Critique of the POP&C Project

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Abstract

This note reveiws the EU POP&C project. It finds that this influential effort is fatally flawed in execution, and more importantly in concept. The results in the opinion of the CTX should not be used in tanker policy making.

Keywords

Tanker Regulation; Oil Spillage; POP&C

1 Introduction

The Pollution Prevention & Control (POP&C) project is a 3 year, 2.2 million euro effort to provide a rational basis for tanker design and regulation. However, much of the effort has focused on a statistical analysis of tanker casualties by hull type. The project has produced at least four papers on this subject. They are largely overlapping, and for our purposes we can focus on the most recent of these reports: Papanikolaou et al, Impact of Hull Design on Tanker Pollution, available from the project web site, www.pop-c.org.

2 Opaque Data

The POP&C papers draws a number of important conclusions from their data base. Yet it is not possible for any third party to examine this data. This is contrary to the most basic principles of scientific inquiry.[1]

This in not just a theoretical problem. One of the project's most surprising findings is that 66% of Non-Accidental Structural Failures are due to "excessive loading". This is completely contrary to the CTX database in which only one structural failure out of 119 is due to excessive loading.[2] It is also completely contrary to my 25 years as a tanker operator. Tanker crews never intentionally over-load a ship, because they know they will be caught by the multitude of cargo surveys. And

[1] By contrast, the the CTX casualty database(CDB) is public and freely available under the GDPL. Any one who wants to can download the entire core data file from www.c4tx.org/ctx/job/cdb/xml/cdb_core.xml. It is in open XML format, so any researcher can ask any question he wants of the data. A http://www.c4tx.org/ctx/pub/cdb_man.pdf is provided to aid in such efforts. Moreover, the sources from which the data was generated are available on the web site in the form of *precis* files. Corrections and additions to the CTX CDB are welcome. They should be sent to cdb@c4tx.org.

The core file does not include permanent ship data. It is designed to be used with any vessel database that is keyed on ship IMO number. Curently researchers must provide their own ship data base. CTX is working to correct this.

[2] See the Energy Concentration. The real cause here was an exhausted Chief Officer who was given an extremely difficult and prolonged discharge sequence by his chartering department.

when they inadvertantly over-load a ship. it is almost always by such a small margin that the over-loading has nil effect on stresses. If this result were true, it would be a bombshell; pointing to the need for new regulations, new training, new paperwork, etc. Strangely the project makes little of this astonishing finding. We need to know why and how they came to such a surprising result.

There are many other conclusions that bear third party examination. For example, I would be interested to see how they split the structural failures between "structural degradation" and "poor design/construction". And blaming 83% of powered grounding on the "squat effect" seems strange to me.[3] Are they saying that the grounding would not have occurred if the ship had been going slower? The CTX CDB groundings do not support this conclusion.

The process of converting incomplete and sometimes conflicting casualty descriptions to a bunch of computer codes, necessarily involves subjective judgement, especially when it comes to assigning causes. This is unavoidable; but what is important is that these judgements be transparent and reviewable.[4]

We need to be able to see the data. Otherwise we don't have scientific inquiry; we have advertorial.[5]

3 Spill Volume Stuff Statistically Insignificant

The problem with oil spill volume from a statistical point of view is that one spill can change just about any total drastically, sometimes by a factor of a thousand or more. Spills have been recorded down to one-third of a liter. The largest tanker spill so far is over 300 million liters, The spill size range is a factor of a billion. Almost all tanker spills are a the very lower end of this range. But almost all the oil that is spilled is spilled in a small handfull of extremely large spills.[6] The POP&C database is no exception. We are told it contains 60 spills, totalling 366,294 tons.[7] Of this total, three spills (Braer (88,214), Prestige (77,000), and Irenes Serenade (80,000) represent 67% of the total.[8] This dependence on a single event means that almost any statement about oil spill volumes is statistically insignificant. This unfortunate fact has not prevented the project from making some strong statements about oil spillage.. These statements are largely embodied in Table 3 of Papanikolaou et al, a portion of which I have reproduced below.

	pre-Marpol	Marpol SH	DB	DS	DH
Total volume	351,186	1,517	4,377	8,851	363

In the POP&C database, almost all the oil (351,000 tons) was spilled by pre-Marpol single hulls. Conversely, Marpol single hulls (1,517 tons) and double hulls (363 tons) spilled very little oil.[9] The authors congratulate themeselves and then reach some strong conclusions.

[3] The project has a penchant for reporting just about everthing in percentages. In statistics, percentages are meaningless without at least some sort of confidence interval.

[4] The CTX database is supported by a set of precis files, one precis file for each casualty. The precis files contain the sources (or links to those sources) on which the data in the core file were based. It also includes the CTX's reasoning (and doubts) in selecting the codes that it did. Ant researcher can inspect the precis files on the web site.

[5] An ancillary big benefit of openness is improvement in the data. I am sure that the CTX CDB would benefit greatly from inclusion of the POP&C data. And I strongly suspect that the reverse is true.

[6] See Tankship Tromedy, Chapter 3 for a more detailed discussion of this issue.

[7] LMIS is very poor at picking up minor spills. We can be sure that between 1978 and 2003, Aframax tankers had far more than 60 spills; but we can also be sure that all the missing spills were very small and would have had nil effect on the total volume.

[8] It the project had not arbitrarily thrown out the Aegean Sea (75,000 tons then four spills would have represented 73%. A great deal of mystery surrounds the Irenes Serenade. Ship was 105,000 tonner and CTX has the spill at 87,000 tons. CTX believes the most likely cause of this killer casualty was corrosion in the forepeak ballast tank, which allowed cargo vapor access to the focsle or foredeck. These vapors were ignited by sparks from the anchor chain being let out. But at this stage this is conjecture.

[9] I assume that almost all the Marpol single hull spillage is the Nagasaki Spirit which CTX has at 1,200 tons. But since we can't look at the data, who knows?

> To the authors' knowledge the data of Table 3 provide for the first time a statistical analysis of the accidental pollution performance off the different tanker hull configurations in operation. As expected, DS [Double Sided] and DB [Double Bottom] are seen to perform better than the SH-non SBT/PL [pre-Marpol] tankers and worse than the DH [Double Hull] tankers. In this respect, their performance justifies the exemptions which were included in the 2003 amendments to MARPOL. What is however surprising is the nearly excellent performance of the SH-SBT/PL [Marpol single hulls] tankers, which incidentally are seen here performing better than the DS and DB fleets. It is worth pondering here whether the regulators would have been so keen to legislate the accelerated phase-out of the SH-SBT/PL tankers had they been aware of these findings.

Given the statistical insignificance of the volume numbers these conclusions are unwarranted. One way of seeing this is by changing the sample slightly. If the project had not arbitrarily thrown out the Aegean Sea, a perfectly good Aframax double hull, then the double hulls would have spilled 75,000 tons in Table 3. And if the project had not arbitrarily focussed on 80,000 to 120,000 tons, then the database would have included the Sea Empress (72,000 tons), the Exxon Valdez (40,000 tons) — not to mention a great deal of other spillage by all types — both of which are Marpol single hulls.[10] The point is that, when your numbers are dependent on a very small sample of extremely large spills, you must make that sample as large as you can; and then still be very careful what you say. We could have a 300,000 ton spill tomorrow, which would completely change the decade totals.

4 Wrong focus

Perhaps the most crippling flaw in the POP&C analysis of tanker spills is its myopic focus on hull type. The Aegean Sea did not run aground because she was a double hull.[11] The Braer did not drift aground because she was a pre-Marpol single hull.[12] The Prestige did not break up because she was a pre-Marpol single hull.[13] The Irenes Serenade did not explode because she was a pre-Marpol single hull.[14] The Nagasaki Spirit did not run into the Ocean Blessing because she was a Marpol single hull.[15] The same thing is true of the Exxon Valdex and Sea Empress, and just about every really big spill that you can name. In short, type of hull has almost nothing to do with big spill volume.

Now it is true that the public at large does not understand this. But that is no reason for people that put themselves forward as tanker experts to pander to this public perception.

5 Confusing Cause and Effect

The POP&C data base divides all casualties into six major categories: collision, contact, grounding, fire, explosion, and the strangely named non-accidental structural failure.[16] The authors try not to use the word "cause" for these categories. And the papers include some cautionary verbiage from time to time. But "233 incidents were caused by collision" is pretty clear, and "initiation of each

[10] If appears that there was some work on Suexmax and VLCC's, but the project for some reason has chosen not to publish these results.

[11] The problem was lack of low speed manuverability. The Aegean Sea ran aground because she was not twin screw.

[12] Poor seamanship allowed loose pipes to roll around on the aft deck, destroying the BFO tank vents, and letting sea water into the bunkers. This error combined with lack of twin screw redundnancy caused the spill.

[13] The ship was converted to SBT without properly protecting the new ballast tanks. Lousy maintenance and lousy oversight by Class resulted in a corroded structure which could not withstand a rather normal Bay of Biscay storm.

[14] Probably corrosion in the forepeak ballast tank. The forepeak ballast tank is the same in all types of hulls.

[15] Piracy left both the Nagasaki Spirit and the Ocean Blessing bridges unmanned. 30 crew were murdered in this little noted masssacre.

[16] The distinction between fire and explosion strikes me as artifical. An explosion is just a rapidly spreading fire. As a result, you will often find a conflagration described as both a "fire" and an "explosion". The important distinction is where the fire started. Tank fire/explosions and engine room fire/explosions almost always have quite different causes. We need to see the data to understand why the authors made this separation.

incident" sounds to me like a long-winded way of saying "cause". In any event, they treat these categories as causes. And they surely knew that users of their work would do the same.

Collision, grounding, fire/explosion are consequences, not causes. Something always happened first. The key question in any casualty is not whether it involved a collision, or a grounding, or fire — many casualties involves combinations of collision, grounding and fire — but what caused these events.[17] Treating something like grounding as a cause is doubly irrational. It shifts regulatory focus away from preventing the grounding in the first place and towards mandating grounding-proof ships, an impossibility. Blaming a spill on grounding is like blaming the earth for an airplane crash.

A practical result of POP&C's confusion of cause and effect is that it totally obscures the importance of machinery failure in tanker spillage. According to the CTX database, machinery failure is the second most important cause (after structural failure) of tanker spillage.[18] If this is true, we should be considering all sorts of way of reducing machinery failure and its consequences, including twin screw. By design, the POP&C project can shed no light on this crucial issue.

If we are truly after rational tanker regulation and design, we need to focus on the real cause. The well-intentioned POP&C project is an unfortunate step backward in this regard.

[17] The CTX database avoids the trap of a single category/cause code. Each casualty is described by a sequence of as many as seven event codes. By fiat, collision, grounding, etc can never be the first event code. If we don't know what caused a casualty, we say so. As the POP&C authors themselves point out, POP&C should have done something similar.

[18] The CTX sample of very large spills is big enough so that this statment is almost statistically significant. A single spill could easily move machinery failure down a notch but it would remain one of the top three causes. Structural failure has such a big lead that its ranking as the number one cause is clearly statistically significant.