1. Publication Nº	2. Version	3. Date	5. Distribution
INPE-4602-PRE/1325		*June 1988*	☐ Internal ☒ External ☐ Restricted

4. Origin	Program
DAS/DBL	*ATCLB*

6. Key words - selected by the author(s)

BALLOON; LONG DURATION; BOOMERANG

7. U.D.C.: *629.733.3*

8. Title *INPE-4602-PRE/1325*

SCIENTIFIC BALLOONING IN BRAZIL

10. Nº of pages: *05*

11. Last page: *04*

12. Revised by

Thyrso Villela Neto

9. Authorship

Ricardo Varela Corrêa

Responsible author

13. Authorized by

Marco Antonio Raupp
Director General

14. Abstract/Notes

Scientific Ballooning is being increased in the world because of the possibility of the use of up-to-date detectors and applied electronics. After the burst of the SN1987A, several institutions from several countries have shown interest in using our Balloon Facilities, since only Brazil and Australia have the necessary structure for stratospheric balloon launching in the Southern Hemisphere. Several places in the countryside have good airports in low population densities areas, ideal for balloon launching. Depending on stratospheric wind speed, flights over 25 hours are possible. Flights during "turn-around" and "boomerang" flights may increase flight duration. At the Balloon Base, only west direction flights are possible, with up to 15 hours at ceiling. With the increasing users, demands for lighter instruments and safer flights are providing new ideas for power and weight reductions. The telemetry is being improved with transmission in "L" band and new command system. The tracking antennas at balloon base and at down range station will provide location of balloon, backing up the OMEGA system. The OMEGA system in the Southern Hemisphere is reliable and suitable for balloon trajectory. A new onboard filter is providing OMEGA data with more than three stations locked at the receiver, during the worse time of day (sunrise and noon).

15. Remarks

VI Simpósio Nipo-Brasileiro de Ciência e Tecnologia, São José dos Campos.

SCIENTIFIC BALLOONING IN BRASIL

RICARDO VARELA CORRÊA
Department of Astrophysics
Instituto de Pesquisas Espaciais

ABSTRACT

Scientific Ballooning is being increased in the world because of the possibility of the use of up-to-date detectors and applied electronics. After the burst of the SN1987A, several institutions from several countries have shown interest in using our Balloon Facilities, since only Brazil and Australia have the necessary structure for stratospheric balloon launching in the Southern Hemisphere. Several places in the countryside have good airports in low population densities areas, ideal for balloon launching. Depending on stratospheric wind speed, flights over 25 hours are possible. Flights during "turn-around" and "boomerang" flights may increase flight duration. At the Balloon Base, only west direction flights are possible, with up to 15 hours at ceiling. With the increasing of users, demands for lighter instruments and safer flights are providing new ideas for power and weight reductions. The telemetry is being improved with transmission in "L" band and new command system. The tracking antennas at balloon base and at down range station will provide location of balloon, backing up the OMEGA system. The OMEGA system in the Southern Hemisphere is reliable and suitable for balloon trajectory. A new onboard filter is providing OMEGA data with more than three stations locked at the receiver, during the worse time of day (sunrise and noon).

INTRODUCTION

Scientists are assembling larger and heavier payloads, thus needing a balloon facility with trained personnel with the ability to launch large volume payloads and the capability for long duration flights. Since the location of our launch path limits the period of the year to launch from April to December (too close to the sea), several options were studied to allow all year balloon programs with the increase of flight duration and balloon volume.

Ground and on board telemmetry needed to be up-dated with higher transmission rates and more precise localization systems to allow these flights.

Three areas needed to be changed to answer the demand: telemetry, balloon tracking and launching. The ground and on-board telemmetry were implemented with microcomputers, tested to be space qualified. On board housekeeping data is being monitored by microcomputers and also the command system, allowing confiability in the ground system.

Balloon tracking was a major problem since only OMEGA Navigation system was used. The reliability of this system was increased with the use of high Q on board filters. Tests have shown that in the worse weather conditions, more than three stations are locked. A phasemeter and two dish antennas, one at down range site and the other at the launch site, will provide a second system to assist the OMEGA. The phasemeter will measure distance between launch site and the balloon, and the antenas will furnish the azimuth of the balloon.

Personnel training was performed at our launch site, to allow balloon launch up to 450.000 m^3. More intensive training will be carried out to increase the capability to launch larger volume balloons.

In the southern hemisphere, stratospheric winds will change direction during March/April and September/October. At these periods, flights over 10 hours are easily attained if an inland airport is used. Figure 1 shows the airports already used for balloon launch.

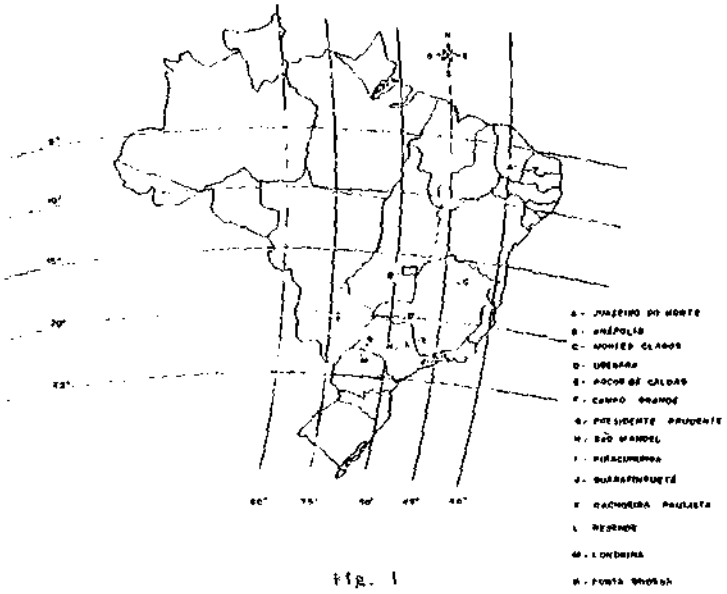

fig. 1

In Figure 2, wind vectors from satellite data obtained in September 13 1987 shows clearly the low wind speed and no dominant direction, characterizing the beginning of the"turn-around" period. In October 10, 1987 a 231.000 cu-m (8.3 mcu-ft) balloon were launched from an inland airport, flying over 15 hours at ceiling at 3.5 mbar. The recovery was done 100 km from the launch site. This flight showed the possibilities of long duration flights in the southern hemisphere.

Fig. 2

Figure 3 shows wind direction and speed at several altitudes where is possible to visualize turn-around periods. Each altitude has plotted a two year period of wind data. At turn-around, wind speed is low and increases to a maximum between January to March.

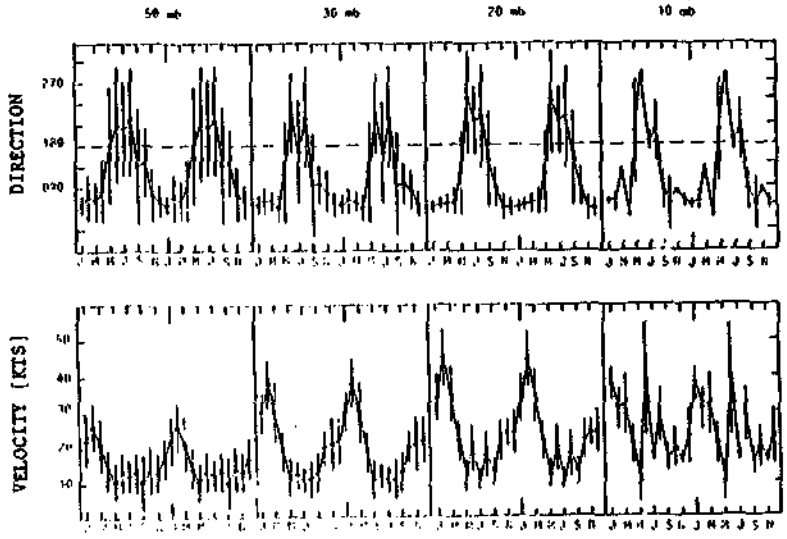

Fig. 3

Another way of obtaining a long duration flight is using opposed wind directions at different altitudes. These "boomerang" flights are possible if wind soundings are available assuring at which altitude the wind direction changes. Althought Boomerang flights were never attempted in Brazil, studies have shown its feasebility. Figure 4 is a sketch of this type of flight.

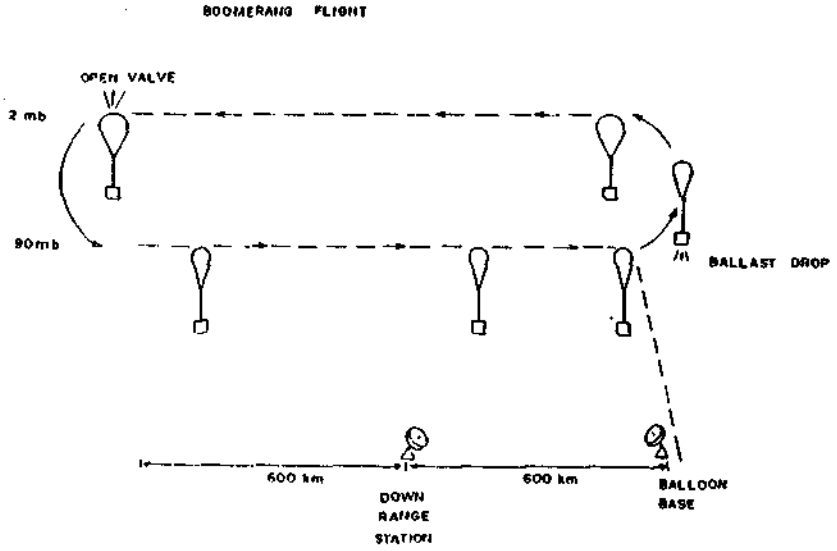

Fig. 4

MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO DE PESQUISAS ESPACIAIS

PROPOSTA PARA PUBLICAÇÃO

- ☐ DISSERTAÇÃO
- ☐ TESE
- ☐ RELATÓRIO
- ☒ OUTROS

IDENTIFICAÇÃO

TÍTULO: SCIENTIFIC BALLOONING IN BRASIL

AUTOR(ES): RICARDO VARELA CORRÊA

ORIENTADOR:

CO-ORIENTADOR:

DISS. OU TESE

DIVULGAÇÃO: ☒ EXTERNA ☐ INTERNA ☐ RESTRITA

EVENTO/MEIO: ☐ CONGRESSO ☐ REVISTA ☒ OUTROS *PRE Simposio*

LIMITE	DEFESA	CURSO	ORGÃO
__/__/__	__/__/__		

REV. TÉCNICA

NOME DO REVISOR: Thyrso Villela Neto

RECEBIDO	DEVOLVIDO	ASSINATURA
17/5/88	__/__/__	T. Villela

NOME DO RESPONSÁVEL: Hugo Vicente Capelato

APROVAÇÃO

APROVADO	DATA	ASSINATURA
☒ SIM ☐ NÃO	17/5/88	Hugo Vicente Capelato, Chefe, Departamento de Astrofísica

REV. LINGUAGEM

Nº	PRIOR.	RECEBIDO	NOME DO REVISOR
		__/__/__	

PÁG.	DEVOLVIDO	ASSINATURA
	__/__/__	

DATILOGRAFIA

OS AUTORES DEVEM MENCIONAR NO VERSO INSTRUÇÕES ESPECÍFICAS, ANEXANDO NORMAS, SE HOUVER

RECEBIDO	DEVOLVIDO	NOME DA DATILÓGRAFA
12/05/88	12/05/88	Eliana M.C.Martins

DIRETOR

Nº DA PUBLICAÇÃO: PÁG.:

CÓPIAS: Nº DISCO: LOCAL:

AUTORIZO A PUBLICAÇÃO

☐ SIM

☐ NÃO __/__/__

OBSERVAÇÕES E NOTAS

APÓS A PUBLICAÇÃO, ESTA FICHA SERÁ ARQUIVADA JUNTAMENTE COM A VERSÃO ORIGINAL

INPE 106