**Ideas for future balloon launches**

**Establish general payload requirements**

* Rules:
  + Maximum volume
  + Maximum mass (2lbs?)
  + Must have continuous line through payload
  + No flying liquids
  + No sharp corners
  + Must have a harmless payload sticker
  + Must be able to fly at any position on the payload string
  + Don’t drop things
* Payloads may request waivers from these rules as necessary. Waivers will be granted unless there’s a specific reason not to or safety concern

**Establish general payload design suggestions**

* Try to standardize battery connections
  + Allows us to charge batteries easier, need fewer tools/backup hardware on launch day
* Try to standardize mounting screws, etc
  + need fewer tools on launch day
* External power switch if possible
  + allows sealing payloads sooner, simplifies launch
* Payloads should undergo thermal testing before launch

**Establish Official Titles/Positions**

* **These people are not required to do these things, only to ensure that they get done**
* Lab Director
  + Responsible for maintaining and managing the lab:
    - Managing accounts
    - maintaining relations with radio group
    - keeping the lab stocked
* Launch Director
  + Responsible for all planning leading up to the launch:
    - making sure emails are sent to VIPs, etc
    - ensure all items on packing list are packed the night before
    - in charge of launch prep until the balloon is released
* Flight Director
  + Responsible for all events after balloon release:
    - coordinating chase
    - coordinating recovery
* Recovery Coordinator
  + Appointed in event of a late recovery for which the flight director is not present
  + Responsible for safely recovering the payloads
    - Following safing procedures for all payloads

**Prelaunch**

This launch we primarily had issues with preparing payloads. The following suggestions are designed to encourage us to not do things at the last minute. Our payloads are becoming too complicated for that to have a good chance of success. Also a couple additions to the pre-flight checklist in response to issues with this launch.

* 2 (3?) weeks before launch, Payload Launch Proposal submitted. Lists payload
  + purpose/goals
  + data to be acquired
  + minimum working condition
  + estimated payload weight
    - For Flight Director
  + any payload rule waivers requested
    - For Flight Director, any special requests for placement on payload string, not having a continuous rope through payload, flying liquids, etc
* 1 week before launch, Payload Launch Info submitted. Includes:
  + Payload summary
    - For social media coordinator for email summary to VIP list
    - Include an image of the payload
  + Final Payload weight
  + Callsigns flying on payload (if applicable)
  + Payload Point of Contact (PoC)
    - Name and cell phone number
  + Payload status
    - including payload functional test results demonstrating that payload is in minimum working condition
    - Should include test of datalogger, xbee communication (if present), all instruments
  + Payload assembly tools
    - For launch director to add to flight-specific packing list
    - Includes everything required on launch morning
  + Payload recovery tools
    - For launch director to add tools to flight-specific packing list
    - everything required to open and safe the payload
    - these tools get added to flight-specific packing list
  + Payload recovery procedure
    - For flight director to ensure payloads are recovered safely
    - Includes instructions for safing the payload in the event that the person recovering the payload is not the payload owner (ex, have to wait until next day for tree climber)
    - Include pictures if necessary
* If a payload does not pass their functional test 1 week before launch, they are tentatively removed from the launch manifest until they can demonstrate their minimal functionality.
  + How do we deal with payloads which fly multiple experiments? Remove that experiment?
* Add to launch director checklist to ensure that all vans have full gas tanks night before
* Launch director and flight director should meet night before launch to review initial tracking plan (add to prelaunch checklist)
* 1 week out, establish better connection with weather people to get updated weather predictions before flight weather go/no go
* Determine launch time based on winds, visitors, length of day, etc

**Launch**

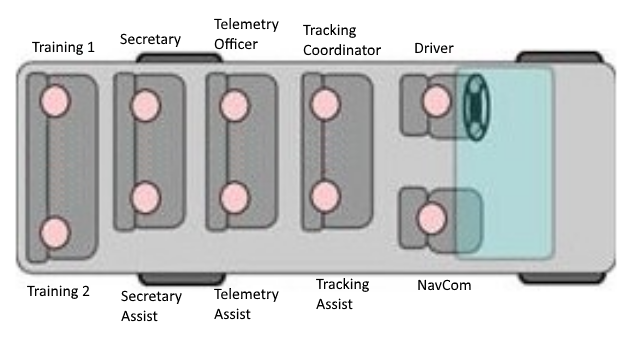
This launch we had a smooth preparation which I think may have been in part due to the timeline decided upon before the flight. These suggestions are designed to replicate that for future flights. Also a couple of suggestions so that we don’t take off anyone’s head in future launches.

* Upon arrival at launch site, Launch director determines estimated launch time and inform team during briefing
* Launch director, flight director, payload commander, lab director should have walkie talkies during preflight operators to aid communication
* Should have photographer taking photos of setup
* Upon arrival at launch site, Launch director setup payload assembly string roughly perpendicular to estimated wind direction
* Begin balloon inflation in BLT as soon as possible after arrival, once inflated, hold till announced launch time
* Launch timeline:
  + Upon arrival: assign chasers to vans and assign roles. Rearrange personal belongings into chase vans if necessary. Review launch site layout (tarp location, van parking positions, inflation area, payload string location)
  + T-20min: All vans should have a communication coordinator appointed. Ensure they are all able to operate walky talkies and know the frequency. All communication people must have the cell phone numbers of all other communicators (in case the radios/zello aren’t working).
  + T-15min: Turn on all vans, turn on all tracking radios, turn on all tracking transmitters and do tracking check. Also check APRS.fi if possible.
  + T-10min: Ensure that chase vans are fully packed and ready for immediate departure upon launch.
  + T-10min: Seal late-closeout payloads
  + T-5min: Arrange payloads in launch configuration
  + T-0min: Release
* Before launch, Launch director ensure that payload holders are perpendicular to wind
* Before launch, Launch director ensure no one is standing downwind of launch
* add to checklist, launch director should make an announcement that others are welcome to chase with us, but should follow as part of the caravan and should not go ahead and/or attempt to get to the landing site before the main tracking van
* gromets on BLT for tie downs

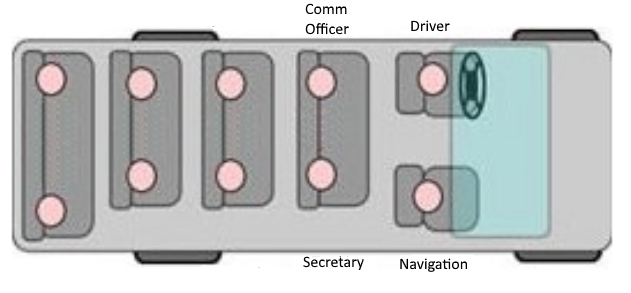
**Flight**

These suggestions are designed to clarify the roles of personnel in the vans but aren’t really different that what we already do.

* Main tracking van roles:



* + Driver (driver’s seat):
    - drive
  + NavCom (passenger seat):
    - provide directions if necessary (must have smartphone and be willing to use it for point-to-point directions, must have a driver’s license and drive regularly),
    - operate walkie talkies and/or zello
    - monitor APRS radio
    - provide balloon status updates
    - relay driving directions to other vans
  + Tracking Coordinator (2nd row):
    - Track via APRS.fi and/or Nick’s tracking software
    - provide general driving guidance based on balloon location/prediction
  + Tracking Assist (2nd row):
    - Learning tracking
  + Telemetry Officer (3rd row):
    - Operate 900MHz base station and receive live telemetry
  + Telemetry Assist (3rd row):
    - Assist in operating 900Mhz and reviewing data
  + Secretary (4th row):
    - live tweet updates
    - record important events/status of hardware (ex: how are the 900MHz radios working, are there point’s we’re not getting good packets? record important things that are said in the van)
  + Try to limit people in main tracking who do not have a defined role, try to get new people into the van to train them on roles
  + Try to have transmitters in vans so that we can tell where they are
* Secondary Van roles:



* + Driver (driver’s seat):
    - drive
  + Navigator (passenger seat):
    - monitor APRS radio (if present)
    - provide directions if necessary (must have smartphone and be willing to use it for point-to-point directions, must have a driver’s license and drive regularly)
  + Communications officer (2nd row):
    - operate walkie talkie and/or zello
    - receive updates from main tracking and relay instructions to driver/navigator
  + Should carry recovery gear
* This is designed to be the nominal setup. Will need to be adjusted for situations in which we are deploying an advanced team.

**Recovery**

These suggestions are designed to smooth the recovery process, especially when we have to recover at a later time because we can’t get them back on the day-of.

* If flight director is not present during recovery, appoint a recovery coordinator who will be present. Recovery coordinator is responsible for making sure all recovery personnel follow payload recovery procedures to safe them.
* Recovery director must have been present at the landing site and have observed the status of the balloon and payloads

**PostFlight**

These suggestions are designed to define a system for closing out a flight, something we don’t have formalized at the moment.

* Create post-flight checklist for flight director to closeout flight.
  + Within 1 week of recovery: Flight director should ensure that payload flight summaries have been received from each payload. Summaries should include:
    - confirmation that raw versions of all data (including headers indicating data type and units, if applicable), data processing scripts, and any pictures/videos taken have been uploaded to archive server
    - Overview of payload performance. What worked, what didn’t, any interesting data?
    - Lessons learned
  + Within 1 week of recovery: Flight director should ensure that photographer has uploaded all photos/vdeos have been uploaded to server
  + Within 2 days of launch: Flight director should ensure that tracking coordinator has uploaded raw APRS packets archive server
  + Within 2 (3?) weeks of recovery, full summary of flight performance

Things to purchase after this flight:

* Additional car power plugs for tracking radios
* Additional micro sd loggers
* Additional SD cards

Feedback:

* Good: Launched on time
* Good: BLT worked well, got damp on ground which caused velcro to come off, will be sewed for next time
* Cmd: Structure worked well, good packets all the way
* Bad: People almost got their head taken off during takeoff
* May have configuration issue with d710’s, don’t seem to work as well as 700’s. Cooper is arranging someone to come in and give presentation about them and look at our settings
* Cmd:
  + wasn’t flying Lipo protection, batteries fried, will be working next time
* Trapsat:
  + downloaded data from ground, we’re looking at doing something similar via xbee’s
* Spectre:
  + waiting to discharge battery, no results as of yet
* Whitebox data:
  + didn’t get radio lock on 900mhz, no data
  + hardware was good, flying same software as last time, need to look into it more
* Whitebox pic:
  + no pics, software issues, possibly also hardware issues (shield)
  + no packets, wasn’t taking pics
  + 900mhz did have radio lock, just wasn’t getting data
* Need to start logging which antennas we use with which radio and what kind of reception we get
* Bach Box:
  + pictures were great, only temp sensor worked
* TurtleNest:
  + had turtles, great pics, also had aprs tracker, stayed warm
  + 100% success!
* Hermes lite:
  + had good tracking with the yaggi the whole flight
* Host:
  + video is nauseating, fly kite bearing next time
* Balloonduino:
  + voltage reg didn’t work, mis-set, killed lipo
  + no comma separators in data logging, not very useful… but it did log data…
  + bme280 (pressure, temp, humidity) working, sd card working, adc (voltages, currents) working
* PATCHES are cool.