

Mission Overview

A High Balloon (HAB) mission consists of a latex balloon that is capable of carrying a cluster of experiments to near space. These balloons are filled with helium or hydrogen and expand as they ascend through Earth's atmosphere. The objects that are attached to a HAB are often referred to as the payload train and each payload serves a particular purpose. HAB missions must include a parachute, radar reflector, and communication tracker.

The Discovery Museum, working closely with the University of Bridgeport, aims to teach and motivate students to pursue STEM fields. The Discovery-1 HAB mission was a trial launch where the museum tested its launch, tracking and recovery capabilities. The payload was equipped with an array of telemetry equipment such as the Tiny-Tracker, a hand held long range radio and an antenna. The payload also consisted of a 'Cut-down' mechanism which was built using a bread board.

Mission Timetable

T – 1 week	
Office	Run Flight Path Prediction
	Run High Altitude Coordinating Meeting
	Assign Mission Coordinators
	Contact chase boats and chase cars
	Contact guests for Launch Day and alert media
Workshop	Review all checklists and operational plans for payload setup, launch day operations, recovery operations, flight notifications
	Perform preflight test of payload and determine operational readiness state
	Inventory materials, equipment and supplies and order necessary consumables
Radio Room	Perform preflight test of mission operations center and determine operational readiness state

T – 3 days	
Office	Run Flight Path Prediction and review with coordinators
	Confirm readiness of recovery teams and determine preliminary staging locations for chase boats and chase cars
Workshop	Confirm Guests for Launch Day
Radio Room/Mission Control	Ground station readiness review

T – 1 day	
Office	Run Flight Path Prediction and review with coordinators
	Review Launch Day order of events
	Notify FAA
	Notify Coast Guard
Workshop	Stage all Launch Material
	Begin charging batteries for payload, radio and computers
	Stage payload train
	Measure final mass of payload
	Perform balloon burst calculation to determine required nozzle lift for 5 m/s ascent rate
	Stage container with required nozzle lift ballast
	Measure the correct quantity of water in a jug for correct neck lift
Confirm launch time and inform mission coordinators	

	Inform chase boats and chase cars of GO/NO-GO, and if GO, locations and times for staging
Museum	Hold GO/NO GO Meeting
Launch Day	
Office	Run Flight Path Prediction and review with coordinators
Museum	Assemble at gathering point to execute job assignments
Workshop	Final check of launch site materials
Loading Dock	Load canisters of helium onto transport
	Load launch supplies onto transport
Launch Site	Weather check of cloud cover and wind speeds at launch site
Radio Room	Setup ground station
Launch Site	Setup launch site
Radio Room	Radio check with launch site
Radio Room	Run Flight Path Prediction and review with coordinators
	Radio chase boats and chase cars staging
Launch Site	Inflate balloon and test nozzle lift
	Tie off balloon to backup anchor
	Activate balloon payload
	Test payload for APRS broadcast
	Caulk payload lid
	Rig up payload harness
	Rig payload train: balloon, parachute, radar reflector and payload
	Test payload for APRS broadcast
	Tune Radio - APRS freq
	Rig up nichrome wire cut-down cable on tether - Test cut down for continuity
Radio Room	Rig payload train to balloon
	Test BaseApp COM with payload
	Call ATC @203-378-4106
	Run Flight Path Prediction and review with coordinators
	Radio chase boats and chase cars: GO FOR LAUNCH
	Poll all mission coordinators for final GO/NO GO for Launch
Field	LAUNCH BALLOON
	Call ATC
Radio Room	Chase boats and chase cars maintain active tracking of payload

	Radio recovery crews to go on active recovery status
	Track descent of balloon
	Call ATC
	Maintain contact with recovery teams while they attempt to acquire visual contact
	Radio latest APRS locations to chase teams as payload descends
	Alert all chase teams that visual contact has been acquired
	Deploy nearest available recovery assets to last known location of payload
	Radio assets not in recovery range to stand down
	Chase teams perform search, contact and recovery operations to retrieve payload
	Chase team that establishes contact with the downed payload radios base
	Recover payload
	Return payload to base for analysis
	Radio all chase teams that the payload has been recovered and on route to base
	Call ATC
	Confirm that land and sea chase teams have received “END OF MISSION” contact and can formally stand down and return to base

Mission Operation

Ground station Team

- Switch ON equipment – Power supply, Rotator controller and computer interface, Radio.
- Open BaseApp
- Set the antenna (azimuth and elevation) towards the payload launch site
- Match radio frequency with the payload frequency
- Setup communication between radio, base app and the payload
- Test CUT-OFF mechanism using a LED light
- Clear cache memory
- Communicate lift off with the recovery and the launch team
- Track Payload using aprs.fi
- Maintain radio contact with recovery team and update information continuously.


Launch Team

- Divide the team into two.
- Alpha team is in charge of balloon.
- Beta team is in charge of payload and other functionalities related to the payload and payload electronics.

Alpha Team

- All members of alpha team should have their cotton gloves on while handling the balloon
- Lay the cylinder of the helium on the floor horizontally and attach the pressure gauge using the wrench
- Make sure there is free flow of the gas through the nozzle
- Using very little air pressure, fill the balloon to unfold it completely
- Tie the water jug to the neck of the balloon with the nozzle
- At a steady flow rate, fill the balloon with helium until the balloon can lift the water jug by itself.
- Make sure the balloon is correctly fastened to the payload train
- Make sure the balloon is twisted and folded before it is fastened to the payload train

Bravo Team

- They are in charge of the payload
- Layout the payload train
 - Payload
 - Radar reflector
 - Parachute
 - Balloon
- Make sure the battery is completely charged
- Setup communications with the ground station and payload
- Turn off the wifi on the GoPro
- (Settings on Radio) 
 - Payload tiny track
 - Ground station tiny track
 - Payload electrical settings

Recovery Team

- Should consist of two chase cars and two chase boats
- Each vehicle is equipped with a long range HAM radio antenna
- Each vehicle should have three personnel or more – Driver/Pilot, navigator and HAM Radio operator
- The navigator will have a laptop with “*Direwolf-1.2*” tracking software and should be trained to use the software
- The driver shall take directions from the navigator and concentrate on the road
- HAM Radio operator would maintain constant communication with other chase vehicles and the ground station updating his location