



Industrial Productivity

Aerial Video Imaging

Below, Michael E. Henry, president of SkyVision, Inc., Houston, Texas, examines a videotape taken by his company's Cessna 182 airplane. A recently formed affiliate of Barr Air Patrol, Inc., an aerial pipeline and utility patrol company, SkyVision provides aerial video service to operators of pipelines, power lines, and other rights-of-way. The videotape supplements visual inspection with a high resolution permanent record useful in planning, construction and maintenance of pipeline/power line rights-of-way, or in environmental data collection.

In 1989, Henry and his partner in both companies, Ron Hyde, saw a need for the aerial video service in such applications as planning and routing rights-of-way, environmental studies, documentation and reference, and before/after evidence in liability

issues. With no knowledge of how to build and operate such a system, they sought guidance from Johnson Space Center (JSC) and were introduced to two NASA engineers who agreed to serve as consultants: Olin Graham, principal engineer responsible for the design and development of TV systems used in the Apollo, Skylab, Apollo-Soyuz and Space Shuttle programs and design supervisor of Space Station Freedom's video system; and W. K. "Bill" Creasy, a private pilot, aeronautical/mechanical engineer with long experience in aircraft design and modification, formerly JSC's manager of Space Station flight elements.

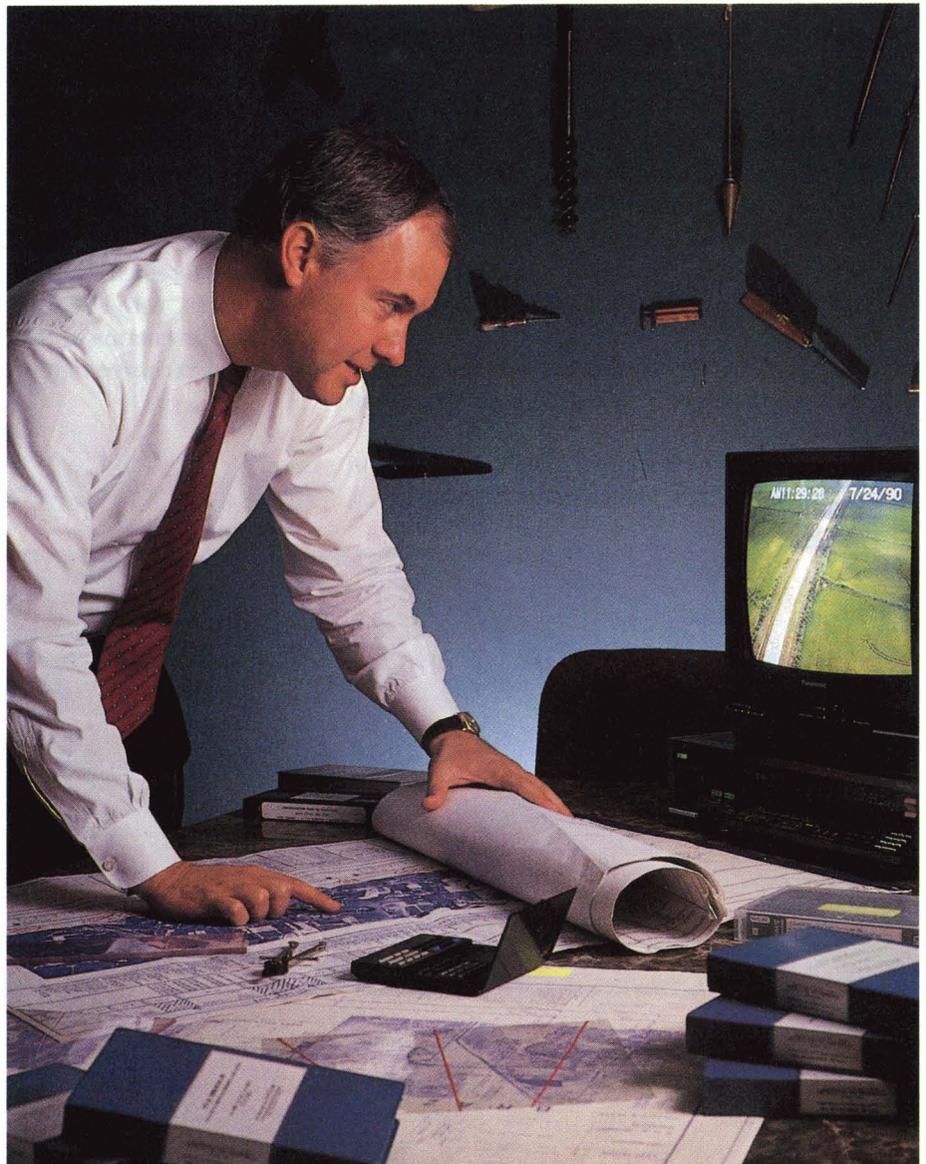
The NASA consultants analyzed SkyVision's requirements related to videotaping long distance pipeline



and power line rights-of-way from a single engine airplane at altitudes from 200 to 1,500 feet. Their first recommendation was for a high quality yet cost effective video system: the Sony DXC-750 camera with a small, lightweight head that would create less wind resistance and load when mounted under the Cessna 182's wing.

A key requirement was to reduce the effect of the "smear factor" that occurs when the camera is moving at 80-100 miles per hour over a stationary subject. Flight tests determined the optimum camera speed for stopping motion (1/2000th of a second); that shutter speed provides a clear image of the right-of-way, which can be observed more closely by stopping the video and inspecting the subject area frame by frame.

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The consultants designed and fabricated a wing-mounted fiberglass camera pod (**above left**). The camera head can be actuated in pitch and yaw and the video team can adjust the camera angle in flight to get the desired field of vision. The camera pod is aerodynamically shaped to reduce vibration, and vibration is further mitigated by a shock absorbing foam specifically selected after tests of the aircraft's vibration frequency.

A solo pilot can operate the entire video system alone. The camera control unit, video recorder and TV color monitor are installed in a rack on the cabin floor in place of the right front seat. The controls are conveniently located so that the pilot can start and stop recording, operate the zoom lens and maneuver the pod without compromising safety. The type of

view the system provides is illustrated by the image **at left**, taken on a demonstration flight over Texas' Barrier Islands at 1,500 feet. Zoom capability is shown in the **bottom left** image, which shows an oil drum washed up on the shoreline. An important feature is illustrated in the **bottom right** image, in which the video is following a pipeline to a group of storage tanks.

At the bottom of the image is a microprocessor readout showing the latitude and longitude, and the bearing of the airplane (along with the time, cut off in this frame). A Global Positioning System (GPS) receiver provides the position data, accurate to within 15 meters; it gets the data from the USAF's network of GPS satellites, which provide precise position information to receiver-equipped military and civil aircraft, ships and surface vehicles. The GPS information enables matching the location of the video image with coordinates on a map, providing a document that could prove useful as a reference, for example, in a legal case such as encroachment.

SkyVision's video service proved highly successful in its first 16 months of operation, completing 29 projects involving about 6,000 miles of videotaped right-of-way. Examples include work related to railroads, pipelines and power lines, state and federal highways, rights-of-way, coastlines, offshore environmental surveys, and real estate sales and appraisals. The company plans to add aircraft and expand the capabilities and applications of its equipment.

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