BALLOON OPERATIONS SUPPORT

NASA BALLOON PROGRAM
CONTRACT NO. 80GSFC22CA019

FLIGHT APPLICATION INSTRUCTIONS

OF-300-11-H, REV. D
APRIL 4, 2023

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Columbia Scientific Balloon Facility
1510 FM 3224
Palestine, Texas 75801

REVISION CHANGE LOG

REVISION	EFFECTIVE DATE	DESCRIPTION OF CHANGE
A	02/03/2016	Initial release of qualification information
B	12/10/2021	Updated all sections to reflect current references, components, processes, and requirements.
C	07/29/2022	Updated to reflect new NBOC-2 contract number
D	04/04/2023	Updated to reflect Revision G of Flight Application

Meaghan White (affiliate)

Digitally signed by Meaghan White (affiliate)
Date: 2023.04.04 11:14:18 -05'00'

Meaghan White
Technical Writer/Editor

Date

PREFACE

WHY USE SCIENTIFIC BALLOONS

Balloon payloads provide information on the atmosphere, the universe, the Sun, and the near-earth and space environment. As with sounding rockets, scientific balloons are valuable tools for scientists and undergraduate as well as graduate students conducting work in scientific fields.

Balloons offer a low-cost, quick-response method for conducting scientific investigations. Scientific balloons offer important advantages, for example:

- Balloons are mobile; they can be launched from various locations to conduct experiments
- Balloons can be readied for flight in as little as six months
- Balloons can take instruments above 99 percent of the screening effects of the earth's atmosphere
- Balloons offer a cost-effective option to the staggering expense of multi-million-dollar rocket launches
- Balloon payload instruments can be rapidly upgraded to keep pace with developments in detector technology
- Balloon flight cycle time can be very short, and several flights can be performed every year

TYPES OF RESEARCH

Some types of research for which balloons are used include:

- Cosmic ray astrophysics
- Gamma ray and X-ray astrophysics
- Optical and ultra-violet astrophysics
- Infrared/submillimeter astrophysics
- Atmospheric sciences
- Magnetospherics
- Micrometeorite particles

About the Columbia Scientific Balloon Facility (CSBF)

In October 1982, sponsorship of the NSBF was transferred from the NSF to the National Aeronautics and Space Administration (NASA), and the NSBF became a separate entity under the University Corporation for Atmospheric Research (UCAR). At that time, the NSF issued NASA an indefinite user permit for all land and other real property at NSBF in Palestine, Texas.

In October 1987, the NASA contract to operate the NSBF was awarded to the Physical Science Laboratory under the auspices of New Mexico State University in Las Cruces, New Mexico, and administered by Goddard Space Flight Center's (GSFC) Wallops Flight Facility in Wallops Island, Virginia.

On August 23, 2005, NASA signed off on a play by U.S. Congressman Jeb Hensarling (R-Texas) to rename the NSBF to the Columbia Scientific Balloon Facility (CSBF) in honor of the seven astronauts who perished during the loss of the Space Shuttle Columbia. Each of the seven stars in the CSBF logo represents one of the astronauts.

In November 2014, NASA awarded the contract to operate the CSBF to the Space Systems Group, Technical Services Division of Orbital Sciences Corporation in Greenbelt, Maryland. Northrop Grumman purchased Orbital ATK in 2018, and in 2021, Peraton purchased part of Northrop Grumman's Space Systems Sector including the CSBF Support contract, NASA Balloon Office Contract (NBOC), currently NBOC-2.

The purpose of the CSBF is to provide a permanent complex for scientific balloon flight operations. The CSBF provides the services of launching and tracking large (400-ft diameter), unmanned, high altitude (120,000+ feet) research balloons, and recovering the scientific experiments suspended beneath them. CSBF customers include NASA centers, universities, and scientific groups from all around the globe.

The CSBF provides complete balloon operations services and engineering support to the United States and foreign scientific communities. In over fifty years of operation, CSBF personnel have launched more than 2,000 balloons for 35 universities, 23 other research agencies, and 33 foreign groups. These launches were conducted at the permanent launch site in Palestine, and at remote sites within the contiguous United States, as well as Alaska and Hawaii. Foreign sites in Antarctica, Argentina, Australia, Brazil, Canada, India, New Zealand, Sicily, and Sweden were also utilized as launch locations.

CSBF fulfills the need for dependable flight support through the following activities:

- Planning, developing, and maintaining facilities which provide operational services meeting the balloon flight support requirements of the scientific community
- Providing consulting services in the field of scientific ballooning
- Meeting future scientific balloon flight support needs by evaluating trends in research involving the use of balloons, then performing the research, development, testing, and evaluation necessary to develop more advanced services

CSBF operations services include:

- Inflating the balloon
- Launching the balloon
- Providing telecommanding services and data retrieval with reliable electronics systems
- Tracking and recovering the balloon and payload

Some of the areas of engineering support are:

- Balloon systems design
- Balloon materials research
- Electronics design
- Electronics design
- Gondola design
- Thermal analysis

Additional support areas include:

- Power system consultation
- Instrumentation consultation and integration
- Recovery system design

This document is intended to summarize the services provided by CSBF, and to list general guidelines and requirements for users interested in or requesting balloon flight support services through CSBF.

TABLE OF CONTENTS

LIST OF TABLES

GLOSSARY

BPO	Balloon Program Office, NASA Goddard Space Flight Center/Wallops Flight Facility
CIP	Consolidated Instrument Package
CSBF	Columbia Scientific Balloon Facility
FM	Frequency Modulation
FRR	Flight Readiness Review
GSE	Ground Station Equipment
LDB	Long-duration Balloon
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NBOC-2	NASA Balloon Office Contract-2
nm	Nautical Mile
PCM	Pulse Code Modulation
PI	Principle Investigator for the Science Group
QC/QA	Quality Control/Quality Assurance
RF	Radio Frequency
RSO	Radiation Safety Officer
SMD	Science Mission Directorate
ULDB	Ultra-long-duration Balloon
V	Volt

OVERVIEW

This document provides science groups with general information regarding the policies and procedures for preparing and submitting applications for balloon flight support from CSBF. It includes:

- Instructions for completing the application process and related forms
- Funding requirements for non-NASA sponsored users
- Options for user-supplied equipment
- Required certification information
- Typical procedures to expect from pre-flight to post-flight

Additionally, this document contains a list of associated reference materials along with a list of critical contact for information and support throughout the entire application process.

APPLICATION PROCESS AND PROCEDURES

Each year the CSBF accepts applications from scientific investigators to support balloon flights from various launch sites. The investigator submits a balloon flight support application for requested missions.

Conventional balloon flights are those with flight durations ranging from a few hours to a few days and use direct line-of-sight electronics for commands and data. Conventional flights are typically conducted from the CSBF launch sites in Palestine, Texas; Fort Sumner, New Mexico; and Kiruna, Sweden. Conventional flights have also been launched from Australia and Alaska.

Long-duration balloon (LDB) flights normally traverse between continents or circumnavigate one of the poles and may last as long as four weeks. LDB flights rely on satellite-based electronic systems for commands and data. These flights are usually conducted from one of the LDB launch sites in Sweden, Alaska, Australia, New Zealand, or Antarctica.

Flight applications can be downloaded from the CSBF website at http://www.csbf.nasa.gov/docs.html.

NOTE:

It is important that this fillable .pdf version of the flight application be submitted. Older versions of the application may not be accepted as those do not contain the most recent vital data requests and references.

The applications contain detailed flight requirements information which CSBF uses for planning purposes. This includes the types of services and equipment required for the flight and support for rigging, electronics, meteorology, and aviation. To obtain NASA/CSBF balloon flight support, science groups must complete a balloon flight support application form and return the form to CSBF. In general, applications are due by June 15 of each year.

CSBF reviews each application to determine the basic types of services and equipment required to support the flight before adding the project to the Flight Candidate Program. By July 31st of each year, CSBF submits the Annual NASA Candidate Flight Plan to NASA Goddard Space Flight Center/Wallops Flight Facility Balloon Program Office (BPO) for approval.

When the flight schedule has been approved, BPO forwards it to CSBF and technical coordination begins between CSBF engineers and the science group.

NOTE:

Contact BPO regarding LDB balloon flight support early in the payload development process. CSBF and BPO will use direct discussion with the science group to review specific details regarding LDB flight requirements not addressed in the LDB flight application.

Additional Documentation Required

In addition to the flight support application, the science group must meet certain design and safety requirements and will be required to provide supporting documentation in the following areas:

- Gondola design certification
- Pressure vessel certification
- Hazardous materials used on the ground and/or in flight

For details refer to *Part VII – Payload/Gondola Data* on page 15, *Part IX – Safety* on page 16, and sub-paragraph *Radioactive Materials* also on page 16.

Flight Scheduling

Flight scheduling is based on conditions necessary for a successful flight, such as seasonal requirements or flight duration. For instance, flights requiring long float times must be scheduled close to Spring and Fall turnaround periods when float winds are light and variable.

Flight scheduling can also be affected by safety requirements that may restrict the flight trajectory. Flights from Palestine, Texas, are generally limited to smaller balloons and payloads due to WFF Safety/NASA Range Safety criteria regarding population. This period is normally between mid-May and late August.

Special flight requirements (e.g. valve-down or items released from the payload) will require that a risk analysis be performed to determine the acceptable conditions under which the flight may be performed.

If the scientific user must reschedule a flight, CSBF will attempt to work the flight into the current year, although such rescheduling is not always possible.

If a flight is postponed past the end of the fiscal year (September) for which a flight was approved, the application must be resubmitted unless the user is present at CSBF when the flight application expires. Special considerations may be made to extend an approved flight into the next fiscal year. These arrangements must be made with NASA WFF/BPO.

CSBF Support Services

Flight support services provided by CSBF include:

- Balloon
- Helium
- Rigging
- Electronic interface
- Flight and staging facilities
- Services directly associated with flight support

This is funded by NASA for flights by NASA-sponsored scientists but must be paid for by other U.S. scientists and foreign users.

BALLOON FLIGHT SUPPORT APPLICATION

This section provides brief explanations of the information requested in the balloon flight support application. The fields are listed in the order in which they occur on the application.

PART I – FLIGHT TYPE

CONVENTIONAL FLIGHT Click inside the applicable box to indicate the flight is/is not a conventional supported flight.

LDB TEST FLIGHT Click inside the applicable box to indicate the flight is/is not a conventional engineering/science validation flight in preparation for a future LDB flight.

LDB FLIGHT Click inside the applicable box to indicate the flight is/is not a planned future LDB supported flight.

SPB FLIGHT Click inside the applicable box to indicate the flight is/is not a planned future SPB supported flight.

PIGGYBACK Click inside the applicable box to indicate the flight is/is not proposed as a space-available payload of opportunity mission, with another primary mission.

PART II – SCIENCE

The Science section of the application provides CSBF a general description of the science instrument and the science objectives of the flight.

DISCIPLINES Disciplines are defined by NASA and reflect the nature of the scientific experiment being performed. They are also used to assist CSBF and BPO in tracking the various types of experiments using the balloon program. Table 1 lists the balloon-centric Science Mission Directorate (SMD) organization.

Table 1 - Balloon-Centric SMD Organization

DIVISION	SCIENCE DISCIPLINE	HQ OFFICIAL	EMAIL
Astrophysics	Infrared, Submillimeter, and Radio Astrophysics	Sheth Kartik	Kartik.sheth@nasa.gov
	Cosmic Ray and Particle Astrophysics	Thomas Hams	Thomas.hams@nasa.gov
	X-Ray Astrophysics	Valerie Connaughton	Valerie.connaughton@nasa.gov
	Ultraviolet and Visible Astrophysics	Michael Garcia	Michael.r.garcia@nasa.gov
	Gamma-ray Astrophysics	Valerie Connaughton	valerie.connaughton@nasa.gov
Heliophysics	Geospace Sciences	Jared Leisner	Jared.s.leisner@nasa.gov
	Solar and Heliospheric Physics	Dan Moses	Dan.moses@nasa.gov
	Upper Atmospheric Research	Kenneth Jucks	Kenneth.w.jucks@nasa.gov
Solar System Exploration	Exo-Planets	Carolyn Mercer	Carolyn.mercer@nasa.gov
	Planetary Science	Stephen Rinehart	Stephen.a.rinehart@nasa.gov
Special Projects		Thomas Hams	Thomas.hams@nasa.gov

SCIENCE DESCRIPTION This text is used in briefs to NASA officials as content in press releases in outreach and public relations programs. Please use layman's terms when possible.

DESCRIPTION Descriptive text explaining the general nature of the scientific experiment and instrument(s).

OBJECTIVES Descriptive text explaining the scientific objectives expected from the flight.

PART III – CONTACTS

The Contacts section provides information about the responsible individuals in the science group with whom flight and payload related information and scheduling can be communicated.

PRIMARY CONTACT
Principal Scientific Investigator The primary contact is the principal investigator (PI) or individual responsible for the payload and balloon flight details.

SECONDARY CONTACT
Co-investigator The secondary contact (Co-investigator) is an individual who can be contacted in the event the PI is unavailable.

PROJECT OFFICER
Engineering The Project Officer is an individual who is familiar with and can be contacted regarding the engineering details of the experiment.

PART IV – FUNDING

This section describes the funding responsible for covering the costs of the flight. This information will be included in the mission project plan submitted to NASA BPO prior to the flight.

NASA Sponsored

NASA Program
The name of NASA program or grant providing funding.

Sponsoring Directorate
The name of NASA directorate providing funding (see Table 1 on page 12.)

Science Discipline Chief
The name of the responsible NASA official or discipline scientist within the sponsoring Directorate division.

NON-NASA Sponsored All non-NASA sponsored users provide funding through fund transfers from the sponsoring agency to NASA. Upon receipt of the funds, NASA approves CSBF to establish an account for the user.

Foreign users are required to have a Memorandum of Understanding (MOU) with NASA Headquarters. Foreign users will also be assessed a user's fee for each flight. All foreign users must provide funding, including the user's fee, to NASA as per the established MOU.

CSBF can make no direct procurement for equipment or services until necessary agreements are in place and monies have been received from user.

Users can contact the Balloon Program Office for information regarding cost estimates, contractual agreements, MOUs with NASA, and instruction pertinent to the transfer of funds. Current Lead NASA Mission Manager, Andy Hynous, can be contacted at andrew.hynous@nasa.gov.

PART V – FLIGHT PROFILE

The Flight Profile section provides details concerning science requirements that are used for flight planning, cost estimating, and scheduling.

LAUNCH SITE — The location at which the PI would most like the flight to occur based on the science requirements.

ESTIMATED SITE ARRIVAL DATE — The date the science team expects to arrive at the launch site for final preparations prior to the flight.

REQUESTED FLIGHT DATE — The date the science team prefers to launch based on the science requirements. Note that this date is tentative and dependent upon final BPO flight scheduling as well as weather conditions at the site.

FLOAT REQUIREMENTS — Float requirements data provides critical variables CSBF uses in determining the balloon size needed for the flight. Additionally, this data is compared to climatological data for the launch date and location requested by the PI to determine whether the float duration requirements can be achieved.

MINIMUM — Entries in this column indicate the minimum altitude, time at float, altitude stability and launch time at which the science experiment results can still be considered successful.

DESIRED — Entries in this column indicate ideal altitude, time at float, altitude stability, and launch time for obtaining optimum results from the science experiment.

OTHER THAN NORMAL FLIGHT PROFILE REQUIREMENTS — Additional requirements to be considered by CSBF so that minimum scientific success criteria can be met by the flight.

ASCENT/DESCENT RATES — Specific rate(s) at which the experiment must ascend to or descend from the minimum float altitude.

ALTITUDE STABILITY — Note any science requirements during observation periods or during the flight float phase for altitude stability. Typical float stability can vary greatly.

ALTITUDE VARIATIONS — Note any science requirements for observation at different float altitudes. Typically accomplished by valving or allowing controlled drop.

VALVING — Controlled descent of the balloon by releasing helium from the valves.

OTHER — Described any other special requirement not listed above which affects the general flight profile.

PART VI – MINIMUM SCIENCE SUCCESS CRITERIA

The preliminary minimum success criteria specify the scientist's minimum requirements for a successful flight. Before a flight can proceed, there must be a reasonable chance of meeting the minimum success criteria.

SCIENCE OBJECTIVES

State the minimum and desired scientific objectives that must be met to achieve mission success.

Provide a summary of the minimum and desired experiment (detectors, pointing systems, etc.) performance.

BALLOON AND SUPPORT SYSTEMS

Provide full details of the minimum and desired performance for any pertinent balloon, telemetry, commanding, or recovery requirements.

METEOROLOGICAL SUPPORT

Provide details of the minimum performance on any other data source or support elements separate from the balloon flight but necessary to achieve mission success. For example:

- Post-flight satellite imagery
- Post flight National Weather Service WSR-88D radar imagery
- National Weather Service surface observations
- National Weather Service radiosonde data
- Launch site surface weather data

PART VII – PAYLOAD/GONDOLA DATA

PAYLOAD/GONDOLA

The Payload/Gondola section provides details about the size, weight, and other mechanical aspects of the science payload and gondola. Payloads that have previously flown enable CSBF to use prior exposure and knowledge about the payload during the gondola certification process. Indicate previous flight information where applicable and whether any mechanical changes have occurred to the payload or gondola since that flight.

Also indicate any restrictions that might exist, such as proximity of the payload to other items on the flight train.

PART VIII – SPECIAL REQUIREMENTS

BALLOON

Use this section of the application to indicate any special balloon requirements that need to be taken into consideration.

ROTATOR

Indicate if utilizing a science provided or NASA provided rotator to point the gondola, or none. LDB flights require slip ring pass through signals for CSBF use up the flight train. SPB flights require additional slip ring cabling.

HIGH-GAIN ANTENNA

For LDB or SPB flights, indicate if you require a data rate higher than 10kbps.

PART IX – SAFETY

All science groups planning to use hazardous materials are required to submit special ground and flight safety plans to address hazards associated with these items.

HAZARDOUS MATERIALS LIST

This section addresses handling and reporting requirements for hazardous materials associated with balloon payloads. Hazards most often associated with balloon payloads include:

- Radioactive materials
- Lasers
- Cryogenic materials
- Pressure vessels
- High voltage
- Pyrotechnics
- Toxic gases
- Superconducting magnets
- RF Emitters, regardless of output power

The science group must furnish Material Safety Data Sheets (MSDS) for any hazardous material used in the flight. Subsequent sections discuss additional documentation that may be required based on the nature of the hazardous material.

RADIOACTIVE MATERIALS

Some science groups require the use of small radioactive sources for instrument calibration. To facilitate the transfer of these radioactive materials from the user's home organization to CSBF's Palestine launch site, CSBF maintains a Texas Department of Health Radioactive Materials License. This license allows CSBF to receive, posses, and store properly licensed instrument calibration sources that are to be use by research personnel during experiments at CSBF. Acceptable forms of radioactive materials are sealed and/or plated sources of any radioactive materials expect special nuclear materials. The total activity of all sources at CSBF is limited to 100-millicurie.

Science groups intending to bring radioactive sources to CSBF, or other launch sites are required to complete the Hold Harmless and Indemnification form and submit it with the Balloon Flight Support Application.

When a radioactive source will be flown, CSBF must obtain Nuclear Launch Safety Approval (NLSA) prior to the flight. The CSBF Radiation Safety Officer will contact the principal investigator of the science group for details to secure NLSA from NASA.

The use of radioactive sources for remote operations, either within the U.S. or at foreign locations, requires special arrangements. Users should contact the CSBF Radiation Safety Officer so that arrangements can be made to satisfy these requirements.

PART X – EXPENDABLE SUPPORT REQUIREMENTS

GAS/CRYOGEN ESTIMATE

Although gas and cryogen requirements are included on the Balloon Flight Support Application, the information is used primarily by CSBF Operations for planning and scheduling, not for purchasing supplies or equipment. Gases and cryogens in support of science missions (expendables) must be paid for directly by the experimenter's group or from monies transferred to NASA and made available to the CSBF. Science groups are responsible for reimbursement of these costs.

NOTE:

The PI must submit a separate Gas/Cryogen Order Form to CSBF Cryogen Purchasing. Orders received by CSBF Cryogens Purchasing by 4:00 p.m. (Central) will be processed on the next business day. If the request is received on Friday or a Federal Holiday, the order will be processed on the next business day. Allow at least 5-7 business days for delivery.

See the Ordering Gases and Cryogens section on page 22 for detailed instructions on placing gas/cryogen orders.

BALLAST

CSBF normally provides steel shot as ballast; however, if science requirements necessitate the use of non-magnetic ballas (sand) it can be provided.

OTHER EXPENDABLES

Indicate any expendables or services other than those normally supplied by CSBF for its flight support.

PART XI – IN-FLIGHT POWER REQUIREMENTS

BATTERIES

CSBF provides batteries to NASA programs and, upon request, will act as a battery-purchasing agent for non-NASA-funded experimenters.

Click inside the applicable box to indicate your intent for CSBF to purchase batteries for your scientific payload.

Lithium cells and other battery packs routinely used by CSBF are listed in Table 2 below. The PI should detail battery requirements in the flight application to enable CSBF adequate time to order needed supply.

Table 2 - Battery Packs

BATTERY	LOADED VOLTAGE @ 1 AMP	AMPERE HOUR*
SR182175	*26*	*50*

**De-rate ampere-hour rating for temperatures below -20°C.*

NON-CSBF SUPPLIED BATTERIES

Click inside the applicable box to indicate your intent to use/not use non-CSBF provided batteries. If you click YES, explain the type of battery you intend to use.

PHOTOVOLTAIC SYSTEM

Click inside the applicable box to indicate your intent to use/not use a photovoltaic (PV) power system.

Part XII – Ground Support

Environmental Test Facilities (Palestine Only)

Describe any requests for an environmental test chamber for thermal or mission qualification purposes. Such services are limited to pre-deployment integration in Palestine and are non-existent at other launch sites.

Network and IT Requirements

Describe any network or IT requirements needed by the science group at the launch site, including requested ports for firewall traversal. SSH (and other requests) may only be granted with IPV4 white list access lists.

AC Power

Indicate peak loads for science GSE and mission systems, especially for foreign locations where UPS-US power is provided by CSBF. Note any specific non-standard 110V AC systems, or requests for non-standard power/frequency.

Lift Equipment

Click inside the applicable box to indicate your intent to use/not use your own lifting equipment. If you click YES, describe the equipment you intend to provide.

Science Provided Pressure Regulators

NASA requires all pressure regulators for gaseous supply to be reviewed and approved by the WFF SME. Provide requirements and any model numbers for regulators planned on being supplied. Regulators which are NOT approved for use CANNOT be utilized.

Part XIII – Telemetry and Electronics Support

Conventional Flights

CSBF provides electronic flight support equipment for telemetry, command, and tracking of Conventional flights. To make full use of CSBF capabilities, the user must work closely with Electronics personnel during the planning and preparation of scientific electronics and the interface.

For detailed information concerning interfacing to CSBF electronics on Conventional flights, see the Conventional Flight Documentation page at http://www.csbf.nasa.gov/convdocs.html.

CSBF Telecommanding System

The consolidated Instrumentation Package (CIP) enables the scientist to control the scientific instrument during flight within Line-of-sight transmission range of the launch site. It is also used by CSBF for flight control.

The CSBF telemetry system transmits data from the airborne scientific equipment to the CSBF ground support equipment (GSE) in frequency modulation (FM)/FM or pulse code modulation (PCM)/FM format. The radio frequency (RF) signal received by the GSE receiver is then patched to discriminators or directly to PCM decommutation equipment, depending on the modulation applied to the transmitted signal.

The transmission range of the CSBF GSE is limited to the radio horizon distance as determined by the altitude of the balloon. The theoretical radio horizon distance to a balloon from the ground station is approximately 335-nm at an altitude of 100,000-ft (305-km). Downrange telemetry support can be provided for flights passing beyond the range of the primary ground station. Downrange support is provided for all Fort Sumner campaigns. Support for other launch locations requires special long-range planning.

Airborne Telemetry

For conventional line-of-sight flights, CSBF uses a Consolidated Instrument Package (CIP) for airborne electronics. The CIP Command uplink allows for a 16-bit parallel command word and a maximum of 77 discrete commands/interrupts. For data downlink, the CIP contains 3 serial stream channels. The CIP can also share its GPS data via additional serial streams. Refer to the Conventional Flight Documentation page for more details.

Another aspect of the Conventional flight hardware is line-of-sight (LOS) transmitters. CSBF provides these to science to expand capabilities. The LOS transmitters can be used for Bi-phase data directly into the transmitter or NRZ-L encoded serial data via encoder into the transmitter, NTSC video into the transmitter, and UDP data in the transmitter via the EVTM protocol. Each one of these LOS paths provides different capabilities to science. Refer to the Conventional Flight Documentation page for more details.

As part of conventional flights could be the use of the Small Launch Package and Mini-SIP. Refer to "Additional Packages" under LDB/SPB missions below for more details.

EVTM interface is a network interface which allows the reception of UDP packets at the ground station. There will be a Remote Mission Network at both the launch location and the downrange station. The UDP data will be provided on these Remote Mission Networks. Science will be required to provide a second network interface on their GSE's to interface to this network. Refer to the Conventional Flight Documentation page for more details. Indicate your request for EVTM support by clicking the appropriate box.

Ground Telemetry

For conventional flights the flight data will be at the launch location. If a flight is expected to travel beyond the LOS range of the launch location, then a downrange station will be used to extend the availability of flight data.

Flight data will come from the telemetry stations at the respective locations. Science will be required to setup Science GSE's at both locations if they are expecting to use the data from the locations or provide for command/control from two sites. This is due both to the higher data rates LOS methods can provide as well as NOT relying on commercial network for transmission of downrange data (impacting Mission success criteria).

Depending on the interfaces chosen by the science team, CSBF will provide those data streams to the science team from the respective stations. Refer to the Conventional Flight Documentation page for more details.

LDB/SPB Flights

CSBF provides telemetry support for LDB/SPB missions via satellite communication networks. This is to allow for extended flight times which can vary from 5 to 100 days.

Telemetry Requirements

The current satellite networks used by CSBF are the Tracking & Data Relay Satellite System (TDRSS), and Iridium. In addition, the LDB/SPB missions also provide Line-of-sight (LOS) telemetry while in range of the launch location to provide science a faster telemetry up/downlink. Indicate your intent to use any of the listed sub-systems by clicking inside any applicable boxes.

LDB personnel provide support of the LDB/SPB mission equipment and are available to answer questions concerning the equipment. For detailed information regarding the LDB/SPB mission equipment, please review the LDB Flight Documentation page on the CSBF website at https://www.csbf.nasa.gov/ldbdocs.html.

AIRBORNE TELEMETRY

For LDB/SPB missions the primary interface on the gondola will be to the Support Instrumentation Package (SIP). The SIP provides TM interfaces which in turn provide the link to the satellite networks. At the heart of the TM interface are the redundant flight computers on the SIP. Interface to the computers is completed via serial ports. Their interface detail can be found on the LDB flight Documentation page.

A mode of the TDRSS satellite link is considered a direct connection since it doesn't pass through the flight computer. This is the TDRSS EVTM mode. This is a UDP data stream that is provided by science to our onboard network. Details for the implementation are provided to science teams upon request

LDB/SPB missions will work to continue providing Internet connections in the sky for science teams. Currently the option is Iridium Pilot which provides science teams a direct internet link with the payload. However, due to support issues encountered with the provider, it cannot be considered a primary data link.

In addition, the SIP also provides a housekeeping interface to science called the Science Stack. This interface allows science to monitor analog signals, monitor digital bits, and execute commands/interrupts. The telemetry from the science stack is provided in snapshots, not in a continuous stream. Refer to the LDB Flight Documentation page for more detail.

For the LOS portion of the LDB/SPB missions, the science group will have access to the same LOS telemetry options as Conventional flights. This includes standalone transmitters for Bi-phase data directly into the transmitter, serial data via encoders into the transmitter, UDP data into the transmitter, and NRZ encoded serial data into the transmitter. Refer to the LDB Flight Documentation page for more detail.

GROUND TELEMETRY

For the ground side of LDB/SPB missions, the focal point is the Operations Control Center (OCC) in Palestine. This is where the satellite data is retrieved from the respective networks. and then provided to science.

Science will have serial port interfaces to the CSBF GSE for commanding and some telemetry returns including science stack data. TDRSS Direct will also be via a serial interface to the CSBF GSE. TDRSS EVTM will be part of the OCC Missions Network. This will be a separate local network used to provide UDP data and will require a separate network interface on the Science GSE. Refer to the LDB Flight Documentation page for more detail.

In addition to the OCC, there will be a Remote Operations Control Center (ROCC) in the field at the launch location. This will be used to simulate some of the data paths provided to science during integration. The ROCC will also provide limited data from the SIP during the LOS portion of the mission.

As part of the ROCC, science will have interface to the Remote Mission Network. The Remote Mission Network is different from the OCC Mission Network because of the data sources provided. The OCC Mission Network is fed by the TDRSS EVTM. The Remote Mission Network is fed by the LOS EVTM transmitter. The speeds for the two links are vastly different. Refer to the LDB Flight Documentation page for more detail about the differences.

LDB also provides additional support with the Small Launch Package for hand launch missions, and the Mini-SIP for LDB test flights. These packages are specialized and will require additional interface requirements due to their limited capabilities. Please refer to the LDB Flight Documentation page for more detail.

PART XIV – OTHER EXPERIMENTERS

NAME, ORGANIZATION

Provide for participant list with name, email contact, and propose duration on site (arrival/departure dates).

NAME, INVOLVEMENT

Provide for participant list with each party's degree and nature of involvement.

FOREIGN NATIONAL SCREENINGS

NASA requires screening of Foreign National Participants. Provide name, email contact, and country of citizenship. Foreign national participants from designated countries will require a one-on-one escort while onsite for integration and/or at launch facility sites. Costs for providing the escort is the responsibility of the science group. Approval process for FN-designated can take 6 months.

PART XV – FUTURE REQUIREMENTS

Provide information on any balloon flights you have planned for the next three years to assist NASA/CSBF in developing flight support services. Even if your plans are not firm, identifying potential requirements facilitates the planning process. Include the anticipated flights, season/date, and location of each. Also note any special support, services, or capability requirements not presently offered by CSBF. The listing of a future flight in this section is not an official request for a flight. Once you are prepared to make an official request for flight, a separate Balloon Flight Support Application must be submitted for each.

PART XVI – AGREEMENT

Sign and date the Flight Agreement to indicate you have read and agree with all requirements and conditions in the Balloon Flight Support Application, in this Instructional document, and all other supporting documentation on the CSBF website.

PART XVII – CONTRACTS

CSBF staff contact information is provided for your convenience including names, email addresses, and phone numbers.

SUPPLIES AND EQUIPMENT

USER-PURCHASED BALLOONS

CSBF normally provides balloons used in supported campaigns; however, CSBF will launch balloons purchased directly by the users if the balloons comply with CSBF design and QC/QA requirements. CSBF must review and approve the balloon design prior to production to assure compliance with NASA/CSBF balloon specifications.

During balloon production, the normal CSBF QA and manufacturer QC procedures must be in force.

ORDERING GASES AND CRYOGENS

Gases and cryogens in support of science missions (expendables) must be paid for directly by the experimenter's group or from monies transferred to NASA and made available to the CSBF. Science groups are responsible for reimbursement of these costs. CSBF orders helium and other commonly used laboratory gases as required by each science group. Gases other than helium are not stocked at CSBF for the scientists' use; however, CSBF can order commonly used laboratory gases through a local supplier.

Orders for any gases and cryogens not listed on the Gas/Cryogen Order Form need to be placed with the Flight Operations manager or designee.

Requirements for unusual or hazardous laboratory gases should be cleared with CSBF and NASA before arrival. The science group may have to arrange delivery if the gas is unavailable through the local supplier.

LDB flight gas and cryogen requirements are handled differently than those for Conventional flights. The CSBF Campaign Manager will coordinate with the LDB science group concerning gas and cryogen support. Any gases or cryogens required during pre-deployment integration in Palestine will be handled according to the instructions in this section.

DELIVERY LEAD TIMES FOR GASES AND CRYOGENS

The procedures in this section help ensure timely delivery of cryogens and specialty gases. Ordering your gases and cryogens based on these timelines will help ensure timely delivery for your flight.

Please plan to have someone on hand at the launch site to receive the delivery. If this is not possible, the CSBF Campaign Manager and/or Crew Chief will work with you to arrange for receipt of the order.

Table 3 - Notification and Delivery Schedules for Gases/Cryogens

Gas Type	Campaign Type	Order from CSBF	Delivery Time
Compressed Gas • Argon • Carbon dioxide • Helium • Nitrogen • Purified Air **Cryogens** • Liquid helium • Liquid nitrogen	Domestic	30 days prior to arrival at launch site	5 to 10 days
	Remote	60 days prior to arrival at launch site	45 days
Specialty Gas	Domestic	60 days prior to arrival at launch site	30 days
	Remote	60 days prior to arrival at launch site	45 days

Placing Gas/Cryogen Orders

Follow the three steps and subsequent steps below to place orders for gases and cryogens.

1. Obtain the Gas/Cryogen Order form from one of the sources shown in Table 4.

Table 4 - Sources for Gas/Cryogen Order Forms

Source	Instructions
Web download	Logon to http://www.csbf.nasa.gov/bids.html and download the Gas/Cryogen Order Form to your personal computer.
E-mail	Send an email requesting an order form to WFF-DL-CSBF-Cryogens@mail.nasa.gov, Subject: Gas/Cryogen Order Form Request.
Fax	Fax your request for an order form to 903-723-8068, Attn: Cryogens. Please call 903-729-0271 to verify the fax was received.

2. Complete the order form electronically.

Press the TAB key to move to each of the fields in the order form or click directly in a field to place the cursor inside the field.

a. When you open the order form, your cursor should automatically be positioned inside the first field, *Scientist Group Name*. Type in the name and press TAB to move to the next field, *Contact Name*.
b. Continue in this manner, typing all requested information into the *Customer Information* section of the form.
c. Click in the *Qty* field to the left of the type of gas or cryogen you wish to order. Type in the quantity you will need.

d. Press TAB to move to the *Date Required* field. Type the date you want the gas/cryogen delivered to the site.
e. Press TAB to move to the *Replenish Rate* field. Type the quantity and frequency at which you will need to have the gas/cryogen replenished during the campaign.
f. Press TAB to move to the *Notes* field. Type any additional information you feel will be helpful to CSBF Cryogens Purchasing in placing your order.

Repeat steps c through f until your order is complete.

NOTE:
Specify the EXACT PURITIES DESIRED for each type of gas ordered.

g. Save the document and print a copy for your files

3. Submit the completed order form to CSBF using one of the methods shown in Table 5.

Table 5 - Submitting a Gas/Cryogen Order Form

SOURCES	INSTRUCTIONS
E-mail	Send as an email attachment to WFF-DL-CSBF-Cryogens@mail.nasa.gov. Subject: Gas/Cryogen Order Form Attached.
Fax	Fax the completed order form to 903-723-8068, Attn: Cryogens. Please call 903-729-0271 to verify the fax was received.

DOCUMENTATION REQUIRED FOR GASES AND CRYOGENS

All science groups planning to use gases and/or cryogenic materials may be required to submit special ground and flight safety plans to address hazards associated with these items. Refer to the *Ground Safety Plan* and the *Pressure Vessel Certification* documents at http://www.csbf.nasa.gov/gondoladocs.html for details.

RETURNING EMPTY GAS/CRYOGEN CYLINDERS

Notify the CSBF Campaign Manager and/or Crew Chief in charge when cylinder(s) are empty, or before you leave the site. You may also email WFF-DL-CSBF-Crygens@mail.nasa.gov, Subject: Gas/Cryogen Returns. Please include the following return information for EACH cylinder:

- Science group name
- Release number
- Product/cylinder type
- Serial number

NOTE:
This information should be on a tag with each cylinder provided by the gas contractor.