ADVANCED MONITORING CONCEPTS

Robert W. Lilley
Ohio University
Athens, Ohio

The emphasis in initial work will be on application of image processing techniques in the site monitoring of an ILS glide slope transmitting array. The glide slope requires a clear area in front of the antennas for use as a reflecting zone. Reflecting or scattering obstacles in this area can cause incorrect path formation and system outages.

Direct video monitoring is impractical due to the narrow-band nature of communications links from the ILS site to the regional maintenance location. Slow-scan video is possible, but even this technique may require transmission of large amounts of data, tying up remote monitoring lines.

Minimization of data transmitted will be investigated in several steps:

1. Video change detection: subtraction, pixel by pixel, of the current image from a baseline image and transmission of only the changed portion.

2. Edge detection of the changed image, providing a high-contrast outline drawing of the changed portion.

3. Calibration of obstruction shape and size, using known camera tilt angle and ground-plane location; investigation of the need for targets or gnomons in specific locations for image calibration.

4. Investigation of remote or pre-programmed pan/tilt/zoom operations for greater areal coverage or improved characterization of the obstacle.

5. 'Treat analysis' of obstruction versus monitor output versus effect on the glide slope signal in space.

6. Recommendations for interoperation with existing monitor/restart procedures and practices, or for changes in monitor philosophy.

Steps 1 and 2 will be investigated using existing COMTAL Vision One video digitizing and display facilities, with the addition of a data link to the IBM 4341 and 4381 computers, also available. Video digitization at 256x256x8 is implemented; color photographs of actual ILS ground planes, with and without obstructions, will be digitized initially, and used to drive change detection and edge detection algorithms. Required data volume will be measured.

Step 3 will be studied mathematically, using known camera optics and measured ground plane locations.

A prototype installation will be fabricated and tested, providing a test bed for remaining studies. Specific hardware will be selected after the computer studies demonstrate feasibility and necessary sensitivity to potential threats.

ADVANCED MONITORING CONCEPTS

IMAGE PROCESSING

-VIDEO CHANGE DETECTION

-EDGE DETECTION

-OBSTRUCTION CHARACTERIZATION
CALIBRATION GNOMONS?

-REMOTE PAN/TILT/ZOOM

-THREAT ANALYSIS -- VIDEO VS. REAL WORLD

-RECOMMENDATIONS