Redundant Precision Navigation?

Posted on September 3, 2010

Originated from Val Schmidt (UNH) on Sep 3, 2010

I was wondering if there were chronic failures in the fleet of if there was a sense that running dual systems simultaneously might provide some incremental benefit. But what I've come to understand is that it's a matter of spares really - saving the cost of a many-million-dollar cruise in the event of a loss of a ~$100k navigation system.

Thanks again,

-Val

Reply from: Rob Hagg (UW) on Fri, 3 Sep 2010

Val,

I feel it depends on the system. I purchased an additional GcGPS system, and the plan was to run both at the same time. The subscription cost would go up by half the cost of running one.

The benefit is that theres two seperate constilations you can get your fixs from. If each receiver if monitoring a seperate constillation it would allow you to 'tie-in' you fixes. This could be useful in setting instruments and junction boxes for the Ocean Observatory work and identifying cable runs etc.

An additional benefit for us is better performance from our DP and less where and tear on the ships propultion systems. I think there is about an order of magnitude difference in accuracy and resolution between the GcGPS and say PCODE. I think one of the the reasons the DP appears to preform better is due to less apparent velocity change in position from the DPs perspective. Some of our DP ops are quite critical, (ROV ops while connecting instruments an other detailed work) So having a spare GcGPS going to the DP with the same resolution could possibly save the day if one receiver goes out as well.

A while back i was working with CNav to see if we 'UNOLS' could get a group discount and have an option for a 'hot spare' replacement similar to the Phoenix program at RDI. They were receptive to both ideas and gave us a reasonable discount on the purchase of a new receiver to replace on that failed.

My feeling is that all the boats doing survey work, multibeam or

seismic should be running GcGPS systems.

Thats my take on it anyway.

Hope this helps.

Cheers

Rob

Reply from: Rob Hagg (UW) on Fri, 3 Sep 2010

Oh.. I seem to recall our latest C-Nav System was around $8k +10k a year for the service.

One other thing you get with the GcGPS system is RTCM which is easily feed to a POS/MV allowing for better accuracy and stability from it.

The new C-Nav can track US and other Satillites.

Cheers
Rob

Reply From: Dale Chayes (LDEO) on Fri, 3 Sep 2010

In thinking about Vals' question I realized that the sense of "redundant" wasn't totally clear to me.

I tend to think about these kinds of things along two lines: function and value.

In the "function" sense, I think about:

Cold spares:

Parts (or whole systems) in a box on a shelf but configured, up to date, and on the ship. e.g. they aren't turned on, and perhaps not even in the same space as the primary, but they are ready to go. In the event of a localized catastrophe (e.g. small fire, serious power problem, lighting strike, etc.) they are not at great risk.

Warm "spares" or "alternates":

On, running, logged, and monitored. Set up in such a way that in some amount of time (that is short compared to the cold spare class above) we can switch to using it as our primary. Risk of loss due to a localized catastrophe is higher than for cold spares.

Hot "fail-over" spare:

On, running, logged, monitored and interfaced in such a way that it can be substituted for the primary

either manually or automatically in a very short amount of time. There are several issues here that have to be addressed to do this well, including but not necessarily limited to:
- two identical units (say GNSS receivers) risks include both exhibiting the same unexpected behavior, benefits include reduced cognitive load on the part of support and operations folks. If for instance you have a pair of independent GNSS receivers, you only have one set of manuals, procedures, interfaces, data formats, and UIs. If you have two different units, you double that.?
- how to implement the transfer: manually or automatically?
- when to switch: based in part on how long you can safely sustain bad input down stream?
- do you need a third source in order to avoid a deadlock decision?
Clearly this can get very complex and very expensive rapidly so it's hard to justify for all ships all the time.

Each of these three classes entails increasing cost, increasing complexity (and the attendant increase in potential sources of miss-behaivor) so one needs to think carefully about how to justify the increasing cost.

Some cases that might be worth evaluating depending on the actual operation include things like:
- if this system does not work right do we cancel the cruise?
- what is the risk of fouling an ROV (say in a mooring that it servicing) or breaking a drill pipe (in the case of DP drilling) if we can't hold position due to a nav input failure? Are there personnel/safety risks associated with such a failure?
- how much time does it take to turn around an re-do the missing piece of data (MCS, SCS, mutltibeam, etc.)?

Food for thought and discussion,
-Dale