

A Rough Guide to Downlinks

The strong relationship between Axsys Technologies and Troll Systems has resulted in a technological partnership from which our customers benefit in many ways. One of these is the way in which all of our Cineflex products are enhanced by the ability to transmit live pictures to the ground, this being a need throughout the diverse roles that both the Cineflex V14 and the MS2T are called upon to perform.

When considering downlinks as an adjunct to your Cineflex purchase we will recommend that you have a direct conversation with Troll, who are the experts in this field. This guide is therefore just intended to be an overview of the subject and to suggest some of the factors you will need to consider.

The first decision you will have to make is whether you want to transmit images in High Definition or Standard Definition. Of course we all want the very best, but there is always a question of cost versus benefit. In roles such as law enforcement, border security and other forms of military or government surveillance this decision will usually be dictated by the standard operating procedures of the particular organisation, how much autonomy is given to the aircrew, and what form of on-board recording media is being used. Pictures transmitted to the ground will usually be used for situational awareness and force command and control. On board the aircraft will always be the best place to carry out identification and to gather evidentiary material.

The second piece of information we will need from you is the frequency you wish to operate on. Troll produce equipment for all the standard frequencies between 2GHz, and 7GHz, but bespoke equipment can also be produced for frequencies outside that range. Different countries' regulatory authorities take different views on the use of each of these frequency bands and in many cases the frequency will be dictated by pre-existing arrangements within your country. The equipment you order will be designed specifically for the frequency you choose. If you are currently unable to answer the question about the frequency you expect to be allocated then Troll can help with country-specific research on the subject.

The third factor you will need to consider is the range you require. Of course the answer will always be "as far as possible". Downlinked RF must always follow a clear line-of-sight so your local terrain will have an effect. Typically most systems will comfortably achieve 40- 50 kms. In perfect conditions distances as far as 160kms have been attained, but the height that the helicopter would have to fly to achieve that would be operationally impractical.

With those three principle decisions made you will be ready to begin selecting your hardware under the guidance of the experts at Troll.

On the Aircraft

The equipment installed on the aircraft will typically consist of a Transmitter, a Power Amplifier and an Antenna. It's the external antenna that will be the most obvious addition to your helicopter and it's a good idea to understand a little about the basic types. There are four basic antenna variants:-

Omni antennas (Skylink DP) are relatively small and simple. They radiate their signal out evenly in all downward directions. This can be perfectly sufficient and indeed desirable when operating overhead the receive site, such as during the broadcast of a stadium based sporting event. The disadvantage is that the signal is easily dissipated and thus fades quickly over distance.



Steerable antennas (Skylink SP) have their moving parts enclosed within a small domed enclosure. The advantage is that the power of the antenna is all focussed in a single direction, that of the ground receiver. This allows maximum distance for minimum power. The antenna learns the direction of the receive site either by a simple directional instruction from the aircraft GPS, augmented by a small and inexpensive IMU, or by the sophistication of a full mapping system. At higher frequencies smaller antenna can be used but there is an increased risk of various aircraft parts such as skids, steps, and the Cineflex camera itself interfering with the line-of-site. Both the steerable Skylink SP and the omni directional Skylink DP are therefore lowered in flight to protrude beneath these obstructions.



The Skylink SP is the antenna most usually selected for the role of Law Enforcement as there is often competition for space on the underside of a police helicopter. However, if range for the downlink is the overriding consideration, and if lower frequencies can be used, then one of the following two antennas, designed more for the television broadcast industry, would be the answer.

Troll produce two types of **Belly Mounted antenna**. The first is the Skylink LC which is generally positioned near the rear of the underside of the aircraft and works best in the 2GHz frequency band. Just like the Skylink SP this is a steerable antenna in azimuth.



The second is the Skylink HD which is a **Two Axis Steerable Antenna**. It not only stays locked onto the direction of the receive site but also compensates for aircraft roll so that all the transmitted energy is being aimed directly and constantly at the receiver on the ground. In this way the maximum distance can be achieved.

The option of SD or HD is available in all four of the above antenna types and they can each be controlled through the Microwave Control option incorporated into the HDU 900, the power house of the Cineflex control system. Depending on the aircraft type, the choice of frequency, the choice of antenna and the range required, a typical aircraft downlink installation will cost between \$65,000 and \$140,000

On the Ground

Troll have developed a universal receive site package called the A600 XNG which is fully self contained, easy to install and simple to operate. Full details are on Troll's website at http://www.trollsystems.com/brochures/A600_DIRECTIONAL_DIVERSITY.pdf

A typical cost for a fully functional ground receive station would be in the region of \$120,000. To this must be added the cost of installation on-site and any pre-installation survey work.

The best results are achieved from a helicopter when the ground receiver is positioned as high as possible. This might be at the top of a mast on the control building or, if your building is surrounded by high terrain, you may find that an intermediate reception point at the top of a hill is recommended. In that case extra equipment (and therefore cost) will be involved in forwarding the signal onwards to its final destination. This might be achieved by microwave transmission or by fibre optic cable.

Other bespoke options are available to further enhance the distribution of the images generated by the power of the Cineflex. An officer on the ground viewing his position from above, in real time, on a hand held device, will never be caught unawares again.