What is the availability of an unattended system?

The key contributors to the unavailability of an engineering system (not being able to remain operational and meeting operational objective) are, generally:

1.Unrevealed failure: when a standby system fails and becomes unavailable without being noticed by other systems or operators until a test on the system is made or the system is required to function.
2.Testing or preventive maintenance: when a system is removed from operations because it has to be tested or undergo preventive maintenance.
3.Repair: when a system is taken off-line for repair.

An unattended system will function until its first failure and remains unavailable after that, since repairs have not been carried out or the failure is undetected and no repair signal has been generated. Hence, the probability $q(t)$ that at time t the system is not functioning is equal to the probability that it failed before t; that is, the cumulative failure probability $F(t)$. Thus, the instantaneous unavailability of the system is equal to the cumulative distribution function of failure times:
$q(t) = F(t)$

and the system availability is equal to its reliability $R(t)$:

$p(t) = 1 – q(t) = R (t)$

The calculation of the unavailability of a cold standby system is different from that of a hot standby system because the former is a configuration in which the standby system is not subject to failure until it is switched on (assuming perfect switching), while the latter has a finite probability that it may fail while in standby.

The unavailability of a continuously monitored system and the unavailability of a system under periodic testing and maintenance would also be different from that of a standby system.

The Safety Corner is contributed by Ir Dr Vincent Ho, who can be contacted at vsho.hkarms@gmail.com.