HOW RELATIVE SPEED AFFECTS SEE, BE SEEN AND AVOID

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IT IS LUCKY that after twenty years, indeed more than that, of hearing about proposed developments of a collision warning device for airplanes that somehow never seem to materialize, we do have the old standby, **see, be seen and avoid**. This seems to be the only VFR collision warning device we will see for some years to come.

But see and be seen, suffers from serious deficiencies that we all know something about. One was brought out in the voice recordings from the San Diego disaster. Both flight crews knew someone was out there, but neither could see where the other one was. Further, the controller knew a collision course was being flown, but didn't give instructions sufficiently urgent nor accurate for either pilot to act. The Cessna crew was actually lulled into thinking they were in sight of the jet crew, which was erroneous. It is possible to justify the argument that had the controller not been there, but that warning had been given to the two crews, they would have done something about it and the collision would have been avoided.

There is another deficiency of seeing that was also present in that disaster, but as far as this writer knows it has not been mentioned. It is the blind sector caused by the speed differences of two aircraft on collision course.

We shall present the problem here by oversimplifying it for clarification, and it is something all pilots can do something about provided they are aware of it.

It is analyzed most simply by working backwards in time from a hypothetical collision. Consider two airplanes flying straight and level on collision courses. This establishes a limited set of courses for each collision imagined or real as will be seen by Figures 1, 2 and 3. Now assume that each pilot can see at 90° to course, and to the front, but not behind. The figures illustrate the positions of the two airplanes at some instant of time before the collision. The slow airplane can be considered anywhere on the circle, and the fast one on the fixed course. In the diagrams the slow airplane has been placed in a special position. It is the position that would cause the fast one to become hidden from the slow one's view, that is, behind the line of no backwards vision, and his sector of blindness is shown shaded. Notice that there **is never any sector of blindness for the faster airplane!** At all other parts of the circle, each could see the other. Straight and level flight for the example is assumed.

The angle between the border of the sector of blindness and the slow airplane's courseline is:

$$\cos^{-1} A = \frac{1}{\text{speed ratio}} \quad \text{where:}$$

A = the angle in degrees, to one side of course, and the speed ratio is that of the fast speed to the slow speed. The sector can be expressed in percentage of the complete circle by:

$$(2A/360) \times 100 = \text{percent}$$

The numbers will be found plotted in Figure 4.

What do we do with this information once we know about it? We've already been admonished to keep our heads on a swivel. The slower we go the faster we'd better swivel our heads. If we are flying a fast airplane to see and avoid is in our favor, but to be seen may not be. We are obliged to take the responsibility that goes with the fast airplane pilot's better ability to see the slow one, which is to always be sure we are not running over someone.

If we fly any airplane we must be alert to the possibility that someone may be flying a faster one and running over us.

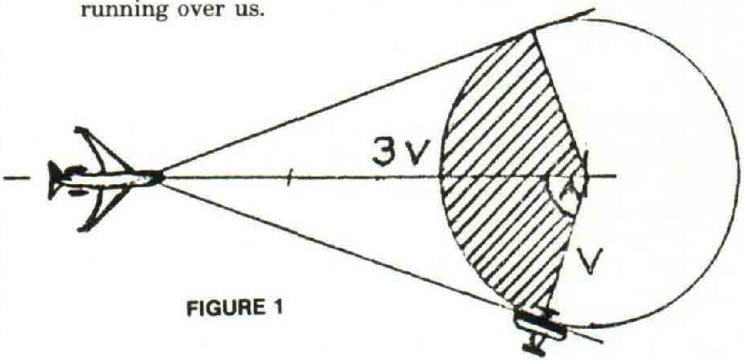

FIGURE 1

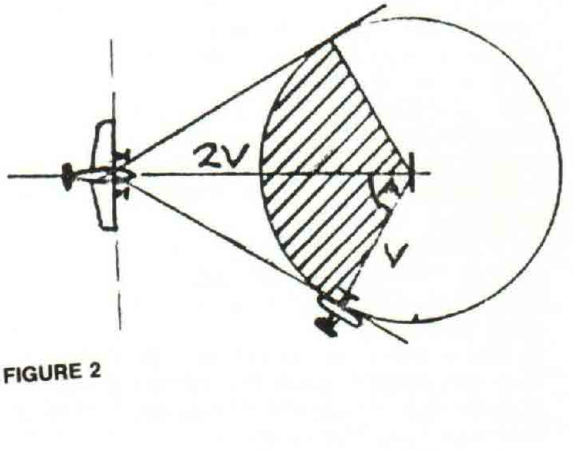

FIGURE 2

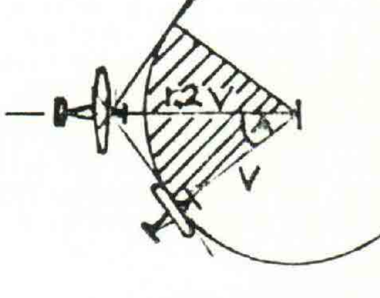

FIGURE 3

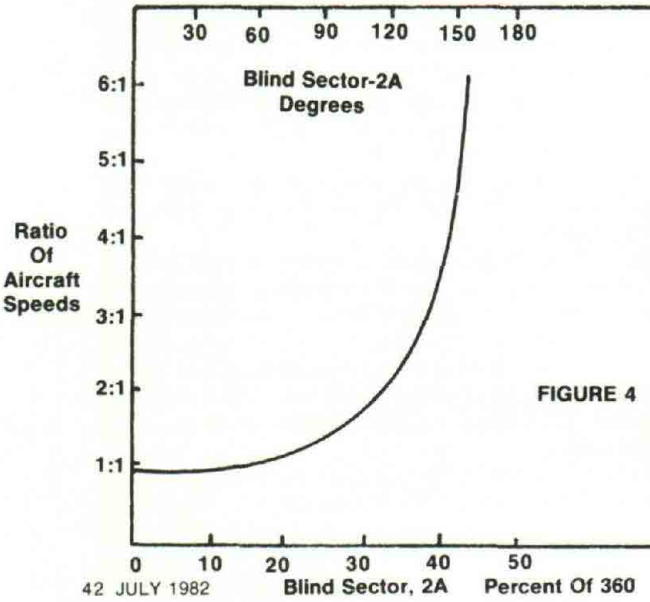

FIGURE 4