AERIAL VIEW SYSTEMS

A Pioneer in Aircraft Video Camera Systems

BY GEORGE L. LEWISON

One of the earliest pioneers in aircraft video camera systems was Joe Brunner, who founded Aerial View Systems in 1987. In the beginning it appeared the simplest way to install a video camera on the aircraft would be to stay in the pressurized areas of the aircraft and not face the problem of penetrating the pressure bulkheads. In addition, external installations would call for airframe modifications that would complicate the obtaining of an STC. As a result his first two aircraft video camera systems were designed to be installed inside the pressurized area.

Brunner has been associated with aviation essentially his entire life. His father was a flight engineer with American Airlines for 30 years and had been flying on aircraft from the Douglas DC-6 to the Boeing 747. Brunner learned to fly while attending Loyola University in Los Angeles. When he graduated, he received an ROTC Commission and subsequently served six years in the United States Air Force. He became a captain and flew F4 Phantom aircraft. After his time in the Air Force was up, he joined Global Navigation and became a manager of corporate and general aviation sales. After five years, Brunner joined Dassault Falcon Jet as their western regional sales manager. He enjoyed that job very much but eventually made the decision to go into business for himself.

Brunner became really interested in video camera systems on aircraft when American Airlines, for a time, had installed a video camera in the cockpit that allowed passengers to see a portion of the terrain ahead of the aircraft. On these aircraft, using a wide angle lens, only 1/3 of the picture was outside of the aircraft and the rest was in the cockpit. The outside picture was very bright and washed out and the portion of the picture that was inside the cockpit was very dark. Even though the overall picture was rather poor, Brunner noticed that the passengers were extremely interested in the in flight video pictures.

Due to this interest, Brunner developed a high quality video camera system for both corporate and general aviation aircraft. As a result, in 1985

This view was taken with an AVS-470 mounted on the bottom of the fuselage and approaching St. Maarten in the Caribbean.

This video frame was taken when the aircraft was flying over the airport.

he left Dassault Falcon Jet and founded his own company. He initially selected the name AirVision but subsequently found that AirVision was a company name that had already been taken. As a result, he changed the name to Aerial View Systems (AVS), and has operated under that name ever since. From the start, Aerial View Systems has been an innovator continually adding features to their camera systems such as auto-tilt, auto-zoom, auto flip and map trac. Two patents are now pending for AVS's external environmental enclosures and the map trac feature.

In order to provide for the initial installations, he began to look for areas on the aircraft that would not require penetration of the pressure bulkheads. He soon realized if the camera itself was small enough it could be mounted on the cockpit glareshield panel and look directly through the cockpit windshield just as the crew of the aircraft do to fly the plane. There were cameras that were available that fit the requirement. His first test of a video camera system on an aircraft was on a Boeing 727 aircraft that was being operated by Airesearch Aviation Co.

In order to provide for the camera to see the area that was ahead of the aircraft, the camera was mounted tilted down so the terrain in front of the aircraft could be seen. Brunner found on this first flight his video camera system functioned fine in the air, however upon landing, the only thing that could be seen was the concrete of the runway and nothing ahead of the aircraft. He then realized in order to provide his customers with a system that worked during the whole flight regime, there would have to be a tilt system added to the camera.

As a result of this first test of his video camera system, he added a tilt mechanism to the camera so it could be used through all the flight regimes from airborne to ground operation. With this early modification to his video camera system, he was able to provide his first customers with a video camera that gave the occupant in the cabin a view of the terrain ahead of the aircraft just as the crew would see from the cockpit. This change, no doubt, was an important factor to contributing to the success of his first installations.

It should be noted that Aerial View Systems has remained a small company since its inception. It is a tribute to our industry that a small company furnishing high quality equipment can remain viable in this industry without being gobbled up by some mega-giant. In addition, as later will be seen, their penetration of the aviation market has been extremely good despite the small operating staff. In fact, many companies offering aircraft video cameras have gone out of business but Aerial View Systems with emphasis on quality and product support is still going strong.

The first permanent installation of Aerial View Systems video camera was on a Gulfstream II aircraft that was being modified at the Jet Center in Van Nuys, Calif. The installation was successful and the video camera system operated as advertised. After this first installation, Aerial View Systems video cameras were installed on many different types of aircraft. In 1990, Gulfstream Aerospace became the first OEM to install an Aerial View Systems video camera system. Almost immediately after that first OEM installation, Dassault's Falcon Jet company installed an AVS Camera on their Falcon 900 Demonstrator aircraft. The future of AVS was virtually assured at that time.

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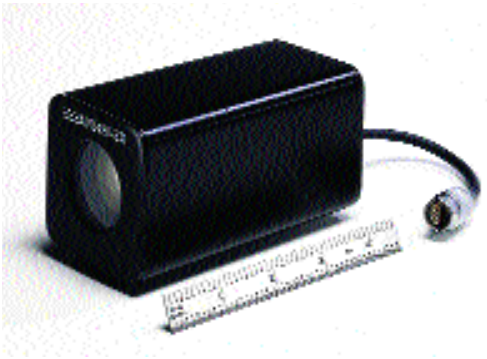
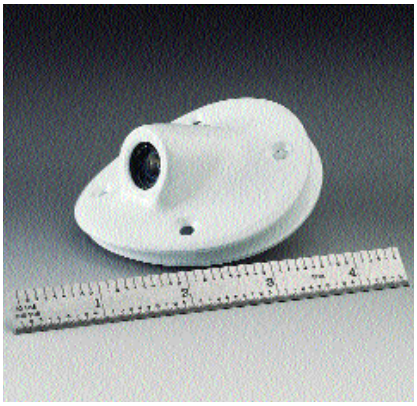
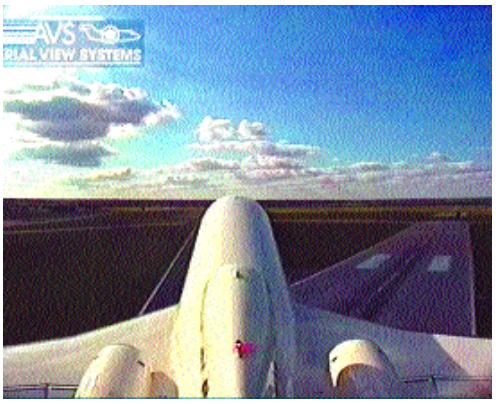


The AVS-420-ZX installed in the glareshield area but utilizing auto zoom in order to maintain camera angle.



The AVS-470 was their first video camera designed to install on the exterior of the aircraft. It was available with different lenses depending upon the application.



This view was taken by the AVS-470 installed in the forward portion of the vertical stabilizer of a corporate jet aircraft.

AERIAL VIEW SYSTEMS

Continued from page 27

The crew can inspect the main landing gear condition by utilizing a bottom mounted cam - era with the display on their CDU in the cockpit.

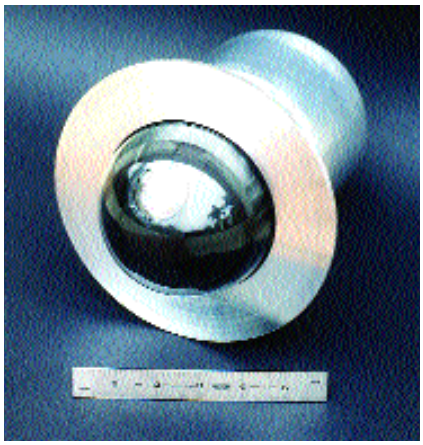
The first camera utilized was designated as an AVS-300, however the initial camera was replaced very quickly with one that was a better operating unit for aviation purposes and was given the designation AVS-460. This aviation camera is still being produced today along with additional models that were designed for different purposes and for mounting in different areas.

The AVS-460 auto-tilt camera is composed of the AVS460-24-28T-CCU camera control unit and the AVS460-24-28T-CH camera head unit. In addition to these major components, there is also a complete complement of mounting racks, trays, gussets, cables, connectors and a servo programmer. The camera control unit does not have to be accessible for most normal operations and remains "On" to be selected by the passengers remotely for viewing. The 28 volt power DC supplied to this camera system normally should be controlled by the radio master switch on the aircraft.

The AVS-460 camera which is mounted on the tilt servo has a total height of 2 inches including the tilt servo unit itself. The camera is 4.5 inches long including the connector, and the width of the servo unit with the camera mounted is 1.8 inches. The total weight of this assembly is 6 ounces including the camera head, lens and servo assembly. The camera remote control unit is 4.4 inches wide by 3.3 inches high by 6.2 inches long. It weighs 32 ounces. The entire system operates on 28 volts DC. The AVS-460 video camera system can simultaneously furnish output in NTSC, S-VHS and RGB format.

On most aircraft where this camera system is in use, the camera head is recessed into the cockpit glare shield panel. It is generally mounted with the camera head between 15 to 20 degrees nose down to provide the camera with a proper angle to view the terrain ahead of the aircraft when in flight. A servo unit in the camera head automatically adjusts the camera head to three different viewing positions for taxi, take off and approach.

On the ground, the camera receives a control function from the aircraft squat switch and rotates the camera to a slightly up position for taxi operations. In flight, take off and approach camera angles are selected automatically by the camera system sensing the aircraft attitude in degrees of ascent or decent. In those aircraft requiring different camera tilt angles, custom settings can be provided to meet the individual requirement.



The new Dome Camera, the AVS-480, with almost unlimited capability.

The AVS-460 model of Aerial View System's video camera system has been installed on many different type of aircraft and is still available today for new installations. In addition to the AVS-460, Aerial View Systems has produced another camera system designed for installation on the cockpit glareshield of the aircraft. The AVS-420-ZX was designed to also install in the same area as the AVS-460 inside of the aircraft, however a different concept has been used with this camera in order to provide visibility of the outside terrain.

The Aerial View Systems AVS-420-ZX aircraft video camera system is unique in that while it does not have a tilt mechanism, it does have a 24X1 stabilized zoom system that allows it to produce images of the terrain by varying the angle of zoom. The auto zoom feature automatically changes the field of view for taxi, take off and approach. In addition, with this camera the passengers can remotely adjust the zoom to view whatever portion of the terrain outside the aircraft they would like to see.

When the aircraft is on the ground, the camera receives a signal from the squat switch that selects the taxi position, which is wide angle. At take off and a deck angle of 12 degrees or more, the camera auto zooms to a 1/3 magnification. At level off and when the deck angle decreases to less than 8 degrees, the camera auto zooms to a 2/3 magnification for cruise. At touch down, the camera returns to full wide angle. Again, during take off and on the ground, the camera returns to wide angle. At any time, the passengers can remotely zoom the camera. Whenever remote zoom is activated, the camera

Continued on page 30

AERIAL VIEW SYSTEMS

Continued from page 28

will reset to telephoto position and refocus, and then the zoom will become operational.

The AVS-420-ZX is normally recessed into the cockpit glareshield and mounted approximately 5 degrees nose down to provide the camera with an approach landing view of the runway. With proper installation of the camera head, the runway will stay in the center of the video presentation throughout the approach. Too steep an approach angle or too shallow an approach angle will nullify this tracking. Again, similar to the tilt action of the AVS-460, the auto zoom of the AVS-420-ZX is selected automatically by the camera control unit. The camera control unit must be mounted level on the aircraft with its axis facing the nose of the aircraft to satisfy the required sensing function.

The AVS-420-ZX camera head which is mounted in the glareshield area is 2.25 inches wide by 2.25 inches high by 5.0 inches long. It has a weight of 16 ounces. It mounts on a mounting plate that is 6.0 inches long in order to accommodate a cam lock for fasting the camera assembly. The remotely mounted camera control unit, which is designated AVS-420-ZX-28-CCU, is 2.6 inches in depth by 4.75 inches in length by 2.1 inches in height. It weighs 12 ounces and is powered by 28 volts DC. In addition to these major components, the AVS-420-ZX video camera system comes with a complete complement of mounting plates and cables and connectors.

At the 2002 NBAA Convention, Aerial View Systems introduced an improved version of the AVS-420-ZX video camera system. The overall dimensions are smaller making it more suitable for glareshield installations—the optical zoom is greater and additional digital zoom has been added. In addition, the improved version has better stabilization. However, the biggest advantage is the smaller size as in glareshield installations every fraction of an inch that is smaller aids in the installation.

The development by Aerial View Systems of the AVS-470 SuperVision Aircraft Video Camera System launched a whole new era of camera locations for AVS as the AVS-470 was designed for external location on the airframe. The camera and lens was small enough so that a streamline fair-

Continued on page 42

AERIALVIEW SYSTEMS

Continued from page 30

ing could contain the entire assembly on the external fuselage of the aircraft. It was now also possible to pick many different external locations for the camera that would allow it to perform additional functions such as observation of the landing gear, the tires, brakes, thrust reversers, on the nose gear, or looking through the fuselage to the outside. The AVS-470 camera looks through a "heated sapphire window" on the external enclosure that mounts it on the airframe.

There are numerous different applications that are able to utilize this new video camera system. It was installed on the leading edge of the vertical tail assembly on some aircraft, in the front of the radome on top of the tail assembly on other aircraft, on the bottom of the fuselage on some installations and even through the nose wheel door assembly for some installations. The cameras were now not just installed for passenger enjoyment but also for airborne inspection of the external parts of the aircraft which added a safety factor that had not been available before.

Because of the many different locations and purposes which are served by the AVS-470 SuperVision Camera System, a series of lenses are available for use in this camera depending upon the application. There is a 24 mm F 3.1 telephoto lens, a 15 mm F 2.0 standard lens, a 7.5 mm F 1.5 wide angle lens and a 4.0 mm F 2.0 wide angle lens. The camera head is extremely small so that it can fit into the external fairing enclosure. The camera head itself is 2.5 inches long by 1.0 inch high and deep. In order to be flexible for installation in various locations, the connector may be provided at the rear of the unit going straight back or at the rear of the assembly at right angles. Weight of the camera assembly is approximately 5 ounces. AVS has a patent pending for this particular type of camera installation.

The camera control unit for the AVS-470, designated as Part Number AVS470-7.5-28AF-CCU, is 4.4 inches wide by 3.3 inches high by 6.2 inches deep. It weighs 32 ounces and installs in the pressurized area of the aircraft. This unit also operates on 28 volts DC and can provide composite video, super S-VHS video and RGB video output. As with the other AVS Camera Systems, the AVS-470 SuperVision Video Camera System comes with a full complement of cables, mounting brackets and miscellaneous hardware.

Some of the applications for this camera system are pilot orientated and as such contribute to the safety of the aircraft. In order to provide a view for the aircraft crew, this camera has been designed to provide a video picture in the cockpit on some flight management systems control display units, such as the Universal UNS-1C and certain other flight management computers made by Honeywell.

For example, the 4 mm wide angle camera installed at the top of the vertical tail assembly looking forward can provide an excellent panoramic view of the aircraft, the sky and the terrain ahead of the aircraft. For the crew, it will also display the status of the thrust reversers, the engine, flaps and slats, ailerons and spoilers can all be viewed. In addition, a 7.5 mm camera installed in one of the outboard winglets can assist the pilot to taxi the aircraft by giving him another view of the tarmac ahead. Also this same 7.5 mm camera installed in the nose gear area can allow the pilots to observe the landing gear, tires, brakes and many other essential items on the bottom of the aircraft.

With one of these cameras installed in the nose gear area, it is also possible to display an image of the runway ahead of the aircraft in the cockpit making it easier for the crew to keep the aircraft properly aligned on very narrow taxi ways. This location is very productive to provide valuable information to the crew in the cockpit. With this type of mount, when the aircraft is airborne and the gear retracted, the camera can provide a view of the terrain immediately below the aircraft.

A new Aerial View Systems SuperVision dome camera, the AVS-480, is about to come on the market. This video camera system will be by far the most advanced video camera system that has ever been made available for corporate and general aviation aircraft. The camera itself is encased in a transparent rotating dome assembly that is designed to install on the bottom of the fuselage of the aircraft. This video camera will be capable of full 360 degree horizontal rotation along with the ability to Pan and Tilt. In addition, it has available a 200X zoom capability. Its sensitivity is 1.0 lux for color and .06 lux for black and white. As a result, it is capable of operating in extreme low light conditions. In addition, this camera will provide 480 lines of resolution, making it one of the highest resolution cameras available for this type of installation.

In the cabin, this camera can be controlled in many different ways that will allow the passengers to rotate the camera, zoom in and out, and track points of interest as desired. In addition, the company logo may be displayed on the cabin screen as well as flight briefing information and display of flight data such as altitude, temperature, true air speed, ground speed, distance to go, time to destination and arrival time. For the crew, this camera can be used for taxi, take off and approach. Maps can be displayed in the cockpit with a zoom in and zoom out feature. In addition, when the air-

craft is on the ground the system can be used as a motion detector that can provide a measure of security for the aircraft.

Along with the new AVS-480 SuperVision Dome Camera, AVS is also marketing a new Map Track Computer, the AVS-480-Zl-28MT-CPU, that can provide almost any type of information desired for display in the cabin of the aircraft. It is the Aerial View Systems Map Track Computer that will allow the occupants of the cabin so much freedom of display. In addition to the outside displays available from the SuperVision dome camera, they will be able to display points of interest on stored maps that will delineate the areas over which the aircraft is flying. It will also provide aircraft data such as altitude, temperature, true air speed, distance to go, time to go and time of arrival.

The Aerial View Systems AVS-480-Z-28MT-CPU is a specialized Map Track Computer that has been designed to work with the new AVS-480 Dome Video Camera System. This computer will have stored all the custom moving maps, with software for including interactive and auto camera tracking of moving maps, aircraft flight data and much more. It also has capability to operate with a minimum of two touch screen display systems. It will store all the data required for cabin briefing and much more. The AVS-480-Z-28MT-CPU has 512 MB of storage and features capability to interface with aircraft ARINC 429 databus.

The AVS-480 SuperVision dome camera also gives the occupants of the cabin tremendous freedom of action in utilizing the dome camera. When used with a touch screen display, the outside scene will appear in a major portion of the upper left part of the screen with camera slewing controls on the right hand side along with zoom in and zoom out controls. In addition, more control buttons are available at the bottom of the screen. One of these on screen control buttons will take them to the stored map information. When the map appears, there are controls for selecting points of interest and various other functions all available to the cabin viewers.

Aerial View Systems has penetrated a really large section of the corporate market. This is because corporate operators are always willing to put the best of any type of avionics system on their aircraft to serve the interests of the corporate VPs as well as their business associates and guests.

In the following paragraph is a partial list of aircraft with Aerial View Systems video cameras. Since this list is always growing, it can never be up-to-date at any time it is published. This penetration of the market is only possible because of the high quality of the various video camera systems and associated components as supplied by Aerial View Systems and their dedication to product support once the cameras are operating on a customer's aircraft.

Boeing 707 aircraft (3), Boeing 727 aircraft (6), Boeing 737 aircraft (11), Boeing 757 aircraft (3), Challenger 600 aircraft (4), Challenger 601 aircraft (23), Challenger 604 aircraft (41), Citation VII aircraft (4), Convair 580 aircraft (2), Falcon 10 aircraft (1), Falcon 50 aircraft (16), Falcon 900 aircraft (57), Falcon 2000 aircraft (21), Gulfstream II aircraft (7), Gulfstream III aircraft (9), Gulfstream IV aircraft (58), Gulfstream IVSP aircraft (27), Gulfstream V aircraft (24), Global Express (5), HS-400 aircraft (1), HS-700 aircraft (3), HS-800 aircraft (22), HS-1000 aircraft (3), KA-200 Aircraft (1) KA-350 aircraft (2), Lear 35 aircraft (2), Lear 55 aircraft (1), MD-80 aircraft (1) Pilatus aircraft (1), and Sabre 65 aircraft (1).

In addition to these aircraft, a number of the aircraft manufacturers have utilized the Aerial View camera systems in their demonstrator aircraft. As of the time this article was written, Aerial View Systems video cameras have been installed on 20 OEM demonstrator aircraft. In addition, AVS camera systems have been installed on 36 different types of aircraft at 50 completion centers and OEMs around the world.

Installation information on the Aerial View Systems video cameras may be obtained on their website, www.aerialviewsystems.com. Currently installation information for the AVS-460 camera designed for interior installation with a servo tilt mechanism is available. Installation information for the the AVS-420-ZX interior installed video camera system with zoom capability is also available. In addition, installation information is also available for the AVS-470 SuperVision external camera. Installation information on the latest AVS-480 SuperVison external dome camera system may be obtained by contacting Aerial View Systems in Newport Beach, Calif., (714) 969-2470.

Aerial View Systems has traditionally worked with and cooperated with avionics shops large and small as well as OEMs and can provide all the information needed for installation of their various video camera systems on many types of aircraft. Aerial View Systems product support is unique in the industry. They want to be sure the customer has a good operating video camera system. As a result, even the OEMs come back for return business as they know they can rely on Aerial View Systems to support their products. For those avionics shops that have not as yet been involved in airborne video camera installations, a call to Aerial View Systems could turn out to be quite productive and create the opportunity for a new revenue source. q