UTILISATION OF INTELLIGENT AUTONOMOUS SURFACE VESSEL FOR MARINE APPLICATIONS

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An Autonomous Surface Vessel (ASV) is a type of unmanned robotic platform utilised for the marine environment. Currently, there is a significant increase in the adoption of Maritime Autonomous Systems (MAS), with a range of robotic technologies being adopted in the military, commercial and scientific and research sectors.

While Autonomous Underwater Vehicles (AUVs) have been widely used for many years, an increase in the use of ASVs, particularly for environmental monitoring, is more apparent than ever.

Example of an ASV platform

ASVs are increasingly being used as fundamental data-gathering tools by research institutions and scientists across the globe, allowing further exploration of our waters and greater understanding of our planet. Previously, these explorations seemed to only be noted amongst the scientific community, but highly publicised events, such as the 2010 disastrous oil spill in the Gulf of Mexico from the Deepwater Horizon platform, have drawn focus to the use of robotics in order to combat and measure the environmental damage to the area and its inhabitants.

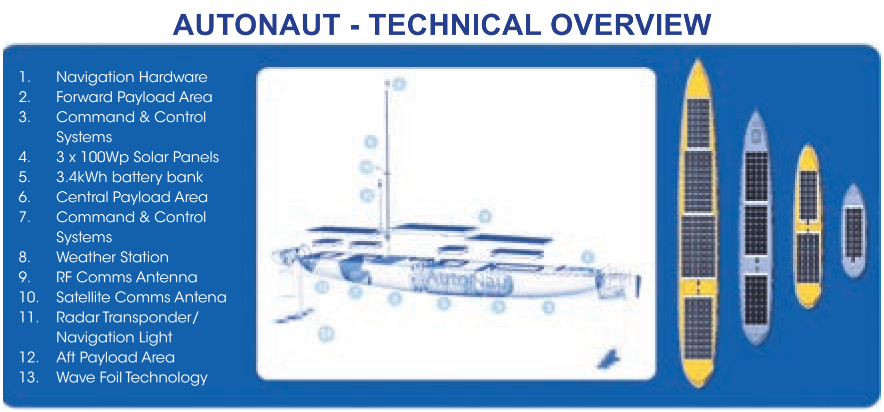
One obvious advantage of using ASVs for environmental monitoring is that they allow examination of events that are too dangerous, time-consuming, repetitive or impossible for humans to undertake. The ability to measure these events with unprecedented distances covered and in quicker timescales, provides crucial efficiency in dealing with large scale environmental disasters and increases our knowledge of the our widely un-investigated oceans.

Unlike traditional manned platforms, ASVs have a very low noise signature. For such environmental monitoring tasks such as Passive Acoustic Monitoring (PAM), it is crucial that the vessel has a low noise signature so as not to skew data gathered, including recording of vocalisation from marine mammals. The other crucial advantage is the reduction of on-site time and maximisation of operational hours. On the whole, this reduces the carbon footprint of the operation and the effects of the mission on the area. Further to this, for small scale operations for data collection, smaller ASVs can be used to reach difficult areas such as caves, harbours and bridges without the need for a support vessel.

It is clear that these maritime autonomous systems – ASVs in particular – provide low impact solutions for marine observations and data collection across a range of environmental monitoring tasks such as water quality monitoring and sample acquisition, marine mammal and aqua culture tracking and current and wave profiling. As technological advances continue to improve, these systems will gain more traction in scientific/research communities, enabling us to achieve greater understanding of the marine environment and its inhabitants and intricacies.[1-3]

SYSTEM CONFIGURATIONS

ASVs can range in complexity but must include four main elements: Body (hull), propulsion system, navigation system and data collection and transmission system. There are no standards regulating ASVs and these differ greatly in appearance and functionality, depending on the production of the unit and its intended function. ASVs are a relatively new technology and have only a brief history. Early ASVs were designed mostly for educational use. Further advancement of ASVs has been due to the rapid progression of technology.



ASV with system modules. (AutoNaut - http://www.autonautusv.com/)[4]

The ASV system is also characterised by such features as:

1. Openess: One of the main problems is integration of the many services and technologies. It has been achieved due to the application of open architecture based upon high-tech, but verified solutions. This means the ASV can be reconfigured for different applications.
2. Portability: The system works on a variety of hardware platforms, a container with command and control post as well as on training sites. The ASV platform should be portable and can easily be transferred to another location if required.
3. Scalability: The system should be operational as a single agent application and in team formation or in multi-agent applications.
4. Modularity: Bearing in mind the multitude of goals, it is necessary to provide an open-ended internal architecture of the system to ensure the possibility of multiple applications of its key elements together with easy replacement of different elements with their alternatives.

There is a great amount of potential in using ASVs to benefit our environment. For example, ASVs can be applied to environmental monitoring tasks, which encompass different types of data collection and observation. There are other data collection methods, including satellite systems and networks of stationary and floating buoys used today by scientists and researchers; however there are limitations to these systems, such as the range of buoy networks and the accuracy and cost of satellite systems. In both areas, ASVs can offer a solution or contribute as an additional resource to collecting ocean data. Many more aspects of environmental monitoring, such as mapping oil spills, have been explored to show how ASV technology can help the environment.

ASVs can also perform tasks in the ocean, such as gathering and delivering water samples or cleaning up ocean contaminants. Current methods of sample collection and cleaning hazardous spills are costly, time consuming and require a lot of manpower.

The application of ASVs in environmental monitoring and task performance areas can lower human and animal vulnerability to certain environmental issues. In the area of weather for example, an ASV may be able to collect new ocean data that will contribute to storm forecasting systems. As more accurate data is fed into weather models, it will produce more accurate outputs. By contributing data to these models, ASVs can improve the accuracy of storm predictions. The improved accuracy may be used to provide more attention to help areas at higher risk of damage from these environmental events and will allow for staging directors to more effectively plan the movement and distribution of supplies and resources during and after the disaster. ASVs also show promise in helping efforts to study current climate change. ASVs can collect oceanic data to help produce models of important currents that transfer warmth around the globe.

Another alternative is to utilise an unmanned ASV as a hub for multiple measurements. It can provide typical weather station information, i.e. metocean data, provided that necessary sensors are installed onboard. Additionally it can conduct the underwater measurement e.g. seawater temperature by lowering a measurement probe e.g. CTD attached to steel cable and electrically controlled winch. Measurement data can be sent via radio telemetry or satellite for quick access. It is also possible to deploy multiple ASVs to cover a bigger area. Since ASVs are operated autonomously, very little operator intervention is required, thus reducing manpower cost. The availability of GPS enables the ASV to operate within desired locations with ease. All these commercially and widely used technologies make unmanned ASVs more economical compared to other robotics platforms such as ROV and AUV.

CONCLUSION

The utilisation of ASVs for marine applications is gaining real momentum. The significant amount of cost savings, in terms of time and operational expenditure, has boosted the importance of ASVs in many marine applications, be it near shore or open sea deployment.

The adding of intelligent capability to ASVs will certainly assist in on-site decision making and better quality data gathering activities. Future extensions of ASV-like functions such as unmanned tankers and servicing ships, are being developed by a number of companies around the world. It is envisaged that in the future, ASVs will be utilised extensively for even more marine activities.

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