Requirements Ever Increasing for

Hydrographer Skill Set

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Anyone who has ever been directly involved in the collection of bathymetric data knows that good hydrographers have an impressive skill set. On a smaller survey vessel, this skill set quite often includes a basic working knowledge across such disciplines as navigation, geodesy, acoustics, computer operating systems, electronics, data telemetry, meteorology, small engine repair, electrical systems and small boat handling. As the capabilities and features of sonars, positioning and motion reference systems continue to increase, so too must the hydrographer's skills increase. Perhaps more importantly, as the capabilities, and hence performance expectations, of these systems are continually stacked higher and higher, the hydrographer's base of knowledge must be ever more broad. While it is possible to achieve such a base of comprehension through extensive field experience, erudition in the disciplines of surveying principles and measurement sciences is a tremendous place to start and forms the most solid base from which to build on the "knowledge pyramid".

As wonderful underwater images obtained by acoustic means become more and more common within trade journals and at manufacturer web sites around the world, more is demanded of the "average hydrographer" by end users of the data sets obtained.

The current surge in equipment capabilities and data demands can be directly correlated to the advancements in computer processing power and, perhaps more specifically, advancing capabilities in the manipulation of three dimensional data sets within advanced software packages.

Sonar system manufacturers have responded to the ability to process extremely large data sets with what seems to be an ever-growing list of system capabilities in the multibeam, scanning and interferometric sonar systems they produce. As the sheer volume of point cloud data collected continues to increase, so too does metadata such as return intensity, water column and backscatter data.

As hardware capabilities increase, and as a natural extension of computer processing capabilities, so too do software capabilities. As software capabilities increase, data end users look closer and

The author training the Tunisian Navy, Bizerta, Tunisia.

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closer at their data sets and the metadata available. The closer they look, the more they see and the more they want! That in turn fuels manufacturers and software developers in the development of the next feature release or upgrade and thus the cycle continues to gain critical mass, becoming ever larger and larger.

Successful system operation can be defined as obtaining geospatially accurate data on a repeatable basis with a realistic summation and reporting of the quality and analysis of the data and metadata extracted. With the more complex systems, a hydrographer's skill set must be more than just a basic working knowledge as mentioned above. Successfully using higher end sonar and positioning systems requires knowledge of advanced positioning techniques, inertial guidance systems and error propagation, etc. Contrary to the shiny brochures, the equipment components that comprise an advanced sonar imaging or mapping system are not typically "plug-and-play".

High end sonar systems are comprised of a number of components – the sonar itself, positioning hardware (typically GNSS), an inertial motion reference unit (MRU), an advanced computer with data collection software, etc., each performing a specific task and often capable of operating in a number of modes. Each of these components is available through a number of quality manufacturers resulting in a sometimes overwhelming system components matrix. Obtaining a single technician or field engineer that fully understands the requirements and nuances of all the hardware combinations available in providing a full system is a rare find.

Manufacturers of high end hardware as discussed above typically offer training on the hardware and/or software they provide. However, such training is often "one-dimensional" in that the field engineer, while thorough and highly competent in the training provided on the equipment supplied by the manufacturer he or she represents, does not necessarily have the same level of competence in the other ancillary hardware comprising the complete system. This is not meant to belittle the average manufacturer field engineer. The fiscal reality is, that an engineer employed by Manufacturer X does not typically have the time or resources to stay abreast and efficient in the equipment offerings of Manufacturers Y and Z.

In theory, one could receive manufacturer training for each component within the total system and be fully competent in the system as a whole. However in practice, this is not usually the case for the average hydrographer or field technician receiving typical "operator training" on a piece-wise level.

Herein is the sometimes subtle difference between training and education, as defined below (Webster's Unabridged Dictionary):

• **Training** — to make proficient by instruction and practice, as in some art, profession, or work…

• **Education** — the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment.

It is certainly possible that a person without formal education could receive training at the "component level" and, from there, assemble and operate a complete system in a competent fashion. However, personal observation has shown that a person educated in the disciplines of geodesy, positioning and inertial navigation, error propagation, etc. (all subject matter enveloped in the discipline now known as "Geomatics") has the greatest odds of overcoming the "learning curve", in the least amount of time, with high end sonar imaging systems. This expediency is of note when considering the costs of the systems under discussion here lending credence to the dictum, "time is money". Individual equipment components have to be integrated into a system, producing accurate, valid and repeatable results in a minimum of time.

UF Geomatics Students onboard SV Florida, USACE Jacksonville.

There are a number of universities offering courses of study in the geomatic sciences. The graduates of these programs have mastered the fundamentals of their chosen course of study and as such are able to apply the powers of reasoning and judgment that their education has afforded them. They are able to assemble advanced systems from the component level, incorporate manufacturer training into the proficient operation of the system and, most importantly, analyze the accuracy and adequacy of data collected providing the all-important measure of quality assurance and quality control. With the high costs of high end sonar systems and operating vessels offshore, getting the job done right, the first time, every time is of the utmost importance.

Federal agencies and larger contracting firms have been operating complex integrated sonar imaging and mapping systems for a number of years. Many have long realized the value of hiring personnel with a strong geomatics background and have focused their recruiting efforts at specific university programs. They have reaped the benefits of their targeted hiring programs accordingly.

As with most technologies, the cost of ownership for the systems referred to herein, though still relatively high, are decreasing and becoming affordable to a larger group of end users. As the number of systems within the industry increases, the percentage of qualified operators is decreasing and regardless of what the

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brochures imply, our world is not all "plug-and-play".

In support of advanced system operation and personnel acquisition efforts, prudent managers embracing these advanced systems for the first time should be contacting geomatics programs to initiate recruiting efforts. Along the same lines, with the world-wide economic down turn we're experiencing now and its effect on new construction (and therefore traditional "terrestrial surveying"), geomatics students should be approaching potential employers in the hydrographic survey world as well. As they begin to get their feet wet offshore, the benefits of their education will pay dividends to both themselves and their employer.

This article should not be construed to infer that the only persons capable of assembling and operating high end sonar systems need be university graduates. Nor is it meant to slight component level training offered by manufacturers. Indeed, the young college graduate has as much to gain from this type of training (as well as industry conferences and seminars, continuing education and hands-on experience) as does the "brought up from the deck plates" field technician and hydrographer. My point is that advanced sonar systems are a major financial investment. The purchase of such a system should be considered only the front end of the investment. Extensive training should also be budgeted for. Spend that money wisely and train the right people. In my experience, the quickest return on this training investment comes from providing manufacturer component level training to those with a broad based, thorough understanding of surveying and mapping principles as offered in a consummate education in geomatics. When those educated persons, trained in the specifics of the equipment they operate become proficient in the use of their advanced system(s), successful system operation is achieved in the quickest fashion and invariably maintained through time.

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