

High Altitude Balloon Photography How To



KANSAS, USA

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There are many platforms for aerial photography: kites, hot air balloons, paragliders, helicopters, drones, jets, and spy planes. But high altitude balloons (HABs) stand out. On the way up a balloon visits the altitudes home to all of these platforms, then surpasses them, achieving truly unique views of the planet that bridge the gap between conventional aerial photography and satellite imagery. HABing provides an opportunity to explore a place from which new perspectives of the world are still possible, but returning with pictures that do it justice does present some technical and artistic challenges. This tutorial will outline best practices for achieving the best pictures possible.

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Setting Up Your Payload Box

Balance Your Payload and Aim for a Level Horizon

Weather balloons provide a relatively stable platform, but the horizon in your pictures won't appear level unless the payload box is perfectly balanced. Before making any holes in your box for the camera lenses, distribute your equipment inside and measure tilt with a small bubble level, shifting the contents as necessary.

Secure Your Cameras

At lower altitudes crosswinds may rock and spin your payload box, but once in the stratosphere stability is usually achieved. At apogee there's near perfect calm. However, the instant the balloon explodes the box can flip and spin in all directions. If the contents aren't secure, expect the worst.

Some common ways to keep a camera in place include using foam wedges or Velcro loops. Avoid methods that add weight. Applying a little duct tape at the last minute also makes good insurance.

The lens holes in your box should form a tight fit. Not only does this impede cold air from getting inside, it also helps hold the camera. If your camera shifts even slightly during flight, the inner edges of the lens hole may appear in your pictures; a particular problem with wide-angle lenses. To prevent this, consider tapering the edges of the hole on the outside around the lens.

Uncover any problems in advance by taking test pictures while gently shaking your payload box.



Example Payload Setup

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Protect Your Cameras From Impact

Your payload box might hit the ground hard. To avoid damage to your cameras not only should they be held firmly in place, but some protective cushioning may be required as well. Installing soft foam padding directly under a camera is one option, but depending on how it's done this may prove destabilizing, allowing the camera to shift during flight, resulting in images that include the edges of the lens hole. Instead, consider adding any cushioning to the underside of the payload box itself. This could take the form of thick Styrofoam wedges affixed to each corner underneath.

Your box may land on its side resulting in damage to any protruding camera lenses, even if they sit flush with the exterior. To counter this, use Styrofoam glue and/or duct tape to affix small pieces of Styrofoam one or two centimeters thick around each lens hole, but be sure they're outside the cameras' field of view.

Avoid Frozen Cameras

Cameras come advertised with a minimum operating temperature. However, in practice most function in temps far lower than the guidelines suggest. Experience has shown that many of the

models commonly used in HABing work perfectly well even in temperatures as low as -10 F (-23 C). But to play it safe, and prolong battery life, some heating can help.

Warming can be accomplished by raising the ambient air temperature inside the payload box or through direct heating. In either case this is most easily accomplished with small, adhesive backed air-activated (or super-saturated solution) hand or foot warmers, most commonly found in hardware, home improvement, or sporting goods stores. Try affixing a warmer over the part of the camera containing the battery, or if applicable, on top of the flash mount, but avoid the LCD screen as they are susceptible to heat damage.

Note: *GoPro cameras generate a lot of heat on their own after running for a while and are known to function well even outside the payload box.*

Planning and Practice Make Perfect

Include the specific steps for activating each camera in your launch checklist and practice starting them up. Battery life is finite. Once they're clicking, time is precious. After you start the cameras, the only remaining steps in your launch sequence should be sealing the payload box and releasing the balloon.

Still Photography

Like waiting for the first images from an interplanetary probe or retrieving a motion-activated wildlife camera, chasing down and recovering a HAB payload generates a similar feeling of anticipation and excitement. Through careful planning and preparation you set the wheels in motion, but ultimately the results are still subject to chance. Following are a few tips for maximizing your success rate.

When evaluating still cameras for use in HABing, some of the most important factors include:

- weight
- battery life
- interval shooting mode support
- RAW file support
- sensor size
- lens interchangeability



GRAND CANYON, ARIZONA, USA

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Camera Options

When it comes to digital cameras the image of a big bulky DSLR may come to mind. However, not only are DSLRs poorly suited for HABing because of their heft, few would risk using one due to the expense. Thankfully, there are some great alternatives. Compact cameras (“point and shoots”) continue to increase in quality and sophistication and the recent introduction of mirrorless compact system cameras has opened the door to even greater possibility—cameras with DSLR like features, such as large sensors and interchangeable lenses, but compact in size and light in weight.

There's no need to spend a fortune on your cameras. eBay offers excellent deals on both new and used models. If you're new to HABing, avoid discouragement by starting small and building up to more expensive equipment.

What follows is a short list of cameras used successfully in HAB flights, but there are many others that have also proven themselves. As a little research will show, there's no need to limit yourself to what is here.

Canon

The **Canon PowerShot** is probably the most popular line of compact cameras used in HABing. What sets them apart is the wide selection of models at many different price points along with the [Canon Hack Development Kit](#) (CHDK), an open source effort that lets you swap out the camera's firmware with an enhanced version including features required for HAB photography, namely an intervalometer (interval mode), as well other valuable options such as RAW file support.

At the bottom end is the 12.1 megapixel (MP) **A1100 IS**, the only PowerShot taking AA batteries. Despite a lack of features and the image quality of higher end models, the ability to use AA lithium batteries lets the A1100 IS click away for as long as fourteen hours. In comparison, mid-range PowerShots only last two hours at most, while high end models can go for a little more than three. The camera has a 35-140mm (35mm film equivalent) lens.



The A11000 IS is an ideal starter camera. It's easy to configure, lightweight, and cheap. If it's your first launch, consider sending up three PowerShot A1100 ISs powered by Energizer Ultimate Lithium batteries and configured with CHDK for 10 second intervals. Position one horizontally (landscape position), another vertically (portrait position), and the third facing straight down. The resulting images will give you a great introduction to the possibilities available in HAB photography.

Stepping up the ladder are the 16 MP **PowerShot A3300 IS** and **A4000 IS**. In terms of feature set, they're nearly identical, though the A3300 IS may be found at a lower price. Neither has exceptional battery life, both usually expiring after two hours, which is often not long enough to capture the entire flight. They feature a 28-140mm and 28mm-224mm lens respectively.





The **SX260 HS** is slightly heavier, but with its 12.1 MP CMOS sensor and longer lasting battery, it offers a better choice over the previous two models. The 25mm wide-angle lens also covers more territory than even higher end models.

The best PowerShots currently supported by CHDK are the **G12** and **G15**. The G12 has a 10 MP CCD sensor and the G15 a 12.1 MP CMOS. Both have 28-140mm lenses, but the G15's is faster. With these cameras you'll get images unsurpassed in quality for the PowerShot line, but with a relatively higher weight (the G15 is significantly lighter than the G12), the trade-off is the total number of cameras you can include in your payload, and thus the number of angles you can cover.



Pentax



Pentax also offers a few choices with DSLR like features, but minus the weight and expense. The mirrorless **K-01** model, although discontinued, can still be found on eBay. While considered an ugly brick by some, the attraction of the K-01 is the incredible battery life, built-in intervalometer, 16 MP APS-C sized sensor, and compatibility with the entire range of K-mount lenses. The sturdy build is an added plus. Out of the box, the camera comes with the world's thinnest fixed focal length interchangeable lens, but if you opt for a K-mount, save weight by using a manual, fixed-focal length lens.



On the lighter side, the recently introduced 12.4 MP **Pentax Q7**, which looks like a toy DSLR, has some of the same benefits of the K-01, but with a smaller 1/1.7-inch CMOS sensor and only a handful of lens choices. The standard 23-69mm lens has the best wide-angle capability of any of the cameras discussed here.

Olympus



A comparable entry from Olympus is the light-weight **PEN E-PL5**, a Micro Four Thirds compact system camera that accepts a wide array of lenses and contains the same 16 MP Live MOS sensor and TruePic VI Image Processor as the flagship Olympus OM-D E-M5

model. The E-PL5 comes standard with a 28-84mm lens. The built-in interval mode is unsuitable for HAB photography. Instead, an external intervalometer must be used. Set at 15 second intervals, the battery can last over 3 hours. The camera's byzantine menus can be a chore, but the image quality makes it worth the effort.

Ricoh

The lightweight **Ricoh GR** doesn't offer the flexibility of interchangeable lenses, but it does have a large 16.2 MP APS-C CMOS sensor, 28mm lens, a long lasting battery, and an unlimited interval shooting mode, which is unique in the market.



Configuring Your Camera for Flight

Many of the same cameras used in kite photography or mounted on amateur drones also perform well perched below a weather balloon. However, there are a few key differences to consider. HAB flights can last two hours or more, making maximizing battery life much more important. And changing atmospherics can create variable light conditions, but unlike a kite or drone you can't land the balloon to make camera adjustments. This means the exposure settings must be setup to operate in their most adaptable modes. Every choice of camera presents room for experimentation in these areas. And every flight will be a learning experience. That being said, there is some general advice worth noting.

First, become intimately familiar with your camera's dials and menu systems. To maximize battery life, keep the LCD screen off, dimmed down, or as static as possible. Turn off the flash, face recognition, red eye reduction, AF assist lamp, GPS, and lower all the volumes.

Depending on the camera, consider using either the Landscape mode (avoid overly vivid Scene modes), Program AE, or Shutter Priority (500 is commonly used in drone photography). Set ISO and White Balance to Auto and the metering to Multi-Segment or Center-Weight.

On an interchangeable lens camera set focus to Manual and use a bit of duct tape to keep the focus ring fixed at the correct spot for infinity. If you're experimenting with the Aperture Priority exposure mode find the sharpest f-stop for landscapes and program it in or set the aperture ring and tape it in place.

Setup your intervalometer to take a picture every ten or fifteen seconds. You might end up with thousands of photos, but only a few will be worth keeping. The larger the pool, the better the odds.

Lastly, when installing a camera in the payload box it's easy to accidentally shut it off or bump a button, messing up the settings. Use bits of duct tape to keep the various dials in place and cover over any sensitive buttons (possibly with bits of Styrofoam padding) in such a way that they can't be mistakenly depressed. If there's a touch screen feature, disable it.

Image format: RAW vs JPEG

Professional photographers and most serious amateurs shoot saving their pictures in the RAW file format. If you're only saving in JPEG, your photos will almost never look as good as they could.

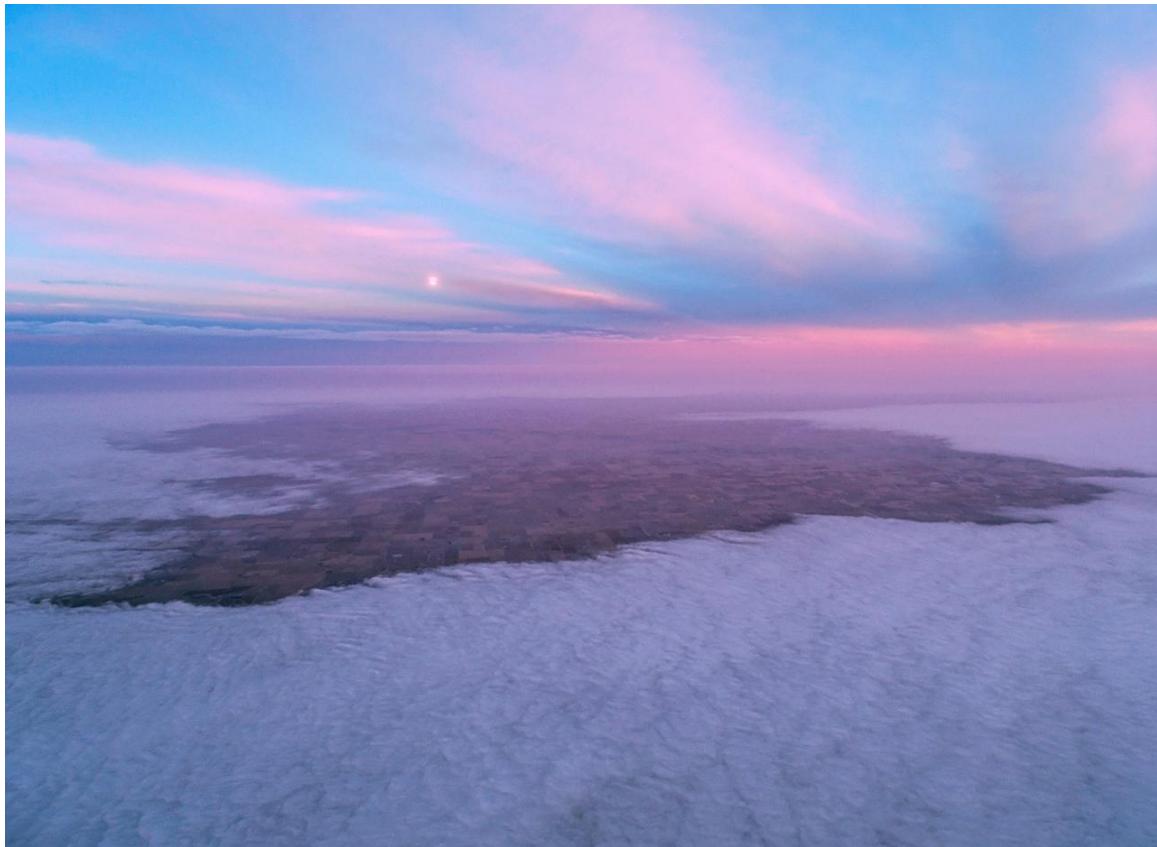
JPEG files are "lossy", meaning the camera's software discards some information during processing, ultimately resulting in a smaller, compressed file with lower image quality and a reduced ability to make improvements later on through editing. In contrast, a RAW file is just that. It contains all of the data originally captured by the camera's sensor, unchanged by any processing algorithm.

Saving in RAW can mean a little more work at the tail end, because your "keepers" will need to be edited using software like PhotoShop, but the payoff in quality can be worth it. With practice, eventually your images will look far better than what the camera spat out in JPEG. But there is a learning curve and until you're proficient it's best to save in both RAW and JPEG. All of the cameras previously discussed have this ability.

Lynda.com Tutorial: [Intro to RAW Capture and RAW Processing](#)

The Photographic Process

The ingredients for producing good aerial photography from a weather balloon include preparation, patience, technique, timing, and practice. The more effort you add to each element, the better the overall results. Happy accidents can also play a role.

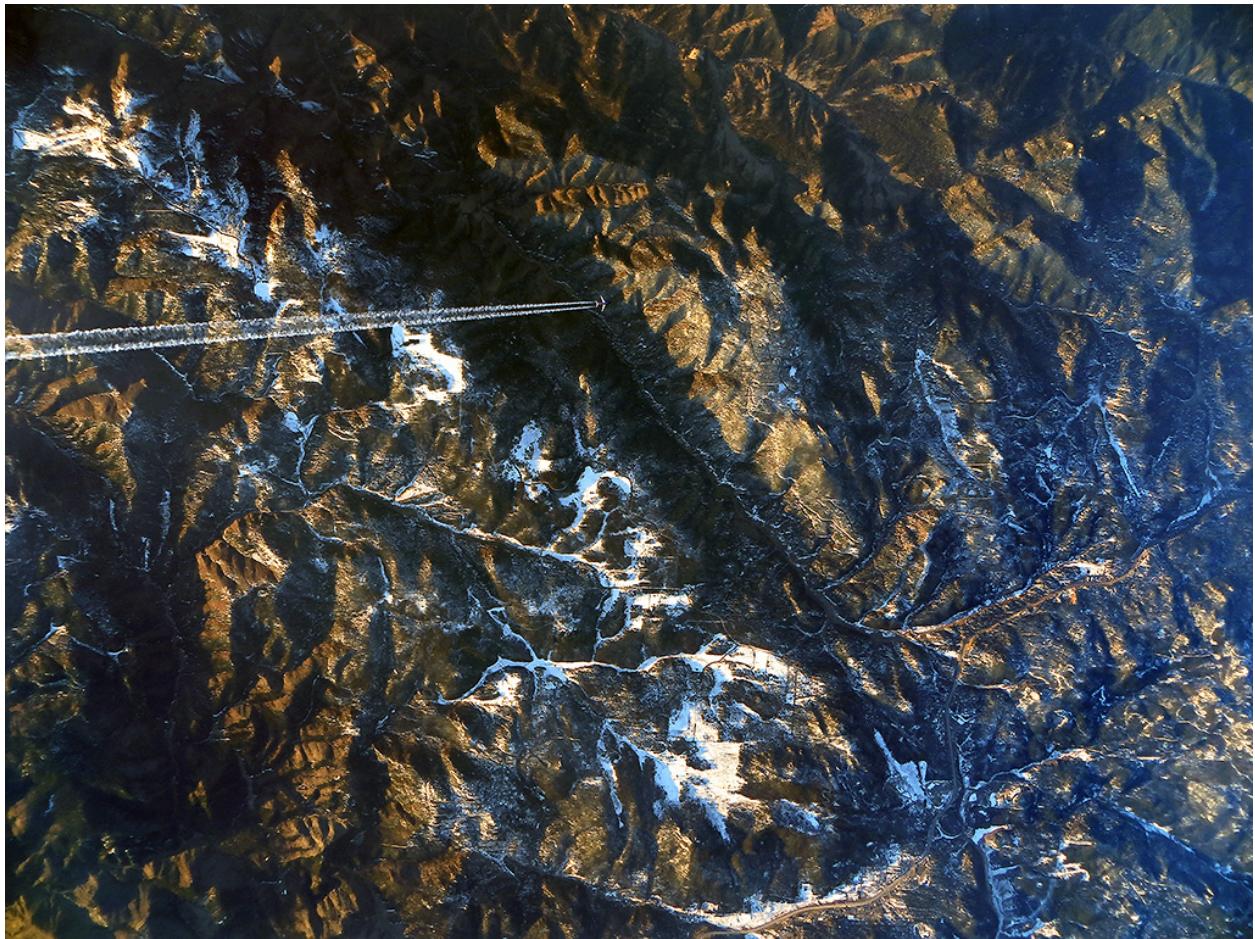


IOWA, USA

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Planning Out Your Image Composition

Imagining the pictures you want in advance is a key part of preparation. Normally, when you set out to photograph a place you can acquaint yourself beforehand by studying pictures in print or online. You can scout the location in person, observe it during different times of day or seasons of the year, and generally proceed at your leisure, knowing the potential options. In contrast, HAB photography offers none of this. However, effective use of flight trajectory prediction tools combined with mapping software can make pre-visualizing your balloon flight possible, allowing you to identify photographic subject matter in advance and plan accordingly.



COLORADO, USA

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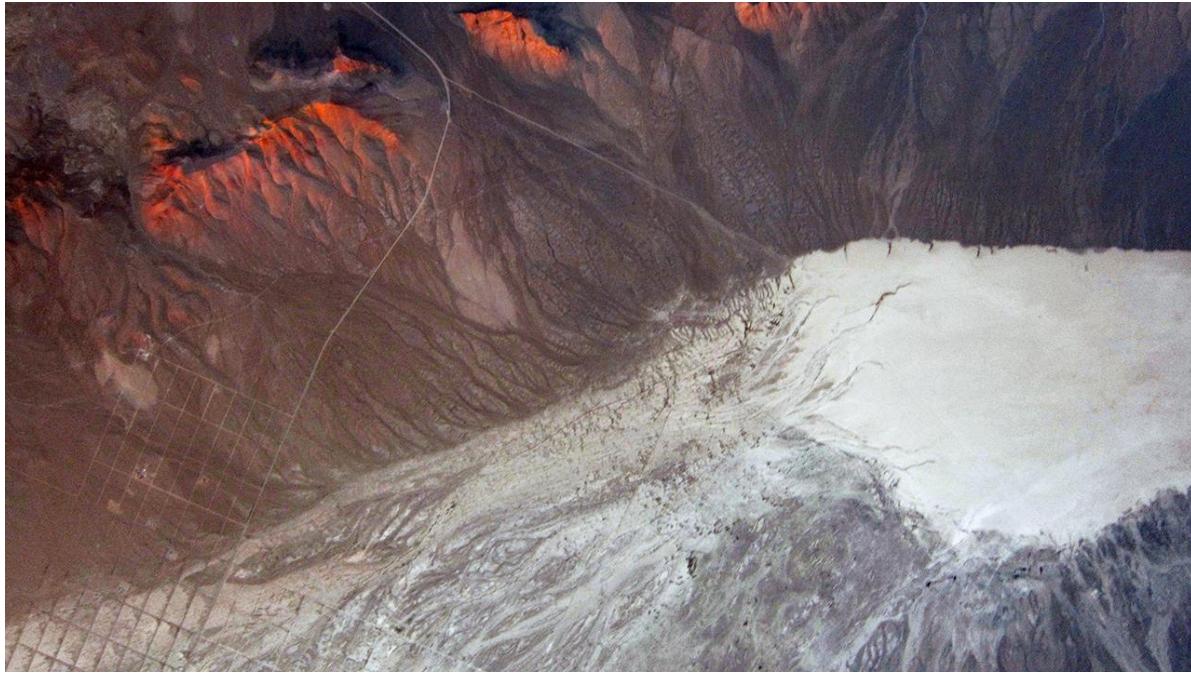
The most popular online flight prediction tool is the [Cambridge University Spaceflight Landing Predictor](#) (CUSF). A great alternative is the [new predictor from the University of Michigan](#). Given a few simple parameters these sites produce a predicted flight trajectory overlaid on a 2D interactive map, which can be exported in KML (Keyhole Markup Language) format and loaded into [Google Earth](#). Using this tool you can dynamically navigate the entire flight path at every altitude over a detailed 3D representation of the planet.



SOUTH DAKOTA, USA

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Looking down from high up you might notice surprising natural patterns taking shape or unusual man-made forms. You might discover, for example, that from 30,000 meters what you thought would look amazing might appear too small through a wide-angle lens. Returning to the flight prediction tools you can adjust your trajectory accordingly or plan on using a different camera setup.



MOHAVE DESERT, CALIFORNIA, USA

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Positioning of the Camera to Capture the Desired Image

Part of what makes HAB photography unique is the ability to fill the background of your shot with the black sky of space. But a picture composed of half black sky and half Earth rarely looks very good. It breaks a classic principle of composition called the rule of thirds.

The question then becomes how to achieve a well composed photograph, with balance and proportionality, when you're not there in person to frame the shot? This may not sound easy, but it's really quite simple.

The only control you have over composition is how you position your cameras from the start. There are three options: landscape, portrait, or down facing. Each placement presents its own interesting possibilities. The trick to achieving a well-balanced landscape or portrait shot is to install the camera in the payload box at a slight down angle, anywhere from 10 to 30 degrees. So long as your box is level, doing this should result in a higher percent of photos coming out with a pleasing composition.



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Choosing the Proper Time of Day

If you drive out to some rural area and launch your balloon in the middle of the day when it's most convenient, you'll likely end up with hazy images in harsh, strong light with washed out details in the sky and on the ground. Neither the sun nor moon will play any starring role in the pictures. But be proactive and drag yourself out at 4 a.m. to launch from the same place just before sunup and you might come home with some of the best sunrise pictures you'll ever take, even when the sky is totally clouded over.



IOWA, USA

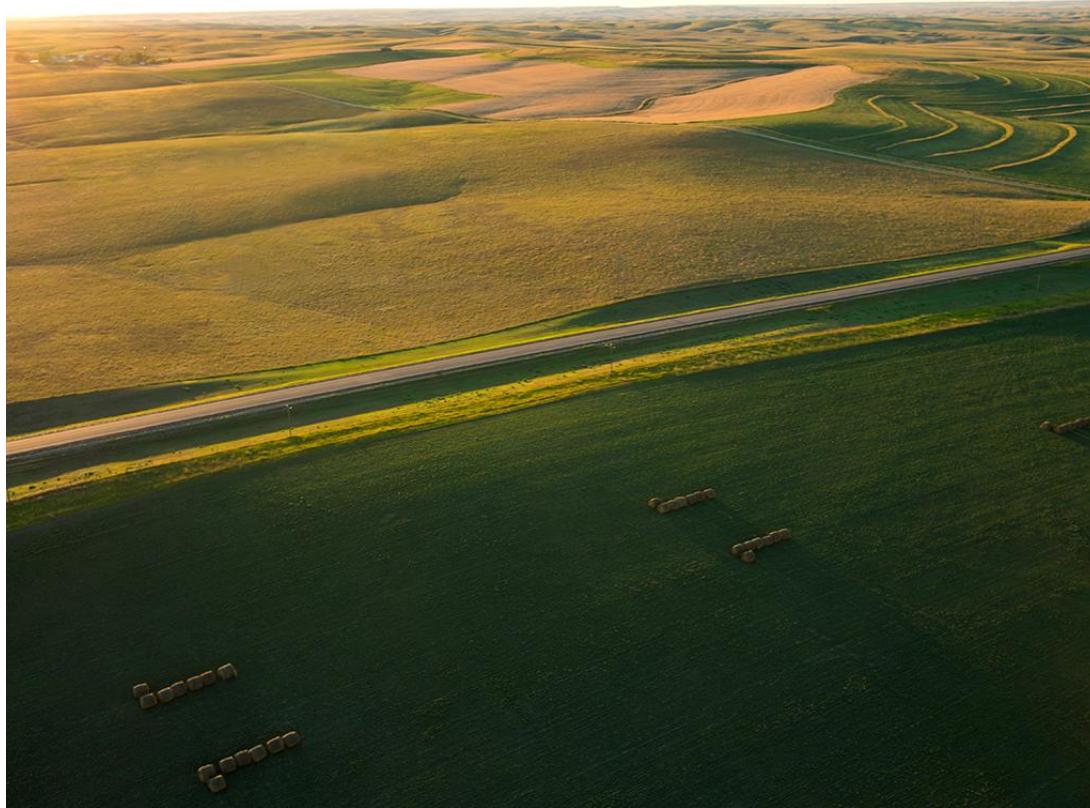
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In photography the so called Golden Hour exists just before, during, and after both sunrise and sunset. There is no better time to be taking pictures from high altitudes. Not only will any clouds be illuminated in long, dramatic, rich and colorful light, everything on the ground will look its best as well. In planning your launch study a sunrise/sunset and moonrise/moonset [calendar online](#). If you can find a window when the moon sits just above the horizon at the same time the sun is rising or setting, you may come away with some unique images.



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Image Post-Processing

The final step in producing great photography is using software like Adobe Photoshop to edit your pictures. Programs like PhotoShop offer near infinite flexibility in terms of what you can adjust, but your goal should only be to bring out what's already there, not exaggerate it. The final image should appear naturalistic. It's a subjective process and hard to put into words, just trust your eye and follow your instincts.

It doesn't take sophisticated knowledge of PhotoShop to make basic improvements. If you're shooting in RAW format you'll have the added option of adjusting key settings such as white balance and exposure.

Using PhotoShop you can rotate an image to level the horizon, crop it, remove chromatic aberration, fix lens distortion and vignetting, increase sharpness, and remove noise. But perhaps the two most basic, powerful adjustments that you'll want to make to nearly every image are Levels (to correct color) and Curves (to adjust brightness/contrast).



BEFORE LEVELS ADJUSTMENT



AFTER LEVELS ADJUSTMENT



BEFORE LEVELS ADJUSTMENT



AFTER LEVELS ADJUSTMENT

Lynda.com Tutorials:

- o [Using Camera RAW in Adobe PhotoShop](#)
- o [Color Correction with Levels](#)
- o [Brightness and Contrast with Curves](#)

Video Cameras

There are many action cameras on the market these days, but in the world of HABing the conversation really begins and ends with the GoPro. In terms of features, quality, weight, and battery life there's simply no comparison. To film his famous "space jump" in 2012, Felix Baumgartner had five GoPros strapped to his body.



To capture video from takeoff to landing, the optional [BacPac battery](#) is a must, but depending on the camera settings and projected flight time, even that may not be enough. Instead of the BacPac, if using a Hero 3+, consider the new [Brunton All Day Power Supply](#). Also be sure to use a 32gb memory card (or to play it safe a 64gb).

Newer GoPro models support both 2.7k and 4k resolution, which sounds attractive on the surface, but there are few viewing platforms on which to experience the benefit and editing the video can be time consuming. Generally speaking, 1080p at 30fps video works best. To shoot the balloon burst with a camera pointed up, use 60fps for slow motion and set the field of view (FOV) to Narrow. Be careful about using the Wide and Ultra-Wide FOV. In the resulting video the horizon can appear to bend and bounce whenever the camera moves. From 30,000 meters even a mountain range can look small and an extreme wide angle also further diminishes details on the ground. The Medium FOV can be a good compromise, but it's subject to personal taste.

Newer GoPros can take still photos (even simultaneously with video), but the quality of the images still leaves a lot to be desired, even at 12 MP.

The most common beginner mistake is to leave the GoPro inside the waterproof case it comes with. If you do that the lens will probably fog over, even with the anti-fog inserts. But without the protection of the case, be sure to take some extra precautions when installing it in the payload box using some of the aforementioned measures.

Note: The new GoPro Hero 4 seems to offer little advantage for HABing over the Hero 3+. [Click here](#) to read more.

Adventure Awaits

HAB photography is in its relative infancy. The pioneering efforts to further explore and develop this platform are ongoing. The possible subject matter just waiting to be documented for the first time from this novel vantage is almost unlimited. There are still many challenging ideas never or rarely attempted before, such as shooting one balloon bursting from another, capturing a solar eclipse, or pictures of atmospheric events like the aurora borealis, super cell thunderstorms, or even hurricanes.

When it comes to cameras, a world of options and ideas remain open to experimentation, including the use of stitched multi-camera, still or video panoramas, stereo 3-D, gimbal-mounted GoPros, or perhaps one day gigapixel photography. The use of programmable camera rigs is also ripe for investigation. Similar to those used in kite and drone photography, such rigs could conceivably eliminate the need to send up more than one camera to cover multiple angles.