



## Why MOSIS?

MOSIS is a unique system for carrying out stability tests without taking a vessel out of service. It differs from a traditional inshore inclining experiment in that it is carried out on a more regular basis and monitors and tracks a vessel's vertical centre of gravity ("VCG") over time allowing action to be taken to prevent small issues from growing. It has proven HSE and cost benefits as well as alignment with commercial and operational goals. There is, to our knowledge, no other proven and accepted system in operation.

### In short, MOSIS can offer...

#### Benefits to owner/client

- Increased and more accurate tracking of the vessel VCG and weight characteristics including the potential to identify any changes that are unaccounted for.
- Actual VCG estimate determined (instead of a penalty VCG as prescribed by the rules for certain vessels).
- More accurate cargo capacity figure for commercial and marketing purposes.
- Accurate compliance with the rules instead of what is often a best guess that gets worse over time.
- Forms part of the vessel planned maintenance system and any discrepancies are identified and dealt with early.

#### Benefits to Flag State and Class Society

- Consistent monitoring of the vessel VCG and its lightship condition.
- Continuous tracking of any lightship additions or inaccurate recording of deadweight additions.
- The vessel is operating with an accurate VCG, not the VCG that was estimated many years before at an inclining that may or may not have been accurate.
- It could also be that the lightweight may not have changed but equipment was added and removed which resulted in the same weight, but not necessarily the correct centre of gravity.

## The Economics

In the current economic climate, the ability of a vessel to continue earning revenue instead of incurring the cost of mobilising to a sheltered port for a traditional inclining is a major cost-benefit. But that is only a part of the discussion. Knowledge of actual VCG impacts different vessels in different ways.

An accurate vessel VCG is required for both the performance and safety of a vessel. Whether it is a statutory requirement because of cumulative changes to a vessel over time, or for operational reasons to ensure the calculated VCG is close to the actual; MOSIS is a cost effective solution to ensure the safety of the crew, cargo and vessel.

For MODUs and floating production units, the cost of coming inshore, off location, is cost-prohibitive but VCG has an impact on their ability to operate. Unidentified weight changes are treated conservatively and reduce their ability to place equipment on deck. Their main issue is statutory compliance and proving to the regulators that their stability is as calculated. The limited choice is a penalty weight or an inclining, all of which have an impact on revenue. MOSIS is an economic solution that resolves statutory requirements, in-service and with no impact on operations.

For conventional vessels, inaccurate VCG calculations are leading to cargo, and even vessel losses. Inaccuracies in VCG often stem from cargo information provided by third parties. There is no way to check this information. The cost of this is rising, whether it is the loss of containers overboard due to incorrect lashings or worse, complete loss of a vessel. And any negative publicity invariably ends up at the door of the vessel owners. MOSIS can help to resolve this issue before any damage occurs by doing a simple stability check before departure. If an issue is identified, it can be resolved in the safety of the port. Without this, the crew only discover there is a problem after the vessel has sailed and it is too late to take any remedial action.

For modern passenger vessels where passengers, crew, stores, laundry, and water move positions regularly, knowledge of VCG allows for better planning both during transit and on arrival in port. Particularly for vessels that run on tight stability margins, the ability to adjust the vessel ballast to get into shallow ports while maintaining a safe margin can be a challenge.

Like passenger vessels, a warship needs accurate knowledge of stability particularly in a damage control situation where the decisions to fight on, run for cover or simply abandon ship are very much based on the damage stability of the vessel. On a multimillion-dollar vessel, informed decision-making saves assets, and most importantly lives.

When stability goes wrong on a vessel, publicity inevitably ends up at the door of the owner and/or the charterer, even if it is due to information supplied by a third party. MOSIS gives control back to the owner and crew, reducing the likelihood of incidents and future claims. It is an operational tool, not an insurance policy, whose sole aim, by ensuring compliance, is to protect revenue and prevent losses.

Contact [info@tymor-marine.com](mailto:info@tymor-marine.com) for a detailed comparison between the cost of MOSIS, a standard inclining if it should be required at any time over a 5-year period, and the cost of repairing damage caused by inaccurate stability calculations.

## A Technical Overview

The two factors which critically affect the stability of a floating vessel are their displacement and their vertical centre of gravity (hydrostatic characteristics). The displacement is straightforward to measure, simply by reading the draft. It is conventionally split into deadweight and lightweight - that is, weight that changes in the short term and weight that remains stable over long periods. The split is determined at design and verified by carrying out a deadweight survey, but the breakdown can be different for different organisations and type of vessel.

The rules are straightforward.

Every year, Class will require a check on the lightweight additions log. Every five years the lightweight may be verified by a check on the vessel's displacement. If this shows a discrepancy greater than 1% between the calculated draft and the actual draft, a deadweight survey should be carried out.

If the lightweight resulting from the deadweight survey shows a difference of greater than 1% in operating displacement for a MODU or 2% lightship change for SOLAS vessels, an inclining should be carried out. Some Class societies recommend an inclining experiment where the total accumulated weight change exceeds 3%.

For some vessels, the weight difference may be included in the calculated lightship, but the 'unknown' weight figure must be placed at an indisputably conservative position on the vessel. Currently, the vessel operator has two commercial choices. They can either take the penalty weight or go inshore for a traditional inclining experiment. Neither of these is particularly attractive. Also, there is no cast-iron guarantee that the results of the traditional inclining will be completely accurate - there are examples where the results were wrong. The cost of re-inclining, however, is usually outweighed by the impact of an incorrect lightship VCG, but with MOSIS, that risk, uncertainty and indeed decision are taken away.

MOSIS provides a third alternative. It allows the vessel operator the opportunity to estimate VCG accurately over time. Statistically, several MOSIS tests will be more accurate than the estimate of lightship VCG from a traditional inclining.

For the vessel owner, there are significant cost savings and operational benefits from utilising MOSIS. From a regulatory perspective, the stability of the vessel is being monitored much more closely and regular use of the system can detect undocumented change so that other comparative techniques can be used to assist in isolating the causes.

## Weight

It is important to understand vessel weight. As noted, a vessel is made up of known and estimated weights with a configuration that varies over time. Although the lightweight is considered a fixed weight, inaccuracies may have been embedded in its value at the 'formal' lightweight. Every inclining test has uncertainty, and the reported result is very unlikely to be the true value.

Tracking of weights on board a vessel can be difficult. However, assuming that a thorough deadweight survey is carried out at or near the time of MOSIS installation, this gives a good baseline to go forward with. It is recommended that a deadweight survey is carried out regularly and if required to resolve an issue identified by MOSIS.

In addition to the deadweight surveys, every MOSIS test includes a weight check because drafts are read and displacement checked against the calculated value. If there is a difference, then it will be obvious - even if it's not that easy to find out where it is.

## VCG

Like displacement, the actual VCG is estimated from each MOSIS test for that particular loaded condition.

There are two checks. The MOSIS estimate of displacement times the MOSIS VCG can be compared with the vessel estimate. Separately, the vessel estimate of the deadweight can be 'backed out' of the overall vessel condition and a longer-term comparative and consistent measure of lightweight and lightweight VCG can be tracked.

These are checks with different, but related purposes - one looks at the overall floating condition of the vessel which is a comparator of the sum of deadweight and lightweight, the other looks at the 'lightweight' as if the deadweight is correct. Taken over time and several tests, it is possible to start to isolate where a discrepancy might be.

The transverse and longitudinal centres of gravity (TCG and LCG) are simply determined from the heel and trim for a given loading condition.

MOSIS uses ballast as a means of getting an angle of around 1 degree. The weight shifted, and the resultant mean angle is used to determine the VCG in exactly the same way as a traditional inclining experiment.

## Conclusions

Whatever vessel MOSIS is installed on, these four critical elements are required for an accurate result are:

1. Accurate draft measurements
2. Accurate tension measurement of any moorings (and risers), where appropriate
3. Accurate content measurement of the tanks used for ballast transfer during the MOSIS tests
4. Accurate recent deadweight survey

With this information and a willing management and crew, MOSIS reduces uncertainty surrounding stability and protects the integrity of your vessel from the day it is installed.

Let's talk about how MOSIS can improve your operational outcomes-

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