Reduction of risks from ship kites through attention zones

The safety implications of kite-assisted propulsion are examined by Torkell Pettersen Stavdal and Thomas Mestl of Det Norske Veritas.

The desire to cut costs by harnessing wind power may lead to a widespread retrofitting of kites to ships. It is estimated that between 40,000 and 60,000 ships operating on long range routes as well as fishing trawlers could benefit from such an additional propulsion system.

As ship kites are still in their developmental phase their design and operation will still have to undergo optimisation both with respect to physical properties like kite shape, material, and also with respect to optimising kite control. According to SkySails, the various kite concepts work with an operation height between 100m and 500m and with a sail area between 160m² and 5000m². The delivered power can be equalised to a 5000kW engine. Depending on wind direction and ship heading the position of the kite can actually be within 200m or so on either side of the ship.

The vertical position is computer controlled to always obtain high traction for any given wind condition. An automated system launches and retrieves the kite between 10 and 20 minutes for normal operations. A regular kite will sometimes be exposed to weather situations with high turbulence or fall winds plunging the kite down into the sea.

Depending on the kite concept, the length of the cable between ship and kite may be several hundred of metres, and for instance in a concept by Delft University, known as Beauroar, it could be as long as 6000m. The kite will almost certainly be operated by an automated control and retrieval system. It is of utmost importance to prevent the kite(s) from plunging as they could get entangled with their own ship(s), or other nearby vessels or maritime objects such as buoys. An entanglement with a small fishing vessel may even result in its capsizing.

Concerns may therefore be raised by authorities or industry that may slow down the acceptance of this environmental friendly technology.

Currently the greatest challenge is in the kite control systems, as wind does not always blow steadily. Gaps of wind or lulls can often lead to plunging and crushing of the kite.

Traffic risks of kites

The use of kites will introduce new risks, not only to the crew when handling the new equipment but also to the ship itself as well as the nearby maritime traffic. The table lists some of the traffic risk associated with kites.

These risks may not only occur in situations where the kite has crashed into the water but may even be present under normal kite operation. For instance, at night or in foggy situations with reduced visibility there is indeed the possibility that helicopters, for example, on their way to or from offshore oil fields could be confronted with high flying kites. Similar risks exist for all low flying air activities such as military or coast guard operations. A meeting with a kite could then lead to catastrophic consequences.

Plunged kite

It might be difficult to guarantee that kites will never plunge - although some concepts even suggest the use of helium filled kites. Nevertheless, a regular kite will sometimes be exposed to weather situations with high turbulence or fall winds plunging the kite down into the sea.

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Attention zones for risk reduction

In a joint industry project between DNV, Kingsberg Maritime and DNV Norcontroll, a so-called 3-dimensional attention zone (3dAZ) concept was developed. It basically places a dynamic and scalable zone around a maritime object that is intended to reflect its risk potential. Objects with a higher risk get assigned a larger zone.

Information about the object is partly drawn from AIS data as well as from other information resources to allow an estimation of the object’s risk potential. The attention zones are then shown on a chart system, such as ECDIS, and thereby direct the attention of the navigator or the VTS controller about a high flying kite who in turn could advise air traffic about this potential obstacle.

The research on the 3D attention zone was partly funded by the Norwegian Research Council, and cooperation has been received from SkySails.

Conclusion

High energy prices will certainly encourage the development of new wind harvesting technologies such as kites. Although these technologies may sometimes bring in new types of risk to maritime traffic, new developments within electronic navigation such as attention zones may mitigate these risks.