In this first of four articles, Lieutenant-Colonel Rick Barker dispels some common misconceptions about CBRN Defence

Myths and Misses

The Winds of Change

Having entered the CBRN business six years ago after 29 years of diversified military assignments, I have noticed a number of widely held beliefs that prior experience tells me are off-target. This and subsequent articles will examine a number of misconceptions and offer suggestions to contribute to the efficiency of CBRN defence.

Perhaps the most common and potentially dangerous ‘miss’ that I encounter is hearing someone say that they will place their sensors upwind of the protected area. The problem here is that they base ‘upwind’ on the prevailing winds of the region in question. Prevailing winds are useful for orienting runways and deciding which side of your house to plant trees on, but of much less utility when establishing CBRN protection.

Thanks to such factors as the rotation of the earth and the temperature difference between the equator and the poles, high-altitude winds in the northern hemisphere tend to be northwesterly. Due to friction between these winds and the earth’s surface, winds at and near ground level tend to follow suit. Sure enough, most runways are aligned

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along headings from westerly to northwesterly.

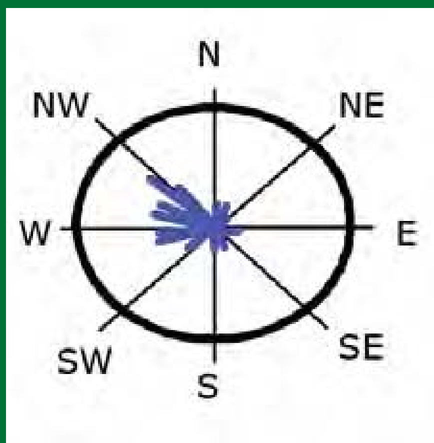
Of course, a runway that faces west also faces east and while aircraft might most often land on a westerly heading, when bad weather approaches, the associated frontal passage often causes the surface wind to swing to the east, forcing a 180 degree turnabout for landing and departing aircraft.

The dusk to dawn hours normally bring a cooling effect to the layer of air closest to the surface, particularly when a clear sky allows radiation cooling. Because of this inversion (the air at ground level is cooler than that above), air at the surface does not rise and mix with air and winds at higher levels and does not 'borrow' their kinetic energy. The result is that winds in the hours of twilight and darkness are often light and variable, meaning that they are below 5 mph (8 km/h) and subject to frequent directional changes.

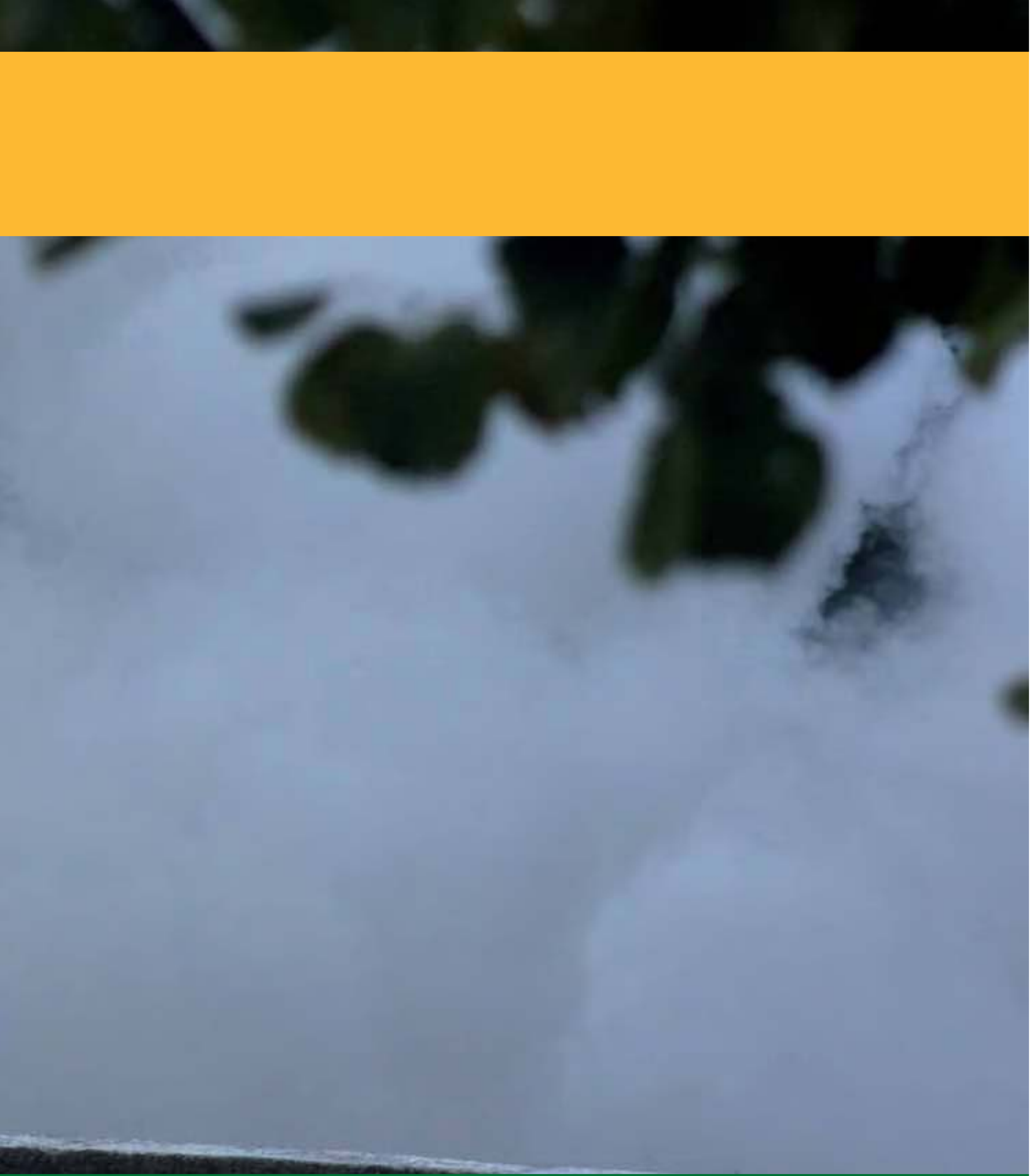
Cloud cover, surface heating, proximity of bodies of water, frontal passages and other factors can also affect the direction and magnitude of surface winds. The figure right is a simplified but typical rendition of a *wind rose* that aviation authorities use to plot winds at airports. The longer lines radiating outwards from the centre represent a greater incidence of winds from the direction that they represent. This diagram shows a typical European or North American plot with a predominance of westerly and northwesterly winds, but also a significant occurrence of winds from all directions and notably from the east.

The folly of concentrating sensors along the NW-SW arc should be apparent at this point. Similarly, programming standoff sensors to scan primarily in this direction could have unfortunate consequences if they cannot react promptly to a directional change.

If sensors abound, manpower is readily available, and significant changes in wind direction can be noted in real time, then detectors can be moved and standoff sensors can be reprogrammed in response to a directional shift.



Unfortunately, these conditions rarely reflect reality. Biological sensors, in particular, are expensive and thus few in number, and not easily moved. Having a team of workers standing by to rapidly shift sensors around a typical two-mile (3 km) perimeter, over varying terrain, is a luxury that few can afford. Changing locations also requires reconnections to the sensor



network, and calculation and inputting of the new location of each transplanted sensor.

Further, this less-than-ideal solution accommodates only a relatively stable change in wind direction. When winds are light and variable, changes could be continuous over many hours and reaction would be next to impossible. The good news is that conditions of light winds would allow for more warning before the release reaches the protected area.

The bad news is that the only apparent solution to all situations is to field more sensors, providing complete 360-degree coverage. This is not financially attractive but is better than having to explain why an already expensive protective system was not able to provide warning when it was needed.

Standoff detectors would normally be fixed in central, protected locations and operators would have to adapt their arcs of scan to any new wind direction. Concepts of use for standoff sensors generally have them working in tandem; this allows one sensor to concentrate on an arc corresponding to the prevailing wind and the other to conduct a continuous 360 degree sweep of the area. In this arrangement, adaptations could be effected with minimal urgency.

This overall situation argues strongly in favour of a system of layered defences: a perimeter array of point detectors, additional fixed sensors within the perimeter to guard against releases that evade the perimeter (as in delivery by indirect fire), and a complementary sub-system of standoff detection.

The last bit of good news is that costs continue to come down as new systems leave the R&D world and find their ways into the marketplace. Biological sensors are cheaper and smaller, and operationally ready standoff detectors will soon be ready for purchase. In the meantime, the myth of the directionally stable prevailing wind is one that planners and defenders should be aware of.