

lies within the swath searched by the surveillance sensors, the monitoring system identifies it 95 per cent of the time), the probability of detection equals  $.125 \times .95$  or  $.119$  — each “look” has approximately a 12 per cent chance of detecting the violation.

*(2) The number of “looks”*

The number of “looks” taken by the surveillance system depends upon the interval length and the “look” rate:

$$L = t \times r$$

where  $L$  = number of “looks;”  
 $t$  = interval length;  
 $r$  = “look” rate per unit time.

For example, assume that the surveillance system searches a swath of the coverage area three times daily. Further assume that the interval length is 10 days. The number of “looks” taken by the system in 10 days, then, is 30.

The variables of the model have now been defined. The probability of detecting a violation at least once<sup>13</sup> for a given interval can be calculated using the binomial probability distribution:<sup>14</sup>

$$p(D) = 1 - [1 - p(d)]^L$$

where  $p(D)$  = probability of detection at least once.

Returning to the example, the probability of detection for each “look” was  $.119$  and 30 “looks” were taken over a 10-day period. Therefore, the probability of at least one detection of the target is  $.9777$ . That is, there is a 98 per cent chance that the violation will be detected within the 10-day period.<sup>15</sup>

### Analysis

Before proceeding with the analysis, it must be emphasized that the overall detection probability estimates presented here are illustrative only. The model from which these estimates are derived is a simplification of reality and, consequently, cannot capture all the operational factors that bear upon this reality. Hence, the estimates are, at best, reflective of actual detection probabilities. Nevertheless, the following analysis highlights the relationship of key variables in the verification problem to the likelihood of detection. It is the exploration of these relationships rather than the precise estimation of detection probabilities that recommends the binomial model when examining the verification problem.