth preparation and implementation of operations is more difficult than foreseen and still requires at least two years of effort.

The implementation of a formal cooperation between the main operators and funding agencies in Europe has been unpractical. As the European call has not been successful: from year to year, no more than one or two proposals have been received. Therefore, it has not yet been possible to resubmit a proposal to the EC, as a integrated project in the Research Infrastructure specific program of the ECFP 7.

On the positive side, it has been possible to sustain operations in the polar zones, to assess the potential of launch bases located in the inter tropical zone and to maintain all operational and technical capabilities, and finally a network between the main European partners.

Therefore, if the situation is complex, it seems possible to set up :

- The EBWAG: an informal European group of operators backed to an European Advisory Committee
- to set up an European integrated team of operators potentially funded by the EC FP7
- and/or a more developed set of bilateral and multilateral agreements.

Attachment : **EUROPEAN BALLOON ACTIVITY
WORKING GROUP**

TERMS OF REFERENCE

(WORKING PAPER)

1 - Understandings

The European Balloon Activity Working Group (EBAWG) is a European forum established with the goal to foster European co-operation in relation with the scientific activities using balloons.

The EBAWG aims to foster, facilitate, and help co-ordinate European scientific activities using balloons such as to be complementary with existing mechanisms used at national, bilateral and multilateral levels by existing European organisations.

These Terms of Reference are non-binding and have not been developed in order to create any legal obligations between or among the Members of EBAWG.

The EBAWG may evolve incrementally, as required, to meet the needs of European scientific activity programmes using balloons.

2 - The Purpose and Objectives of the EBAWG

2.1 Purpose

The purpose of the EBAWG is to provide an open forum for discussion in order to facilitate the development of European co-ordination relating to a comprehensive, co-ordinated, and sustainable European balloon programme.

2.2 Objectives

The objectives of the EBAWG are to:

- (1) share information and future plans relating to the development of national and European balloon activity programmes,
- (2) enhance European co-operation and co-ordination in the development of balloon activity programmes,
- (3) provide opportunities for engagement by all Members and relevant European and regional organisations,
- (4) facilitate the interoperability of balloon activity systems and minimize duplication,
- (5) explore opportunities for collaboration and/or coordinated missions.

3 - Membership and Participation

3.1 Members

Membership in the EBAWG is open to any interested country, represented by the appropriate national space-related organisation.

In addition, membership in the EBAWG is equally open to any intergovernmental, regional or European organisation with an interest in balloon activity, subject to approval by the Members, cognisant that such contributions are valuable to implementing the EBAWG purpose and objectives. Such organisations may express their interest in joining the membership of the EBAWG through written notification by their relevant executive bodies or agencies to the Chair, stating their acceptance of the Terms of Reference and pending approval by the Members.

The European Space Agency is member of the EBAWG.

All Members participate in the EBAWG with all the same rights and obligations.

3.2 Observers

Other United Nations Specialised Agencies and Programmes associated with balloon activities or space research, as well as other intergovernmental or European organisations, or other relevant institutions involved in this domain can be invited to attend the EBAWG meetings as Observers.

Participation in EBAWG by individual persons is by invitation only.

In all cases, observers and advisors must be invited to attend by a Member and observers will be considered part of a national delegation for the duration of the meeting.

4 - EBAWG Structures

The structure the EBAWG will consist of:

- the EBAWG Plenary,
- a Chair,
- *ad hoc* bodies and sub-committees, as decided by the EBAWG Plenary. (including an advisory scientific board)

4.1 The EBAWG Plenary

The EBAWG Plenary will be the means by which the Members will make decisions on all matters relating to the EBAWG.

4.1.1 Composition of the Plenary

The Plenary will consist of one official representative and an alternate for each Member of EBAWG.

Any Member can be assisted by additional experts as required, by invitation by the Member.

4.1.2 Responsibilities of the Plenary

The responsibilities of the Plenary are as follows:

- (1) providing a forum where EBAWG Members can provide updates on current and planned balloon activity programmes, national, regional and European,
- (2) developing, updating and maintaining a non-binding balloon activity European Co-ordination Plan. This plan, to be brought forward for general agreement at each plenary meeting, will build on existing and future funded European balloon programmes and will be published on a suitable web site,
- (3) setting and addressing priorities to fill gaps in the Co-ordination Plan,
- (4) electing the Chair,
- (5) establishing, updating and adopting the Terms of Reference of EBAWG.

4.1.3 Decision-making of the Plenary

Decisions and recommendations of the Plenary will be by consensus of the Members present. "Present" includes in person, by telephone, by video conference, or other practical means determined in advance.

4.1.4 Meetings of the Plenary

The Plenary will normally meet annually. The Plenary will hold extraordinary meetings at the request of the Chair and with a simple majority of EBAWG members.

4.2 The Chair

The Chair is elected by the Plenary for a two-year term and can serve a maximum of two consecutive terms.

The Chair's responsibilities include:

- (1) facilitate, prepare and co-ordinate the updating of Balloon activity European Co-ordination Plan as directed by the Plenary,
- (2) organise, prepare, and support meetings in order to establish plans, programs and priorities,
- (3) facilitate specific activities, generally expected to be an in-kind contribution from one or more EBAWG Members,
- (4) provide annual reports on the activities of EBAWG,
- (5) conduct the day-to-day administrative activities of EBAWG,
- (6) a report on EBAWG activities will be presented by the Chair (or his/her designate) at a European conference

such as COSPAR, COPUOS, IAF/IAC, on a regular basis, at least once during his/her term.

A website will be used to disseminate information on the activities of EBAWG. Any document approved by EBAWG will become public domain and will be posted on this website.

The website will be supported by one or more EBAWG members on a volunteer basis.

4.3 Subsidiary Bodies

In order to ensure that decisions of the Plenary are based upon sound scientific and technical advice, the Plenary may establish *ad hoc* committees, such as technical and scientific advisory committees

5 - Modifications

These Terms of Reference may be modified by the EBAWG Members by consensus.

6 - Meeting Venue and Costs

Meeting venues will be decided by the Plenary by consensus, upon proposal by one of the Members. The Member proposing to host a meeting will bear local administrative costs associated with holding the meeting.

7 - Travel costs

Any Member of the EBAWG will support the travel and living expenses of their delegation in all EBAWG activities.

8 - Withdrawal

Any Member may withdraw from the EBAWG by providing written notification to the Chair.

9 – Establishment, Review and Adoption

The EBAWG is established for a 10-year period and may be continued by consensus at a plenary meeting for additional 5-year periods thereafter with an evaluation at the end of the third year to revisit its needs and assess its progress.

These Terms of Reference are effective as of ????? as adopted by the EBAWG Plenary in ??????. Adoption of these Terms of Reference does not amount to a legally binding commitment, but constitutes a declaration of best efforts.