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AUSTRALIAN GOVERNMENT

DEPARTMENT OF MANUFACTURING INDUSTRY

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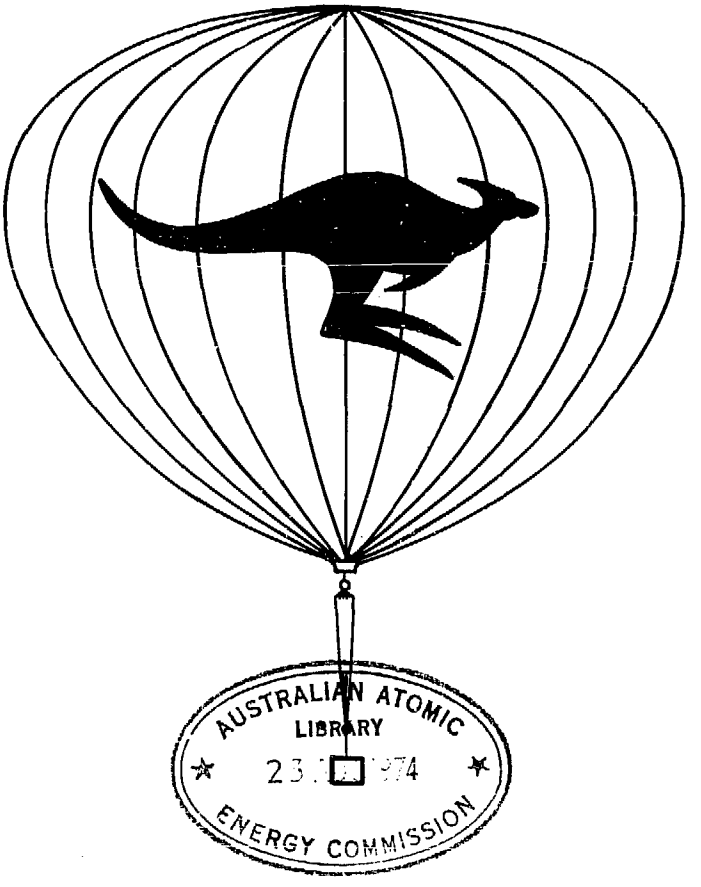
BALLOON LAUNCHING STATION MILDURA AUSTRALIA

HIBAL MANAGEMENT PROCEDURES



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JULY 1974

1 GENERAL

The HIBAL high-altitude balloon, air-sampling programme was initiated by the United States Atomic Energy Commission (AEC) in 1960 and managed on their behalf by the Department of Supply (DOS). A few years later the AEC flight programme was reduced and both AEC and DOS sought to take up the surplus capacity of the HIBAL team by arranging flights at marginal cost for scientists. This continued until AEC terminated their sampling programme in May 1974.

From July 1974 the Australian Department of Science assumed financial responsibility for the activity setting out policy and the programme, and DOS which itself had become part of the Department of Manufacturing Industry (DMI) continued to manage and operate the Station. It was agreed to retain the name HIBAL to describe the activity.

The long term future of the Station depends on an assessment, which will be made in the year 1 July 1974 to 30 June 1975, of the nature and number of future flight requirements. As under the previous AEC-DOS partnership, the policy of actively seeking out potential users, fully utilising the HIBAL facilities and exploiting the natural features of Australia for scientific ballooning, is being continued.

The flight requirements of potential users are received and considered initially by the Department of Science. Flight requirements accepted by the Department of Science are passed to the DMI for implementation.

The station staff are Australian Government employees in the DMI. The Officer-in-Charge of the Station is a professional engineer, designated the Station Director (SD). He is responsible to the Assistant Controller, American Projects Branch (AC/APB), of the DMI, whose office is in Canberra, ACT.

Flights are scheduled in the field by the SD who seeks the best compromise in terms of users' requirements and the capabilities of the HIBAL team.

Users are normally represented during flights and, when so represented, are expected to nominate a Scientific Team Leader (STL), who will be responsible for the scientific user's team. The STL is expected to work in conjunction with the SD and accept responsibility for some aspects of the user's flight.

Some of the costs attributable to a scientific user are reimbursable, and arrangements for financial responsibility, satisfactory to the DMI must be made prior to the DMI confirming a flight commitment.

Since the viability of the Station depends on satisfactorily carrying out a sufficient number of scientific users' flights, and because the users are required to pay some costs, the encouragement and fair treatment of users is deemed to be both necessary and just. Recognition of the prerogatives of users as well as the responsibilities of the DMI and the SD, is therefore a key feature of the management plan.

2 STANDING RESPONSIBILITIES

2.1 Station Director

Responsibility for the conduct of HIBAL business from the Mildura Balloon Launching Station (BLS), and from balloon launching stations which may be set up in Australia from time to time, rests with the SD. Special responsibilities assigned to the SD include:

(a) All aspects of safety, which includes the safety, as affected by HIBAL activities, of the station staff, the general public and aircraft. This is considered to require control by the SD of launch timing, ballast-dropping capability and cut-down capability.

(b) Liaison with the STL to ensure that interfaces between the payload and balloon equipment are satisfactory.

(c) Operational performance of the HIBAL team and HIBAL provided equipment.

(d) Local aspects of flight scheduling in conjunction with the STL.

(e) Liaison with local representatives of government organisations such as the Air Transport Group of the Department of Transport* and the Bureau of Meteorology of the Department of Science.

(f) Public relations and publicity in which HIBAL is concerned.

(g) Obtaining clearance through APB for all radio frequency transmissions to be made during flights.

(h) Ensuring that cut-down systems are acceptable to DMI.

(N.B. A Raven lightweight command receiver/decoder (LWRD) is flown for cut-down on all flights unless other equipment is flown which is of equivalent capability and reliability, and acceptable to DMI).

2.2 Scientific Team Leaders

Scientists who are represented during their flights should nominate an STL to accept responsibility for the activities of their team and for liaison with the SD. Specific responsibilities of the STL include:

(a) All the work associated with the preparation of the payload.

(b) Liaison with the SD to ensure that users' equipment interfaces satisfactorily with HIBAL equipment in its standard form. Where modifications to HIBAL equipment are desired these must be acceptable to the SD.

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* Formerly the Department of Civil Aviation.

(c) Advising the SD of any special requirements affecting scheduling, the conduct and duration of the flights, or the recovery.

(d) Ensuring that the team understand local regulations and arrangements e.g. regarding access to airfield runways, the obtaining of meteorological information, etc.

3 FLIGHT RESPONSIBILITIES

3.1 General

It has been found to be impracticable to precisely define the responsibilities of the SD and the STL without imposing a degree of rigidity which would preclude, on occasions, the attainment of optimum balloon flights. The vagarious nature of ballooning has been recognised and taken into account in the appointment of the SD and it is expected that his attitude, experience and professional skill will lead to a good understanding of the requirements of each scientific user and to the proper allocation of priorities and resources in each situation. Similarly, the state of development of scientific ballooning is such that the STL may be expected to have some understanding of balloon operations and an appreciation of the responsibilities of the SD. The following notes indicate the areas of responsibility, and assignment of responsibility for specific flight decisions.

3.2 Areas of Responsibility of Station Director and Scientific Team Leader

Station Director	Scientific Team Leader
.Economic, safe and effective utilisation of HIBAL resources and equipment within approved budgets and consistent with DMI policy.	Preparation of scientific package and the development of satisfactory interfaces with HIBAL equipment.
.The proper handling, launching and recovery of scientists' equipment, e.g balloons and payloads, having due regard to the requirements and objectives of the scientific team.	The development of a flight plan compatible with local conditions and constraints.

3.3 Assignment of Responsibility

Event	Responsibility
.Acceptance of flight requirements and agreement to support.	Department of Science/ Department of Manufacturing Industry/Station Director.
.Precise scheduling of flights.	DMI/BLS/STL.
.Details for flight support.	SD/STL.
.Specific launch date and time.	*SD/STL.
.Flight duration.	*SD/STL.
.Recovery.	SD/STL.
.Rescheduling flights	SD/STL.

* The responsibility for deferring or terminating a flight for safety reasons rests solely with the SD.

4 INTERFACES WITH OTHER AUSTRALIAN GOVERNMENT ORGANISATIONS

The successful conduct of balloon flights in Australia requires coordination and cooperation with other Government Departments working in associated fields. While all liaison is the responsibility of the SD, certain operational procedures and information requirements arising from these interfaces affect flight procedures. Significant aspects are provided as background material to assist scientific users in gaining an understanding of local procedures.

4.1 Air Transport Group of the Department of Transport (Refer Appendix A)

Coordination of the use of Australian controlled airspace is undertaken by the Air Transport Group (ATG). It is necessary to obtain approval from ATG to fly a balloon and during each flight ATG requires knowledge of the location of the balloon and payload.

4.1.1 Operational Constraints Arising from ATG Requirements

(a) When remote sites are used for launching, a telephone line or other means of communication must be set up from the launch airfield to the appropriate ATG Flight Service Unit (FSU) to facilitate speedy and effective exchange of information.

(b) The SD is required to provide advance notice of intention to launch to the appropriate FSU.

(c) Prior to launch the SD is required to advise the FSU of the anticipated flight plan and to provide a revised estimated time of launch (ETL) if there is any variation from the ETL previously advised.

(d) During flight the SD is required to provide regular advice to the FSU of the balloon's position and to give revised estimates of the impact point and time, if the estimates have been changed.

(e) Flight through controlled airspace is subject to specific real-time negotiation with ATG.

(f) Prohibitions are placed on cut-down which is generally not allowed in close proximity to airfields or in controlled airspace.

4.2 Bureau of Meteorology (Refer Appendix B)

The Bureau of Meteorology of the Department of Science provides various services to HIBAL in relation to balloon flights and requires certain information in order to perform these services.

4.2.1 Summary of Services Provided by the Bureau of Meteorology

(a) Weather forecasts for the area surrounding the launch site and other areas as required for flight planning.

(b) Windfinding flights performed in accordance with general guidelines previously agreed between DMI and the Bureau of Meteorology or as requested by the SD.

(c) Radar tracking of balloons while they are within range of a Bureau of Meteorology radar and provision to the SD of this tracking data and wind calculations derived from the data.

(d) Emergency coverage by Bureau of Meteorology radars if the SD advises that a balloon poses a threat to safety.

(e) Provision, to the extent of available resources, of continuous meteorological services when the SD has advised that such services are critical for the success of an experiment.

4.2.2 Summary of Information Required by the Bureau of Meteorology

(a) Notification of the intended flight programme as soon as the flight requirement has been confirmed and of any changes subsequently arising.

(b) Details of windfinding and other meteorological support required for a particular flight.

(c) Details of the estimated flight schedule.

APPENDIX A

EXTRACTS FROM THE DEPARTMENT OF TRANSPORT, AIR TRANSPORT GROUP OPERATIONS INSTRUCTIONS

The following extracts pertaining to HIBAL operations are from the ATG document AO1/GEN-7-2 as amended by AIC/HO 6/1971.

Notes

(1) In this Appendix all references to paragraph numbers denote paragraph numbers in the ATG document.

(2) Where necessary, the extracts have been edited to conform with DMI metric conversion practices.

(3) The title "Flight Leader" is synonymous with "SD".

Extracts

Para. 4.2 Impact/Recovery Area

4.2.1 The launching sites and flight paths will be selected so that the impact/recovery area will not occur:

(a) on the coastal side of lines joining Cairns, Emerald, Toowoomba, Gunnedah, Temora, Bendigo, Clare and Port Lincoln in Eastern and Southern Australia;

(b) on the Western side of lines joining Geraldton, Merredin and Albany in Western Australia;

(c) within 16 km of any aerodrome or airport used as a launching site.

Para. 4.4 Procedures

4.4.1 Notice of intention to launch will be given to the Mildura, Longreach, Sydney or Perth FSUs as appropriate 12 hours prior to the estimated time of launching. This information will be passed to Melbourne Area Approach Control Centre (AACC), Adelaide Area Control Centre (ACC) and Sydney AACC in the case of Mildura and Parkes, Brisbane AACC and Mount Isa ACC in the case of Longreach, and Perth ACC in the case of launchings in the Perth Flight Information Region.

4.4.2 The OIC of the appropriate FSU shall ensure it is in operation 60 minutes before the estimated time of launch (ETL).

4.4.3 The ETL will be reviewed and advised to the FSU 60 minutes before ETL.

4.4.4 The following flight plan information will be advised 60 minutes prior to ETL:

(a) time interval from balloon launch to 14 km (45 000 ft);

(b) estimated cut-down time and position (which for practical purposes represents penetration of 14 km (45 000 ft) on descent);

(c) impact point and time.

4.4.7 The Flight Leader, BLS, wherever located, will advise the FSU of the balloon's position every 15 minutes if over controlled airspace, and every 30 minutes otherwise. The FSU shall notify any amendment to units concerned if a time previously quoted varies by 10 minutes or more, or if a position area varies by 32 km (20 miles) or more. (It should be noted that "fixes" on the balloon are available on request.)

4.4.11 If the payload or envelope material is likely to penetrate controlled airspace on descent, cut-down of the payload shall not be initiated without prior reference to the responsible AACC or ACC (minimum 30 minutes notice through the appropriate FSU).

NOTE: The Airways Operating Instruction is under review. It is expected that it will be amended to incorporate some improvements in the launch notification procedures, designed to ensure a positive minimum separation between the balloon and aircraft.

EXTRACTS FROM HIBAL DIRECTIVE ISSUED BY THE AUSTRALIAN GOVERNMENT BUREAU OF METEOROLOGY

The following are extracts from the Bureau of Meteorology directive dated August 1971, edited in anticipation of a revision to take account of the undermentioned changes. All references to paragraph numbers denote paragraph numbers in the Bureau of Meteorology directive.

Notes

(1) DMI metric conversion practices.

(2) The change from Department of Supply to Department of Manufacturing Industry.

(3) The cessation of USAEC HIBAL flights.

(4) The use of the acronym HIBAL to describe the activity and all future flights.

(5) The practice of referring to the Bureau of Meteorology Melbourne Office as the Head Office.

Extracts

Para. 17 The Department of Manufacturing Industry is responsible for notifying the Bureau Head Office, Melbourne, of the programme of all HIBAL flights. This information should be provided as soon as possible after confirmation of the requirements of the experimenter, and in sufficient time to permit orderly arrangement of meteorological services. Head Office informs Regional Directors who are required to provide services.

Para. 18 The Station Director provides the following information:

(a) Details of the flight schedule -

- expected time of release
- expected time of payload impact
- float level
- expected variations from normal ascent or descent rates;

(b) Advice of postponement or cancellation and consequent effects on the programme;

(c) Notification of requirement of windfinding flights at times other than those of routine RAWIN flight times and any other variations from the normal meteorological support provided; and

(d) Notification that continuous standby might be required (see paragraphs 47 and 48).

Para. 19 Normally this information is provided to the Officer-in-Charge of the supporting meteorological office who is responsible for advising the appropriate Regional Office of the requirements. In some cases, by mutual agreement, the Station Director may provide the information direct to the Regional Office.

Para. 20 The Station Director should provide all information specified in paragraph 18 as soon as it is available to him and four days notice of the details of a planned launch is desirable. If less than four days notice is given, the Regional Office is advised by telegram or telephone.

Para. 24 The Regional Office responsible for the State in which the supporting meteorological office is located is primarily responsible for the provision of forecasts. When forecasts relating to adjacent Regions are required, it is necessary to ensure compatibility with forecasts issued by other Regional Offices. This is usually accomplished by the normal daily contacts between Regional Offices.

Para. 25 Forecasts for the general area of operations provide information on expected weather conditions (surface wind, visibility, general weather and cloud base and amount). Special reference is made to the risk and likely severity of icing and to the possibility of thunderstorms.

Para. 26 The general area of operations to which forecasts relate is assumed to be a radius of 320 km (200 miles) centred on the launch site unless contrary advice is received from the Station Director. Conditions at the launch site itself are given prominence in the forecast and an appraisal of the predicted flight trajectory supplied by the supporting meteorological office will indicate other areas which should also be given prominence.

Para. 27 Unless special advice is received from the Station Director, forecasts cover the period from three hours before planned launch time to three hours after expected impact time. The forecasts are made available to the supporting meteorological office between eighteen and twenty-four hours before scheduled launching time. The actual times these forecasts are made available are subject to agreement between the Station Director and the Regional Director concerned.

Para. 28 Further outlooks are provided with the pre-flight forecast if the duty forecaster considers that meteorological conditions are likely to prevent a launch.

Para. 29 The responsibility for providing forecasts for tracking aircraft may be delegated by the Regional Director to an Area Office in his Region. Area forecasts for general aviation produced routinely may be supplied if their periods of validity are appropriate, otherwise

similar forecasts are specially prepared and provided to the supporting meteorological office.

Para. 30 The supporting meteorological office is responsible for passing the forecasts from the Regional Office to the Station Director.

Para. 31 HIBAL windfinding balloon flights made at normal RAWIN flight times are generally acceptable e.g. for a sunrise launch the following windfinding flights may be required:

(i) previous 2300 G.M.T.
(ii) previous 1100 G.M.T.

Para. 32 For some flights additional wind information may be required, e.g. when long float times are required it is necessary to establish the general trends of the winds at float level several days in advance. In these cases flights made at one of the normal RAWIN times (usually 2300 G.M.T.) will suffice.

Para. 34 The time of routine windfinding flights may be varied at the request of the Station Director provided that satisfactory staffing arrangements can be made. The Regional Director is notified if such requests cannot be met.

Para. 35 The Bureau aims to provide winds for the specified float level and 600, 1200 and 1800 metres (2 000, 4 000 and 6 000 feet) above and below this level. Observations for other levels are taken as at a normal RAWIN flight. However, due to the altitude limitations of available balloons (40 km) (130 000 ft) and to a lesser extent the accuracy and range of the windfinding equipment it is sometimes not possible to meet specified requirements. The minimum acceptable heights for winds corresponding to specified float levels are as follows:

FLOAT LEVEL (km)	MINIMUM ACCEPTABLE HEIGHT (km)
0-21 (70 000 feet)	specified float level
23-37 (75 000-120 000 feet)	1.5 (5 000 feet)(or less) below specified float level
Higher than 37 (120 000 feet)	37 (120 000 feet)

Para. 36 If the levels specified in paragraph 35 are not reached at the first attempt, a second flight is conducted immediately, unless it is apparent that available equipment is not adequate to achieve the desired result. For example, a second flight would probably not be successful if the radar target had been borne beyond range of the radar on the first occasion. Balloons available might not be capable of reaching the desired height. If the second flight

is also unsuccessful, a third flight is not carried out without approval of the appropriate Regional Office.

Para. 37 Trajectory plots, based on measured winds from the special windfinding flights and ascent rates provided by the Station Director, are prepared as soon as possible after completion of the windfinding flight. The plot is supplied to the Station Director.

Para. 39 The Station Director is supplied with any available information he may require for planning or that he considers necessary for the safety and/or success of the experiment. This includes measured winds from normal RAWIN flights between the last special windfinding flight and the scheduled launching time.

Para. 41 The HIBAL balloon is tracked by radar whilst within range and winds are computed normally for the ascent stage. During the float period, readings of range, azimuth and elevation are made at five-minute intervals, and from these, winds are computed at twenty-minute intervals. The readings and winds are made available to the Station Director.

Para. 42 Occasionally there is a requirement for the payload to be tracked until impact. This service is provided upon receipt of a request from the Station Director.

Para. 43 To facilitate tracking of the payload, the Officer-in-Charge provides the Station Director with a suitable radar target to be included on the balloon train.

Para. 44 If the Station Director considers that a balloon and payload poses a threat to the safety of a community, meteorological offices provide all possible assistance. In such emergencies, routine observations may be deferred or deleted and the working of overtime is authorised. Such assistance might involve the location and tracking of the balloon whilst thought to be within radar range of the meteorological office concerned. Requests are directed through the supporting meteorological office.

Para. 45 Meteorological offices providing emergency tracking supply information of the position of the balloon and winds as required.

Para. 47 Some experiments are more critical than others and to ensure that balloons are released at an optimum time, a practice of continuous standby may be adopted by the Station Director.

Para. 48 Meteorological service is provided during continuous standby subject to adequate staff resources at the supporting meteorological office. The Regional Director is informed if service cannot be provided for this, or any other, reason.

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MANUFACTURING INDUSTRY

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In Reply Quote

SOME NOTES FOR INTENDING USERS OF B.L.S. FACILITIES

In many cases scientists using the B.L.S. Facilities will provide their own balloon by direct purchase from one of the two or three major manufacturers. It is quite possible that B.L.S. may not be consulted prior to the balloon being ordered. A quite serious result of this may be that the total weight of the flight train will be underestimated due to lack of knowledge about essential equipment such as parachutes, cut down devices and the TRAC system.

Because of this, it is highly possible that a balloon will be ordered with a maximum payload limit lower than the actual weight of the composite flight train. If this does occur and an attempt to fly an overloaded balloon is made, there is a very real chance of total failure, either at release or during ascent. At the very best the experiment will fail to reach the desired altitude with a resultant degradation of obtained data.

For the above reasons a sketch of a typical flight train has been prepared with the weights of the major items indicated as follows.

1) BALLOON.

Balloon weights vary according to their size and type of construction. Each particular balloon is designed to lift a limited range of gross weight to within a specific range of float altitude. The gross lift required is the sum of the balloon weight and the weights of all items making up the flight train. The sum of all these latter items together with the desired float altitude should be provided to the balloon manufacturer when ordering the balloon. This latter sum should never exceed the maximum payload weight for the balloon actually flown.

2) BURST SWITCH

This item is inserted into the flight train so as to cut the payload free in the event that the balloon bursts during ascent or float. This ensures separation so that the collapsed balloon does not foul the parachute.

Burst Switch weight is 8 lb.

3) TERMINATION UNIT

This is an insulated box or bag containing various cut down devices. These may consist of

a) one or more safety timers
b) a light-weight command receiver
c) Batteries
d) thermal sink blocks.

How much of this equipment is carried will depend upon the type of flight and the nature of the coupling between the payload and the parachute. If the coupling is rigid and the TRAC Pack is used we may be able to dispense with the light-weight command receiver and its batteries. If a rotating joint exists between the payload and remainder of the flight train the light-weight receiver is essential. Typical combinations used are :

i) A thermal bag with one safety timer and its batteries.
ii) An insulated box with one safety timer, one command receiver, two sets of batteries and some thermal blocks.

Weights :	Bag	2 lb
	Safety timer	3 lb
	Safety timer batteries	1 lb
	L.W. Receivers	4 lb
	L.W. Receiver batteries	2 lb
	Insulated box	10 lb
	Thermal blocks	8 lb

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4) PARACHUTE

Parachute sizes will depend upon the gross weight to be dropped and the desired ground impact velocity.

For an impact velocity of about 20 ft/sec the following parachute sizes are required for given gross loads.

Load lb	100	400	1000	1600
Parachute dia.ft.	20	40	64	80

The effect of doubling the parachute size for a given load is to halve the impact velocity.

Weights of typical parachutes are as follows :

Parachute Diameter ft.	12	40	64	84
Parachute Weight lb.	4	40	65	90

5) PAYLOAD COUPLING

This is the mechanism used to attach the lower parachute shackles to the payload support ring. It may include an impact switch if desired. The impact switch releases half the parachute lines at ground impact so as to reduce dragging in strong winds. This is normally not necessary if ring-sail parachutes are used on heavy payloads.

Weight of the impact switch is 8 lb

6) PAYLOAD

Weight of the payload should include all scientist owned attachments including any rotating joint unit. In addition the weight of B.L.S. supplied batteries, if any, must be included.

7) CRASH PADS

B.L.S. can supply standard crash pads for attaching to the base of the payload. Standard thickness is 4 inches and the pad can be applied in multiple layers. In our experience a thickness of one layer per 25 lb per square foot of base area is adequate for most payloads.

8) BARACODER

This is a transmitter unit which gives a remote indication of payload height and a signal for D.F. purposes. It can be operated during total flight or only during ascent/descent as desired. This is regarded as a prime recovery aid.

Weight of this unit is 4 lb.

9) ANTENNAS AND RADAR REFLECTORS

Radar reflectors are required by D.C.A.* regulations. Antennas are essential if the TRAC Pack and baracoder are flown. Normally these are all mounted on a light pole near the base of the payload.

Total weight is about 8 lb.

10) TRAC PACK

This is our standard command and telemetry system and is normally used with medium to large payloads. Whenever possible the unit should be enclosed in, or attached to the side of, the main payload assembly. The device will operate from internal or external batteries. Internal batteries have an operational period of 20 hours. Although this is basically undesirable the unit can be suspended below the payload and connected by long cables. Weights of various combinations are :

TRAC pack without batteries	38 lb
Internal battery pack	16 lb
External battery pack	32 lb
Suspension frame and rigging	20 lb

11) BALLAST

When flights span the day-night period, float throughout the night, or require close control of altitude, it is possible to carry ballast which can be dropped in a controlled manner. The actual quantity carried will depend upon the degree of control required and the total flight train weight. This subject should be discussed with B.L.S. staff in the planning stage. Typical ballast for a long day and night flight is of the order of 5% to 10% of gross flight weight.

In addition to the above there are various small components such as cable cutters, shackles and lines. These in total could amount to about 2 lb. for a small flight to 20 lb. for a large flight train with a 1000 lb. payload.

Users are strongly advised to discuss their plans with B.L.S. staff at as early a stage as possible. This will assist in reaching accurate estimates of the total

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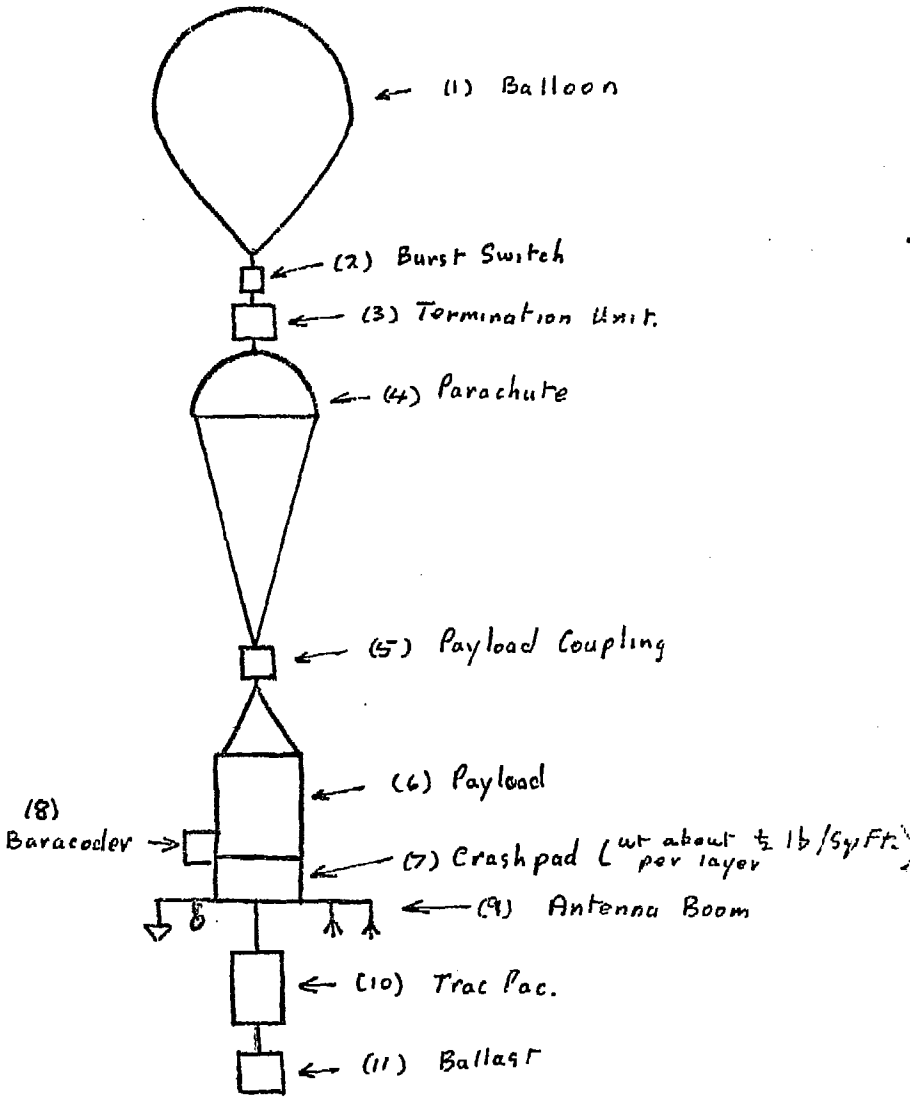
* Department of Civil Aviation now Air Transport Group of Department of Transport

flight train composition and weight so that an appropriate balloon can be ordered.

Please note that the units used in this note are pounds, feet and inches. The reason for this is that all balloons we have used to this date and all our equipment is of American origin and the U.S.A. is not and does not appear to be planning to use metric units.

(P. H. OATS)
STATION DIRECTOR.

Att: Flight train diagram



Typical Balloon Flight Train.