

## **Chapter 22**

### **Contracted Survey Specifications And Cost Estimates**

#### **22-1. General**

This chapter describes the process for contracting hydrographic survey services. It covers development of survey scopes of work, performance specifications, and cost estimates for both fixed price A-E or construction contracts; and task orders under indefinite delivery contracts.

*a.* Procedures for developing hydrographic survey contract specifications and cost estimates are performed similarly to those for A-E design services. Similar technical discipline scheduling and production factors are used to determine the ultimate cost of a task.

*b.* Although this chapter is intended to provide guidance for estimating costs for hydrographic surveying services, the explanations herein regarding procurement policies and practices describe only the framework within which cost estimates are used. For detailed guidance on procurement policies and practices, refer to the appropriate procurement regulations: FAR, DFARS, EFARS, EP 715-1-7 (A-E Contracting), and the PROSPECT course on A-E contracting.

#### **22-2. Background**

Prior to World War II, in-house forces primarily performed design and related surveying support services in the Department of Defense. In 1939, legislation was enacted which created an expanded military construction program and authorized contracting of A-E services. Surveying and mapping services are considered a subset of A-E services. This initial contract work for military design/construction spilled over into the Corps civil works programs after the war--for similar planning, design, and surveying services. Contracting for surveying services began to expand in the late 1950's and early 1960's--especially during the space program build-up. Hydrographic surveying was one of the last Corps field survey data acquisition functions to be contracted--mostly beginning in the 1970's. Prior to the 1970's, the Corps employed well over 200 in-house hydrographic survey crews, mostly using manual tagline/leadline survey methods. In the 1960's and 1970's, administrative and political pressures mandated an increase in outsourced services, including transfer of construction quality control functions to contractors--e.g., dredging progress payment surveys. As of 1999, approximately 40% of all the Corps hydrographic work is contracted--either directly using A-E contracts or indirectly under construction contracts. The expanded use of A-E firms and dredging contractors to perform hydrographic surveying has many positive elements. These firms not only supplement the Corps declining in-house capabilities but also provide specialized expertise in technical areas not routinely performed by the Corps, or in areas the Corps has not maintained the latest technology. Most importantly, however, these firms represent a nationwide service base for use in a national emergency. This asset was clearly evident during the Great Flood of 1993 in the Upper Mississippi & Missouri Basin. During this high-water build up, many private hydrographic contractors were mobilized by the Corps to locate and map levee breaches and backwater flooding limits with multibeam survey equipment.

#### **22-3. Brooks Architect-Engineer Act**

In the Federal government, professional architectural, engineering, planning, and related surveying services must be procured under the Brooks Architect-Engineer Act, Public Law 92-582 (10 U.S. Code 541-544). The Brooks A-E Act requires the public announcement of requirements for surveying services, and selection of the most highly qualified firms based on demonstrated competence and professional qualifications. Cost or

pricing is not considered during the selection process. After selection, negotiation of a fair and reasonable price for the work is conducted with the highest qualified firm. Hydrographic surveying supporting the Corps' research, planning, development, design, construction, or alteration of real property is considered to be a related or supporting architectural or engineering service, and must therefore be procured using Brooks A-E Act qualifications-based selection, not by bid price competition. In each year, the Corps procures about \$750 million in professional services using the Brooks A-E Act. The Corps typically awards over 500 A-E contracts each year, and under these contracts, some 5,000 separate projects (i.e., task orders) are negotiated and performed. About 500-750 of these orders are for surveying and mapping services. A significant amount of additional surveying work is normally included by subcontract under architectural and engineering task orders for the design of specific projects. In addition, each of some 250 dredging contracts awarded annually contains requirements for the construction contractor to perform various hydrographic surveying services during the construction execution. These services are not obtained using Brooks A-E Act procedures but are normally included in the construction unit price. Occasionally, construction hydrographic surveying services are bid as separate line items.

#### **22-4. Types of Contracted Hydrographic Survey Projects**

*a. Navigation project condition surveys.* Project condition surveys are by far the most prevalent hydrographic operation performed by contract. Condition surveys are performed to assess the status of the Corps 12,000 miles of maintained navigation channels and some 926 harbors. These surveys are performed at least annually over these projects, or more frequently in high shoaling navigation channels. (In Southwest Pass, LA, condition surveys are performed daily to support almost continuous dredging). Condition survey data is transferred to NOAA charts of coastal areas and Corps charts of the inland navigation system. Contractors now perform a significant amount of these condition surveys since Corps in-house survey forces are primarily dedicated to performing dredging measurement and payment surveys.

*b. Dredge measurement and payment surveys.* Due to declining in-house survey capacity, contractors are increasingly being called upon to perform contract payment surveys for dredging operations. Given the potential for conflicts of interest, and commonly occurring disputes over payment survey adequacy or accuracy, use of contracted forces for official Government payment surveys requires increased surveillance. This process is discussed in more detail in a later section.

*c. Water control sections.* The Corps flood control and water control responsibilities along most of the nation's river systems entails extensive hydrographic, overbank, and flood plain surveys. Much of this work is accomplished through contract. Contractors are required to develop hydrographic river sections at locations consistent with hydraulic prediction model requirements--e.g., HEC. Often this hydrographic data is merged with upland (overbank) surveys atop levees and topographic/photogrammetric surveys out into the flood plain for inundation studies. Usually the contractor is required to obtain numerous other field data for use in hydraulic and economic damage models (e.g., sediment, land cover/use, first-floor elevations).

*d. Beach renourishment/hurricane protection surveys.* Most Corps beach surveys (for renourishment and/or hurricane protection purposes) are performed by contractors. These surveys involve both hydrographic and topographic sections of the beach--before, during, and post construction--and the offshore borrow area.

*e. Levee/revetment construction.* Contracted hydrographic surveyors are frequently assigned to support on-going marine construction work. A contract survey crew is assigned to provide full-time support to a Corps field area/project office during construction. Typical projects where hydrographic support is needed throughout construction includes levee, jetty, breakwater, dike, weir, or bulkhead construction. For example, along the lower Mississippi River, contracted survey forces are assigned full-time to position Corps-

owned sinking plant used to place articulated concrete mats along the revetments. (Note: Support services during construction used to be called "Title II Services" but are now called "Construction Phase Services.")

*f. Structural investigation.* Detailed hydrographic surveys are often required to assess the underwater condition of bridge piers, navigation locks and dams, hydroelectric plants, etc. Contractors are required to maintain state-of-the-art hydrographic survey equipment to support this work. This may include multibeam systems, diving capabilities, underwater photography, etc.

*g. Archeological and environmental surveys.* Magnetometer and related geophysical surveys are often required to ensure that underwater artifacts are located prior to construction. Environmental impact studies and surveys often require extensive hydrographic survey support. The Corps contracts most of this work.

## **22-5. Contracting Processes and Procedures**

Corps procedures for obtaining A-E services are based on a variety of Federal and DOD acquisition regulations. The following paragraphs synopsise the overall A-E process used in the Corps.

*a. Types of contracts.* Two types of A-E contracts are principally used for hydrographic surveying services: Firm-Fixed-Price (FFP) contracts and Indefinite Delivery contracts (IDC). FFP contracts are used for moderate to large mapping projects (e.g., > \$1 million) where the scope of work is known prior to advertisement and can be accurately defined during negotiations--typically for a large new project site. Due to variable channel shoaling and changing engineering and construction schedules (and funding), most mapping work in the Corps cannot be accurately defined in advance; thus, these fixed-scope FFP contracts are rarely used, and well over 95% of surveying services are procured using IDC.

*b. Announcements for hydrographic surveying services.* Requirements for surveying services are publicly announced and firms are given at least 30 days to respond to the announcement. The public announcement contains a brief description of the project, the scope of the required services, the selection criteria in order of importance, submission instructions, and a point-of-contact. This public announcement is not a request for price proposals and firms are directed not to submit any price-related information.

*c. Selection criteria.* Federal and DOD regulations set the criteria for evaluating prospective surveying contractors as listed below. These criteria are listed in the public announcement in their order of importance and the selection process assigns descending weights to each item in that order. (The order listed below may be modified based on specific project requirements.)

- (1) Professional qualifications necessary for satisfactory performance.
- (2) Specialized experience and technical competence in the type of work required.
- (3) Past performance on contracts with Government agencies and private industry in terms of cost control, quality of work, and compliance with performance schedules.
- (4) Capacity to perform the work in the required time.
- (5) Location in the general geographical area of the project and knowledge of the locality of the project.
- (6) Volume of work awarded by the Department of Defense in the past 12 months.

(7) Superior performance evaluations on recently awarded DOD contracts.

(8) Utilization of small or disadvantaged businesses.

*d. Selection process.* The evaluation of firms is conducted by a formally constituted Selection Board in the Corps district seeking the services. This board is made up of highly qualified professional employees having experience in architecture, engineering, surveying, etc. A majority of the board members for surveying services must have specific technical expertise in that area. At least one member must be a licensed surveyor. The board evaluates each of the firm's qualifications based on the advertised selection criteria and develops a list of at least three most highly qualified firms. As part of the evaluation process, the board conducts interviews with these top firms prior to ranking them. The firms are asked questions about their experience, capabilities, organization, equipment, quality management procedures, and approach to the project. These interviews are normally conducted by telephone. The top three (or more) firms are ranked and the selection is approved by the designated selection authority--typically the District Commander. The top ranked firms are notified they are under consideration for the contract. Unsuccessful firms are also notified, and are afforded a debriefing as to why they were not selected, if they so request.

*e. Negotiations and award.* The highest qualified firm ranked by the selection board is provided with a detailed scope of work for the project, project information, and other related technical criteria, and is requested to submit a detailed price proposal for performing the work. In the case of IDC, price proposals consist simply of unit rates for various disciplines, services, and equipment. This list becomes the contract "Schedule B" of prices, and typically each line item of services contains all overheads, profits, and incidental supplies. Once a fair and reasonable price (to the government) is negotiated, the contract is awarded. The Government Contracting Officer is obligated to strive to obtain a negotiated price that is "fair and reasonable" to both the Government and the contractor.

## **22-6. Indefinite Delivery Order Contracts**

The vast majority of the Corps hydrographic surveying services are procured using IDCs. These IDCs are procured using the selection and negotiation process described above. IDC (once termed "Open-End" or "Delivery Order" contracts) have only a general scope of work--e.g., "Hydrographic surveying services in Southeastern United States." When work arises during the term of the contract, task orders are written for performing that specific work. In the Corps, IDCs are typically issued for \$1 million with two additional \$1 million option term (not year) extensions -- for a total award of \$3 million. Task orders may be issued up to \$1 million each. Larger IDC awards are often made, both in overall award size and task order limit. Task orders are negotiated using the unit rate "Schedule B" developed for the main contract. Thus, negotiations are focused on the level of effort and performance period. Task orders typically have short scopes of work--a few pages. The scope is sent to a contractor who responds with a time and cost estimate, from which negotiations are initiated. Under emergency conditions (e.g., flood fights, hurricanes) contractors can be issued task orders verbally by the Contracting Officer, with the scope of work simply defined as a limiting number of days for the hydrographic survey crew at the contract schedule rate. The entire process--from survey need to task order award--should routinely take only 2 to 4 weeks. From the IDC Schedule B, a hydrographic survey crew and equipment is pieced together using the various line items--adding or deducting personnel or equipment as needed for a particular project.

## 22-7. Contracted Construction Measurement and Payment Surveys

*a.* Fixed-price construction contracts containing unit pricing of items are usually paid based on quantity surveys of material placed or removed. These construction contracts require full-time hydrographic survey support, using either in-house or contracted survey crews (A-E or construction contractor). Typical projects include navigation project dredging, beach renourishment, rock/stone placement, canal/levee construction, revetment construction, etc. On most projects, these quantity survey measurements are performed by in-house Corps forces; however, over the past 15 years, there has been an increasing trend to contract out these payment surveys. Often there are insufficient Corps survey personnel to cover surveying requirements for many on-going construction and dredging contracts. Many contracts (e.g., beach renourishment and revetment construction) require full-time survey capability throughout the construction season; thus, it is usually more efficient to contract this effort.

*b.* When necessary, either independent A-E contractors or construction contractor survey forces may be used in lieu of Corps surveyors. When contracting dredge payment surveys, the following Corps policy is prescribed by Engineer Regulation (ER) 1130-2-520, "Navigation and Dredging Operations and Maintenance Policies," 1996:

"Hydrographic Surveys (For Dredging Projects) ... It is the general policy of the Corps of Engineers that hydrographic surveys for payment purposes be performed by Government equipment and personnel. The method of performance of hydrographic quantity surveys (in descending order) are as follows:

- (1) The Government will perform quantity surveys by using qualified in-house survey crews, if available;
- (2) The Government will provide quantity surveys by contracting directly with a qualified, independent hydrographic survey contractor;
- (3) The Government will permit, only in exceptional circumstances, the use of the dredging Contractor's surveys if the [Government] Contracting Officer determines that such surveys are adequate and reasonable for payment purposes."

*c.* The above policy outlines a preference for performing surveys with Corps forces. This policy is justified in that payment and project clearance/acceptance is based on these surveys, and any disputes (between the Corps and construction contractor) over survey adequacy or accuracy become difficult to resolve unless the contract agent is fully responsible for the survey data. Reduced manpower is making this ideal situation less common; thus, more reliance is being made on A-E firms and construction contractors.

*d.* The use of construction contractors performing their own payment surveys represents a special case, given the need for quality assurance oversight that must be performed by the Corps when such surveys are performed. Corps policy outlines steps that must be taken when a district elects to use construction contractor forces for hydrographic payment/acceptance surveys:

"Before approving use of [dredge contractor's surveys] ... [Division] commanders should require District commands to provide rationale and justification for proposing to use [dredge contractor's surveys] and to document their [unsuccessful] efforts to obtain contracts with qualified independent [A-E] hydrographic survey firms."

"[When dredge contractors perform their own payment/acceptance surveys, quality assurance] verification shall be accomplished by stationing a qualified Government representative familiar with the hydrographic surveying equipment on board the Contractor's vessel during all surveying operations for payment purposes. The Government representative shall verify that all survey equipment is properly calibrated at all times and that surveying techniques and equipment conform to the contract specifications."

*e.* The above "verification" clause is difficult for the Corps to adhere to--especially finding a "qualified" Corps representative to monitor the surveys in progress. The dredge contractor's surveying personnel are recommended to have the following minimum technical qualifications:

"Qualifications. 33 U.S.C. 2292 requires surveying and mapping services for water resources projects to be procured in accordance with Title IX of the Federal Property and Administrative Service Act of 1949 (The Brooks A-E Act, 40 U.S.C. 541). The subject title requires negotiations of contracts on the basis of demonstrated competence and qualifications for the type of professional services required. This is interpreted as requiring that the Contractor must document at least three years of experience in hydrographic surveying of navigable channels and have either a current land surveyor's or professional engineer's license in the state(s) where the surveys will be performed; or an American Congress on Surveying and Mapping (ACSM) certification as an 'Inshore Certified Hydrographic Surveyor.' The Contractor must provide documentation indicating that modern electronic horizontal positioning and depth finding equipment are available and will be used ... the Contractor must provide ... a safe and suitable vessel meeting U.S. Coast Guard requirements ... and that qualified, experienced staff are available and will be used for the operation of the vessel as well as the electronic positioning and depth finding equipment."

*f.* Few dredge contractors have had any trouble conforming to the above criteria. In most instances, dredge contractors normally have survey forces on the project to perform progress payment surveys, and these same forces can be used for payment and acceptance surveys as well. In some instances, dredge contractors will subcontract their hydrographic survey work. Overall, the vast majority of districts still conduct payment and contract acceptance surveys with their own in-house forces. With declining manpower allocations, there is a definite trend towards contracting an increasing amount of these services. These trends are most noticeable in Alaska and California, and in some districts in the Southeast and Gulf Coasts.

## **22-8. Contract Specifications and Accuracy Standards**

*a.* Contract specifications and standards for Corps hydrographic surveying work should make maximum reference to existing standards, publications, and other references. The primary reference standard is this manual. Drafting and CADD/GIS standards are contained in various (Tri-Service) CADD/GIS Technology Center publications. Corps headquarters does not specify standard hardware or software for its districts--each district may establish their own standards based on their unique requirements. U.S. Government policy prescribes maximum use of industry standards and consensus standards established by private voluntary standards bodies, in lieu of government-developed standards. This policy is further outlined in EM 1110-1-2909, as follows:

"Voluntary industry standards shall be given preference over non-mandatory Government standards. When industry standards are non-existent, inappropriate, or do not meet a project's functional requirement, ...[other] standards may be specified as criteria sources. Specifications for surveying and mapping shall use industry consensus standards established by national professional organizations, such as the American Society for Photogrammetry and Remote Sensing (ASPRS), the American Society of Civil Engineers (ASCE), the American Congress on Surveying and Mapping

(ACSM), or the American Land Title Association (ALTA). Technical standards established by state boards of registration, especially on projects requiring licensed surveyors or mappers, shall be followed when legally applicable. Commands shall not develop or specify local surveying and mapping standards where industry consensus standards or Army standards exist."

*b.* According to Corps policy outlined in EM 1110-1-2909, technical specifications for obtaining hydrographic survey data shall be "performance-based" and not overly prescriptive or process oriented. Performance-based specifications shall be derived from the functional project requirements and use recognized industry standards where available. Performance-oriented (i.e., outcome based) specifications set forth the end results to be achieved (i.e., final drawing/chart format or accuracy standard) and not the means, or technical procedures, used to achieve those results. A performance-oriented specification provides the most flexibility and allows the most economical and efficient methods to achieve the desired end product. Performance specifications should succinctly define the basic mapping limits, feature location and attribute requirements, scale, contour interval, map format, sheet layout, and final data transmittal, archiving or storage requirements, the required accuracy criteria standards for hydrographic and planimetric features that are to be depicted, and describe quality assurance procedures that will be used to verify conformance with the specified criteria. Performance-oriented specifications should be free from unnecessary equipment, personnel, instrumentation, procedural, or material limitations; except as needed to establish comparative cost estimates for negotiated services. This would include any in-progress reviews or approvals during various phases of the project.

*c.* EM 1110-1-2909 also states that use of prescriptive (i.e., procedural) specifications shall be kept to a minimum, and called for only on highly specialized or critical projects where only one prescribed technical method, in the opinion of the Government, is appropriate or practical to perform the work. Overly prescriptive specifications typically require specific field instrumentation (e.g., brand name specific multibeam system), boat sizes, personnel, office technical production procedures (e.g., product-specific software or output format), or rigid project phasing with on-going design or construction. Prescriptive specifications reduce flexibility, efficiency, and risk, and can adversely impact project costs if antiquated survey methods or instrumentation are required.

## **22-9. Contract Statements of Work**

Technical specifications for hydrographic surveying which are specific to the project (including items such as the scope of work, procedural requirements, and accuracy requirements) are inserted in the appropriate section of the contract (e.g., Statement of Work--Section C). Procedural and accuracy requirements are referred to this Engineer Manual, as are any quality control criteria for the total (field-to-finish) execution of a hydrographic survey. This manual should be attached to and made part of any A-E service or construction contract requiring hydrographic surveying. References to USACE survey classifications (and related criteria tables) may also be made if required. References to this manual will normally suffice for most USACE hydrographic survey specifications; however, areas where deviations from (or additions to) this manual must be considered in developing the Statement of Work. Following is a guide for a Statement of Work that may be adopted to either a Firm Fixed Price or IDC contract.

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## Guide Specification for Hydrographic Surveying Services

### STATEMENT OF WORK SECTION C

C.1 GENERAL. THE CONTRACTOR, OPERATING AS AN INDEPENDENT CONTRACTOR AND NOT AN AGENT OF THE GOVERNMENT, SHALL PROVIDE ALL LABOR, MATERIAL, AND EQUIPMENT NECESSARY TO PERFORM THE PROFESSIONAL HYDROGRAPHIC SURVEYING \*[AND MAPPING WORK] \*[FROM TIME TO TIME] DURING THE PERIOD OF SERVICE AS STATED IN SECTION D, IN CONNECTION WITH PERFORMANCE OF \*[\_] SURVEYS \*[AND THE PREPARATION OF SUCH MAPS] AS MAY BE REQUIRED FOR \*[ADVANCE PLANNING,] [DESIGN,] [MAINTENANCE DREDGING,] [DETERMINING PROJECT CONDITION,] [AND CONSTRUCTION] [or other function] [ON VARIOUS PROJECTS] {specify project(s) if applicable}. THE CONTRACTOR SHALL FURNISH THE REQUIRED PERSONNEL, EQUIPMENT, INSTRUMENTS, AND TRANSPORTATION, AS NECESSARY TO ACCOMPLISH THE REQUIRED SERVICES AND FURNISH TO THE GOVERNMENT REPORTS AND OTHER DATA TOGETHER WITH SUPPORTING MATERIAL DEVELOPED DURING THE FIELD DATA ACQUISITION PROCESS. DURING THE PROSECUTION OF THE WORK, THE CONTRACTOR SHALL PROVIDE ADEQUATE PROFESSIONAL SUPERVISION AND QUALITY CONTROL TO ASSURE THE ACCURACY, QUALITY, COMPLETENESS, AND PROGRESS OF THE WORK.

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The above clause is for use on an IDC contract for hydrographic surveying services. It may be used for a fixed-price service contract by deleting appropriate IDC language and adding the specific project survey required. This clause is not repeated on individual Task Orders.  
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#### C.2 LOCATION OF WORK.

A \*[PROJECT CONDITION] [ PLANS AND SPECIFICATIONS] [PREDREDGE] [\_] {specify type}HYDROGRAPHIC SURVEY IS REQUIRED AT [\_] {list project area or areas required}. \* [A GENERAL LOCATION MAP OF THE PROJECT AREA IS AT SECTION G OF THIS CONTRACT.]

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Above location clause is used for Fixed-Price contracts or on IDC Task Orders. Use the following alternate clause when specifying an IDC for hydrographic surveying.  
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HYDROGRAPHIC SURVEYING SERVICES WILL BE PERFORMED IN CONNECTION WITH PROJECTS \*[LOCATED IN] [ASSIGNED TO] THE [\_] DISTRICT. \*[THE \_\_\_\_\_ DISTRICT INCLUDES THE GEOGRAPHICAL REGIONS WITHIN \*[AND COASTAL WATERS] [AND RIVER SYSTEMS] ADJACENT TO:]

\* \_\_\_\_\_  
{list states, regions, etc.}

#### C.3 TECHNICAL CRITERIA AND REFERENCE STANDARDS.

(1) U.S. ARMY CORPS OF ENGINEERS ENGINEER MANUAL EM 1110-2-1003, HYDROGRAPHIC SURVEYING. THIS REFERENCE IS ATTACHED TO AND MADE PART OF THIS CONTRACT. (SEE CONTRACT SECTION G).

(\*\*) {List other applicable reference standards which may be applicable to the project--e.g., (Tri-Service) CADD/GIS Standards}.

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#### C.4 WORK TO BE PERFORMED

SPECIFIC PROCEDURAL, TECHNICAL, AND QUALITY CONTROL REQUIREMENTS FOR HYDROGRAPHIC SURVEYING \*[AND MAPPING SERVICES] TO BE PERFORMED UNDER THIS CONTRACT ARE LISTED IN THE PARAGRAPHS BELOW. UNLESS OTHERWISE INDICATED IN THIS CONTRACT \*[OR IN INDIVIDUAL TASK ORDERS THERETO], EACH REQUIRED SERVICE SHALL INCLUDE FIELD-TO-FINISH EFFORT PERFORMED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS IN EM 1110-2-1003.

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The following technical clauses are added as necessary in either fixed-price contracts, IDC contracts, or included in individual Task Orders under an IDC.

Fixed-Price contracts: Detail specific hydrographic surveying and mapping technical work requirements and performance criteria which are necessary to accomplish the work.

IDC and Task Orders: Since specific project scopes are indefinite at the time a basic IDC contract is prepared, only general technical criteria and standards can be outlined. Project or site-specific criteria will be contained in each Task Order, along with any deviations from technical standards identified in the basic IDC contract.

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C.4.1. GENERAL HYDROGRAPHIC SURVEY REQUIREMENTS.

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For fixed-scope contracts and/or task orders, use the following types of clauses to detail the general work specifications. Terminology would be appropriately modified to cover beach surveys, river sections, disposal area surveys, etc. A general description of the project and any unique purpose of the survey may also be added.

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a. A HYDROGRAPHIC SURVEY OF THE PROJECT INDICATED IN PARAGRAPH C.2 SHALL BE PERFORMED AND PLOTTED AT A \*[PLAN] [SECTION] [PROFILE] SCALE OF 1 INCH = [\_\_\_\_\_] \*(HORIZONTAL) [AND 1 INCH = [\_\_\_\_\_] FEET (VERTICAL)]. SURVEY PROCEDURES, DATA COLLECTION EQUIPMENT, METHODS AND DENSITIES, AND EQUIPMENT CALIBRATION FOR THIS WORK SHALL FOLLOW THE CRITERIA GIVEN IN EM 1110-2-1003 FOR THIS CLASS OF SURVEY. \*[A MAP DETAILING THE WORK SITE IS ATTACHED AT SECTION G OF THIS CONTRACT.] [DREDGING CONSTRUCTION CONTRACT DRAWINGS DEPICTING SECTIONS LIMITS ARE ATTACHED.] \* A TOTAL OF [\_\_\_\_\_] CROSS SECTIONS IS REQUIRED.

(1) SURVEY LINE SPACING SHALL NOT EXCEED \* [THE LIMITS GIVEN IN EM 1110-2-1003 FOR THE GIVEN CLASS OF SURVEY] [\_\_\_\_\_] FEET][FULL COVERAGE].

(2) SURVEY LINES SHALL BE REFERENCED TO THE \* [CENTERLINE] [\_\_\_\_\_] OF THE PROJECT AND SHALL BE RUN PERPENDICULAR TO THAT ALIGNMENT. \* CROSS SECTIONS SHALL BE RUN \* [ON EVEN STATIONS] [AS SHOWN ON THE ATTACHED DRAWING] [BEGINNING AT STATION \_\_\_\_+\_\_\_\_]. [SURVEY LINES SHALL DUPLICATE THOSE SHOWN IN THE ATTACHED CONSTRUCTION DRAWINGS.]

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Add sufficient information to describe the required survey alignment, orientation, and origin, particularly if sections are to duplicate prior surveys.

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(3) CROSS SECTIONS SHALL BE RUN AT \_\_\_\_ FEET CENTER TO CENTER C/C AND SHALL EXTEND [\_\_\_\_\_] FEET PAST THE SLOPE-GRADE INTERSECT POINT.

(4) \* LONGITUDINAL LINES [MAY] [MAY NOT] BE RUN IN LIEU OF CROSS SECTIONS FOR CLASS 1 PAYMENT SURVEYS. \* LONGITUDINAL LINE SPACING SHALL FOLLOW THE SPACING GUIDELINES IN EM 1110-2-1003 WITHIN CHANNEL TOES AND ON SIDE SLOPES. \* LONGITUDINAL LINES WILL BE USED TO COMPUTE SECTIONAL END AREAS SPACED AT \_\_\_\_-FEET C/C.

(5) \* PROJECT CONDITION SURVEY LONGITUDINAL LINE SPACING SHALL NOT EXCEED THE LIMITS GIVEN IN \* [OR [\_\_\_\_\_] FEET]. \* CHANNEL \* [TOES], QUARTER POINTS AND CENTERLINE SHALL BE RUN. \* LONGITUDINAL SIDE SLOPE COVERAGE FOR CLASS 2 SURVEYS \* [IS] [IS NOT] REQUIRED [AT A SPACING NOT GREATER THAN [\_\_\_\_\_] FEET].

(6) DEPTH ELEVATION MEASUREMENTS SHALL BE OBTAINED AT \* [THE DENSITY GIVEN IN OF EM 1110-2-1003] [\_\_\_\_\_] . DEPTHS SHALL BE PLOTTED ON THE FINAL DRAWINGS AT THE DENSITY SHOWN IN EM 1110-2-1003.

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Use the following type of clause for basic IDC contracts)

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b. THE CONTRACTOR MAY BE REQUIRED TO PERFORM HYDROGRAPHIC SURVEYS DURING THE TERM OF THIS CONTRACT. SURVEY PROCEDURES, DATA COLLECTION EQUIPMENT, METHODS AND DENSITIES, AND EQUIPMENT CALIBRATION FOR THIS WORK SHALL FOLLOW THE CRITERIA GIVEN IN EM 1110-2-1003 FOR CLASS OF SURVEY SPECIFIED IN TASK ORDERS TO THIS BASIC CONTRACT. TASK ORDER INSTRUCTIONS WILL CONTAIN SPECIFIC SURVEY LIMITS AND ANY MODIFICATIONS TO EM 1110-2-1003 FOR THE PARTICULAR PROJECT. NORMALLY, MARKED-UP PROJECT MAPS OR CONSTRUCTION DRAWINGS WILL BE PROVIDED TO DELINEATE WORK AREAS.

C.4.2. HORIZONTAL POSITIONING PROCEDURES AND ACCURACIES.

a. VESSEL POSITIONING SYSTEMS AND/OR MODES UTILIZED ON THIS CONTRACT SHALL CONFORM WITH ALLOWABLE HORIZONTAL POSITIONING CRITERIA IN EM 1110-2-1003, BASED ON THE CLASS OF SURVEY REQUIRED. THE

CONTRACTOR MAY BE REQUIRED TO DEMONSTRATE TO THE GOVERNMENT THAT HIS POSITIONING SYSTEM, MODE, AND/OR PROCEDURES ARE CAPABLE OF MEETING THE ACCURACY REQUIREMENTS IN EM 1110-2-1003.

d. \* THE CONTRACTOR SHALL HAVE A COMPLETE MANUAL TAG LINE SURVEY CAPABILITY AS SPECIFIED IN EM 1110-2-1003. THE TAG LINE SHALL BE CONSTRUCTED TO SURVEY LINES NOT EXCEEDING [\_\_\_\_\_] FEET FROM THE BASELINE. TAG LINE PROCEDURES, LIMITATIONS, ALIGNMENT METHODS, AND CALIBRATIONS SHALL CONFORM WITH EM 1110-2-1003.

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Specify any other unique positioning requirements not covered in the above clauses but which will be required during the contract. This may include visual positioning, sextant control, azimuth intersection positioning, differential GPS, RTK, etc. Reference the appropriate section of EM 1110-2-1003 if such systems are employed.  
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C.4.3. REFERENCE HORIZONTAL CONTROL DATA. UNLESS OTHERWISE INDICATED, THE GOVERNMENT WILL PROVIDE SUFFICIENT EXISTING PROJECT CONTROL FROM WHICH HYDROGRAPHIC SURVEYS MAY BE EXTENDED. THIS CONTROL SHALL BE PRESUMED TO MEET THE ACCURACY REQUIREMENTS IN EM 1110-2-1003. WHEN HYDROGRAPHIC SURVEYS ARE REQUIRED TO BE CONTROLLED FROM PARTICULAR EXISTING MONUMENTS, THIS WILL BE NOTED IN THE \* [INSTRUCTIONS] [DRAWINGS FURNISHED].

a. ALL HORIZONTAL AND VERTICAL MONUMENTS ARE KNOWN TO BE IN-PLACE AS OF \*[date]. DESCRIPTIONS FOR EACH POINT \*[WILL BE PROVIDED PRIOR TO CONTRACT AWARD] \*[ARE ATTACHED AT CONTRACT SECTION G] [WILL BE PROVIDED WITH EACH TASK ORDER]. \*[THE CONTRACTOR'S FIELD REPRESENTATIVE SHALL IMMEDIATELY NOTIFY THE GOVERNMENT'S CONTRACTING OFFICER REPRESENTATIVE IF EXISTING CONTROL POINTS HAVE BEEN DISTURBED.]

b. NEW STATION MONUMENTATION, MARKING, AND OTHER CONTROL REQUIREMENTS. WHEN EXISTING CONTROL IS FOUND TO BE DESTROYED OR DISTURBED, OR WHEN ADDITIONAL CONTROL SURVEYS ARE REQUIRED, SUCH CONTROL WORK SHALL BE ESTIMATED AND PAID FOR AT THE RATES ESTABLISHED IN SECTION B OF THIS CONTRACT.

C.4.4. DEPTH MEASUREMENT PROCEDURES AND CALIBRATION.

a. GENERAL. THE CONTRACTOR'S FIELD SURVEY FORCES SHALL HAVE THE CAPABILITY TO OBTAIN MANUAL (LEAD LINE AND SOUNDING POLE) AND SINGLE-BEAM [MULTIBEAM] ACOUSTIC DEPTH MEASUREMENTS DURING THIS CONTRACT. ALL DEPTH MEASUREMENT EQUIPMENT, PROCEDURES, AND QUALITY CONTROL SHALL STRICTLY CONFORM WITH THE MINIMUM CRITERIA STANDARDS IN EM 1110-2-1003. THE GOVERNMENT RESERVES THE RIGHT TO INSPECT ANY DEPTH MEASUREMENT EQUIPMENT EMPLOYED DURING THIS CONTRACT.

b. DEPTH MEASUREMENT PRECISION/ACCURACY. DEPTH MEASUREMENTS INCLUDING DEPTH OBSERVATION PRECISION AND RESOLUTION SHALL MEET THE VERTICAL ACCURACY STANDARDS PRESCRIBED IN EM 1110-2-1003.

c. MANUAL DEPTH MEASUREMENTS. LEAD LINE AND SOUNDING POLE INSTRUMENTS SHALL HAVE THE WEIGHT AND DIMENSIONS GIVEN IN EM 1110-2-1003. {Note any variations from these standards due to unique project conditions, such as suspended sediment.} LEAD LINES AND SOUNDING POLES SHALL BE MARKED, READ, AND CALIBRATED IN ACCORDANCE WITH THE CRITERIA IN EM 1110-2-1003. LINE/POLE CALIBRATIONS SHALL BE RECORDED \* [IN STANDARD FIELD SURVEY BOOKS] [ON FORMS/WORKSHEETS]. THESE CALIBRATION RECORDS SHALL BE RETAINED FOR INSPECTION IF NECESSARY.

d. ACOUSTIC DEPTH MEASUREMENT. A SURVEY QUALITY [SINGLE BEAM][MULTIBEAM] ECHO SOUNDER SHALL BE USED FOR WORK PERFORMED ON THIS CONTRACT. THE DEVICE MUST BE CAPABLE OF PROVIDING THE REQUIRED VERTICAL ACCURACIES. THE ECHO SOUNDING RECORDER SHALL BE IN GOOD CONDITION AND FREE FROM INDEX ERRORS, FREQUENCY INSTABILITY, OR OTHER RECORDING INSTABILITIES WHICH MAY AFFECT THE QUALITY OF THE DATA.

g. ACOUSTIC CALIBRATION REQUIREMENTS. ACOUSTIC DEPTH SOUNDERS SHALL BE CALIBRATED IN STRICT CONFORMANCE WITH THE ALLOWABLE METHODS, TOLERANCES, AND OTHER CRITERIA GIVEN IN EM 1110-2-1003. ANY DEVIATION FROM THESE CRITERIA MUST BE APPROVED BY THE CONTRACTING OFFICER. DEPTH SOUNDING EQUIPMENT SHALL BE CALIBRATED SUCH THAT THE TOLERANCES GIVEN IN EM 1110-2-1003 ARE ACHIEVED. BAR CHECK, VELOCITY CHECKS, PATCH TEST, PERFORMANCE TESTS, AND/OR BALL CHECKS MUST BE RECORDED \* [IN A STANDARD FIELD SURVEY BOOK] [ON FORM \_\_\_\_\_] [ON WORKSHEET \_\_\_\_\_] AND ON THE ANALOG GRAPHICAL RECORDING. FAILURE TO PERFORM AND SUBMIT EVIDENCE OF CALIBRATION FOR EACH DAY'S WORK WILL RESULT IN THE WORK BEING DEEMED UNSATISFACTORY AND REQUIRING CORRECTION AT THE CONTRACTOR'S EXPENSE. EXTERNAL CHECKS OF THE CALIBRATION EQUIPMENT OR VESSEL DRAFT/SQUAT SHALL ALSO BE PERFORMED AS REQUIRED IN EM 1110-2-1003. THESE PERIODIC CHECKS SHALL BE RECORDED IN A STANDARD BOUND SURVEY BOOK AND RETAINED ABOARD THE VESSEL FOR REVIEW BY GOVERNMENT OR CONTRACTED CONSTRUCTION INSPECTORS.

C.4.5. VERTICAL REFERENCE DATUMS. DEPTH MEASUREMENTS SHALL BE REDUCED TO THE SPECIFIED DATUM USING CONCURRENT STAFF/GAGE READINGS AT \* [ ] [A FIXED REFERENCE POINT], AS DESCRIBED IN EM 1110-2-1003. RIVER GAGES OR TIDE STAFFS/GAGES SHALL BE CONSTRUCTED, REFERENCED, MAINTAINED, STILLED, AND READ IN ACCORDANCE WITH THE CRITERIA IN EM 1110-2-1003. THE \* [REFERENCE] [CONSTRUCTION] DATUM FOR THE WORK IS \_\_\_\_\_, UNLESS OTHERWISE NOTED.

\*\*\*\*\*  
Specify any unique river stage or tidal modeling requirements (eg, RTK DGPS) of the contract or task order thereto, such as types of gages, recording intervals, comparative gage readings, water transfers, and benchmarks which must reference the gage. Specify any unusual differential leveling requirements not covered in EM 1110-2-1003.  
\*\*\*\*\*

C.4.6. FIELD DATA RECORDING, REDUCTION, ARCHIVING, AND PLOTTING REQUIREMENTS.

C.4.7. \* VOLUME COMPUTATIONS. THE CONTRACTOR SHALL HAVE THE CAPABILITY TO COMPUTE EXCAVATION AND PLACEMENT QUANTITIES FROM WORK PERFORMED UNDER THIS CONTRACT. THE GOVERNMENT WILL FURNISH CONSTRUCTION TEMPLATES AND LIMITS FROM WHICH VOLUMES ARE TO BE COMPUTED FROM PROJECTED SECTIONAL END AREAS USING ANY OF THE TECHNIQUES GIVEN IN EM 1110-2-1003.

C.4.8. MISCELLANEOUS QUALITY CONTROL PROCEDURES. [add as required]

C.4.9. \* SPECIAL PURPOSE SURVEYS. THE CONTRACTOR SHALL HAVE PLANT, EQUIPMENT, AND PERSONNEL CAPABLE OF EXECUTING THE FOLLOWING TYPES OF SURVEYS AT THE RATES SPECIFIED IN SCHEDULE B:

\*\*\*\*\*  
For each special purpose survey required on the contract, add sufficient procedural and technical detail necessary to describe the work. Equipment and instrumentation requirements should be identified. These special survey requirements must be separate (negotiated) line items on Schedule B, since equipment and personnel requirements may differ substantially from basic hydrographic work. Do not simply list these items on a basic IDC contract to cover unforeseen requirements.  
\*\*\*\*\*

- a. CHANNEL SWEEP SURVEYS.
- b. SIDE SCAN SONAR SURVEYS.
- c. SUB-BOTTOM PROFILING.
- d. SUB-BOTTOM PROBING.
- e. MAGNETOMETER SURVEYS.
- f. ENVIRONMENTAL MONITORING SURVEYS/STUDIES.
- g. WRECK/UNDERWATER OBSTRUCTION INVESTIGATIONS.
- h. BEACH PROFILING SURVEYS.
- i. JETTY/GROIN SURVEYS.
- k. RIVER SECTIONS.
- l. HYDROLOGICAL/HYDRAULIC SURVEYS/STUDIES.
- m. DREDGE DISPOSAL MONITORING CONTROL.
- n. {other hydrographic-related surveys/studies}

C.4.10. \* PROJECT REPORT. A PROJECT REPORT SHALL BE SUBMITTED FOR EACH SURVEY. \* [ ] COPIES OF THE REPORT SHALL BE INCLUDED. THE REPORT SHALL INCLUDE ITEMS SUCH AS: SCOPE OF WORK, CONTRACTOR PERSONNEL AND EQUIPMENT UTILIZED, WEATHER CONDITIONS, TIDAL DATA, GENERAL SITE PLAN MAP, LINE DESIGNATION MAP, CALIBRATION PROCEDURES USED, HORIZONTAL AND VERTICAL ACCURACIES, AND ANY OTHER PERTINENT INFORMATION TO DESCRIBE THE PURPOSE, METHODS, AND RESULTS OBTAINED.

C.5. SUBMITTAL REQUIREMENTS.

C.5.1. SUBMITTAL SCHEDULE: THE COMPLETED SURVEY DRAWINGS AND/OR DATA FILES, ALONG WITH SUPPORTING DATA, SHALL BE DELIVERED WITHIN \* [ ] DAYS AFTER NOTICE TO PROCEED IS ISSUED] \* [BY {calendar date}] [UPON COMPLETION OF FIELD ACTIVITIES]. \* IF FOR ANY REASON THE COMPLETION DATE CANNOT BE MET THE CONTRACTOR WILL ADVISE THE CONTRACTING OFFICER, OR HIS DESIGNATED REPRESENTATIVE, BY TELEPHONE AND CONFIRM BY LETTER THE REASON FOR THE DELAY. \* THIS NOTIFICATION ACTION MUST BE SUBMITTED WITHIN [ ] DAYS PRIOR TO THE NEGOTIATED COMPLETION DATE OF THE PROJECT. \* A COPY OF THIS LETTER MUST ALSO BE ATTACHED TO ENG FORM 93, FINAL PAYMENT.

\*\*\*\*\*  
Include a more detailed submittal schedule breakdown if applicable to project. If on-site data processing and reduction are required, so indicate.  
\*\*\*\*\*

C.5.2. PACKAGING AND MARKING: PACKAGING OF COMPLETED WORK SHALL BE ACCOMPLISHED SUCH THAT THE MATERIALS WILL BE PROTECTED FROM HANDLING DAMAGE. EACH PACKAGE SHALL CONTAIN A TRANSMITTAL LETTER OR SHIPPING FORM, IN DUPLICATE, LISTING THE MATERIALS BEING TRANSMITTED, BEING PROPERLY NUMBERED, DATED AND SIGNED. SHIPPING LABELS SHALL BE MARKED AS FOLLOWS:

U.S. ARMY ENGINEER DISTRICT, \_\_\_\_\_  
ATTN: \_\_\_\_\_  
{include office symbol and name}  
CONTRACT NO. \_\_\_\_\_  
\*[TASK ORDER NO. \_\_\_\_\_]  
[STREET/PO BOX] \_\_\_\_\_  
{complete local mailing address}

\*HAND CARRIED SUBMISSIONS SHALL BE PACKAGED AND MARKED AS ABOVE, AND DELIVERED TO THE FOLLOWING OFFICE ADDRESS:

\_\_\_\_\_  
{insert office/room number as required}

C.6 PROGRESS SCHEDULES AND WRITTEN REPORTS.

\*\*\*\*\*  
Detail any requirements for a prework conference after contract award, including requirements for preparing written reports for such conferences.  
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## 22-10. IDC Task Order Requests For Proposals and Specifications

IDC Task Orders are issued for specific projects that arise during the course of a contract--normally during a three-year period. The contractor is requested to submit a proposal for time and cost to perform the work, using the previously negotiated unit prices in the IDC schedule. The request for proposal letter will contain supplemental standards and specifications specific to the particular project, along with maps, drawings, guidance documents, etc. The following examples illustrate a typical Task Order letter Request for Proposal along with supplemental specifications for specific task orders representative of coastal and inland hydrographic survey projects.

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## SAMPLE REQUEST FOR PROPOSAL

Engineering Division  
Design Branch

Subject: Contract No. DACW17-96-D-0017

EMC Inc.  
101 West Market Street  
Greenwood, Mississippi 38930-4431

Gentlemen:

Enclosed are marked drawings depicting the scope of work for the following project:

Canaveral Sand Bypass Phase II  
Pre and Post Construction Survey  
Canaveral, Florida (Survey No. 97-096)

General Scope. Furnish all personnel, plant, equipment, transportation, and materials necessary to perform and deliver the survey data required hereinafter in accordance with the instructions and conditions set forth in Contract No. DACW17-96-D-0017. Services not specifically described herein are nevertheless a firm requirement if they can be identified as an item, or items, commonly a part of professional grade work of a comparative nature. All work shall be accomplished in accordance with the manuals and TM's specified in your contract.

- Your attention is directed to the Site Investigation and Conditions Affecting the Work clause of your contract. After we have reached agreement on a price and time for performance of this work, neither the negotiated price nor the time for performance will be changed as a consequence of conditions at the site except in accordance with the clause. Costs associated with the site investigation are considered overhead costs which are reimbursed in the overhead rates included in your contract. Additional reimbursement will not be made.

a. Field Survey. Pre and After construction hydrographic and topographic beach survey data shall be collected for the borrow area and beach fill area. Enclosure 1 is the contract plans. Enclosure 2 is the control monument descriptions. Enclosure 3 is the technical requirements for the surveys.

- The Contractor shall furnish one 4-Man hydrographic survey party. The task order shall be issued based on the estimated-not fixed-number of field crew days, project manager, CADD days, and computation days. When the assignment is completed the task order shall be adjusted to reflect the total cost. To certify the hours worked and progress, a daily report shall be furnished to Design Branch from the field party employed. Weekly submittal is acceptable. The Contractor's work hours and days may have to be adjusted to coincide with the Corps of Engineers request. The Contractor shall indicate on the daily report the survey party hours worked on that day. The Contractor shall be notified 24 hours in advance of any work assignment.

- The points of contact are, Mr. Hank Rimmer, at 904-232-1606, and Mr. James Lanier at 407-783-8407. Any instruction given to the survey crew by the Atlantic Coast Area Office shall be coordinated with Mr. Rimmer before commencing.

b. Data processing. The Contractor shall make the necessary computations to verify the accuracy of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey.

c. CADD. The hydrographic and topographic features shall be translated or digital capture into Intergraph IGDS 3D design files according to the specifications furnished. The survey data (cover and section view sheets) shall be provided in Intergraph Microstation (PC or 32) Version 4.0 or higher, AT&T System V Unix, CLIX R3.1 Vr. 6.3.2 format as shown in the letter dated 30 September 1992.

Surveying shall be in strict compliance with the Technical Requirements for Surveying Mapping and Photogrammetric services manual and the Minimum Technical Standards set by the Florida Board of Land Surveyors and Mappers.

The completion date for this assignment is 90 days after the Notice to Proceed is signed by the Contracting Officer.

All material shall be returned to Design Branch upon completion of this assignment.

You must notify the Contracting Officer immediately when the work effort is 85% of the not to exceed amount. Contact Design Branch at 904-232-1613 for questions or assistance with your proposal.

You are required to review these instructions and make an estimate in writing of the cost and number of days to complete the work. Please mark your estimate to the attention of Chief, Survey Section.

This is not an order to proceed with the work. The Contracting Officer will issue this at a later date.

Sincerely,

Walter Clay Sanders, P.E.  
Assistant Chief, Engineering Division

Enclosures (withdrawn from example)

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## Example Task Order Scope of Work--Sand Bypass Project

CANAVERAL SAND BYPASS PHASE II PROJECT  
PRE AND POST HYDROGRAPHIC AND TOPOGRAPHIC  
BEACH CONSTRUCTION SURVEY  
CANAVERAL, FLORIDA  
SURVEY No.97-096

1. LOCATION OF WORK: The project is located at Canaveral, Florida.

2. SCOPE OF WORK:

2a. The services to be rendered by the Contractor include obtaining topographic and hydrographic beach survey data (x, y, z) for the borrow area from CCAFS-38 TO CCAFS-29, for the beach fill area from R-7-T to R-14 and CADD files as shown on Enclosure 1, contract plans and specifications.

2b. The services to be rendered by the contractor include all the work described below. Details not specifically described in these instructions are nevertheless a firm requirement if they can be identified as an item, or items, commonly a part of professional grade work of a comparative nature.

2c. The contractor shall furnish all necessary materials, labor, supervision, equipment, and transportation necessary to execute and complete all work required by these specifications.

2d. The Corps of Engineers, Design Branch shall be contacted the same day that the Contractor plans to commence the work. The points of contact are, Mr. Hank Rimmer, (CORPS OF ENGINEERS DISTRICT OFFICE) at 904-232-1606, and Mr. James Lanier (ATLANTIC COAST AREA OFFICE) at 407-783-8407. Any instruction given to the survey crew by the Atlantic Coast Area Office shall be coordinated with the Mr. Rimmer before commencing. A meeting with the Atlantic Coast Area Office, Mr. Lanier shall be arranged before commencing the surveys to establish the priority for the surveys.

2e. Rights-of-Entry must be obtained verbally and recorded in the field book before entering on the private property. Enter in the field book the name and address of the property owner contacted for rights-of-entry.

2f. COMPLIANCE: Surveying shall be in strict compliance with Engineering and Design Standards and Specifications for Surveys, Maps, Engineering Drawings, and Related Spatial Data Products and the Minimum Technical Standards set by the Florida Board of Professional Surveyors and Mappers.

2g. All digital data shall be submitted on CD ROM's.

3. FIELD SURVEY EFFORT: Topographic and hydrographic beach survey data shall be obtained for the borrow area from CCAFS-38 TO CCAFS-29, for the beach fill area from R-7-T to R-14 and CADD files as shown on Enclosure 1, contract plans and specifications. Enclosure 2 is the contract plans and specifications. Enclosure 3 is the control monument descriptions. Enclosure 4 is the Technical Requirements.

3a. CONTROL: The Horizontal datum shall be NAD 1927 and the vertical datum shall be N.G.V.D. of 1929. All control surveys shall be Third Order, Class II accuracy.

3a1. The basic control network can be accomplished using precise differential carrier-phase Global Positioning System (GPS). Differential GPS baseline vector observations shall be made in strict accordance with the criteria contained in the engineering manual EM-1110-1-1003 and with the Geometric Geodetic Accuracy Standards And Specifications For Using GPS Relative Positioning Techniques by Federal Geodetic Control Committee, version 5.0.

3a2. Network design, station and baseline occupation requirements, for static and kinematic surveys, satellite observation time per baseline, baseline redundancies, and connection requirements to existing networks, shall follow the criteria given in the above said engineering manual. A field observation log sheet shall be completed at each setup in the field.

3a3. GPS derived elevation data shall be supplied in reference to the above said datum. Existing benchmark data and stations shall be used in tandem in a minimally constrained adjustment program to model the geoid. All supporting data used in vertical adjustment shall be submitted.

3a4. Existing Corps of Engineers project control shall be utilized for establishing horizontal and vertical control. No control monuments shall be utilized that are not included in the control network shown in the contract plans. All established or recovered control shall be fully described and entered in a FIELD BOOK, in accordance with the Technical Requirements of this contract. Recover or establish horizontal and vertical control monuments at each profile line. The designations for new control monuments will be furnished when needed. All horizontal and vertical control shall be verified before using.

3a5. All horizontal and vertical control (double run forward and back) established shall be a closed traverse or level loop no spur lines, with third order accuracy. All horizontal and vertical control along with baseline layouts, sketches, and pertinent data shall be entered in field books.

3a6. All monuments, survey markers, etc., recovered shall be noted on the copies of control descriptions. Control points established or recovered with no description or out-of-date (5 Years old) description shall be described with sketches for future recovery use.

3a7. All original field notes shall be kept in standard pocket size field books and shall become the property of the Government. The first four pages of the field books shall be reserved for indexing and the binding outside edge shall be free of all marking. Design Branch will issue field book numbers upon submittal of field books for checking.

3b. TIDE STAFF: The survey data shall be collect on MLW datum which is 1.9 below N.G.V.D. located in vicinity of "CABLE SOUTH PORT" monument.

3c. BORROW AREA: Collect survey data (X, Y, & Z) for profile lines CCAFS-38 thru CCAFS-29. The profile lines shall start at the monuments (range 0) and extend seaward to range 1600 with data points at 25 foot range intervals and all breaks and 12.5 foot intervals in the water. The profile lines shall be ran on the azimuth shown in Enclosure 1. Establish a survey stake at 3.5 foot MLW elevation on each profile line. The survey stake shall be labeled with 3.5 MLW.

3d. BEACH FILL AREA:

3d1. BASELINE: Establish a baseline landside of the monuments with line of sight from R-7-T to R-14. The baseline shall be establish between elevation 9.5 MLW and the monuments. Establish POT's along the baseline at 100 foot intervals.

3d2. PROFILE LINES: Collect survey data (X, Y, & Z) on 100 intervals with data points at 25 foot range intervals and all breaks for the land portions and 12.5 for the water portions, from the monuments (range 0) to range 1000 seaward. Establish a survey stake at 9.5 foot MLW elevation for each profile line. The survey stake shall be labeled with 9.5 MLW.

3e. BREAKLINE: Breaklines shall be located for all natural or man-made features as needed. The breaklines shall be located with X, Y, and Z and identified.

3f. DATA COLLECTION (RTK or TOTAL STATION): Data collection will be allowed for data points only, showing all instrument positions, calibration, backsites and closing readings in the field book. If RTK is utilized Q1 and Q2 files shall be furnished. Before using RTK, one session shall be performed around the expected survey area. After observation of the primary control (four monuments; one on each corner of the work area) the geoid model shall be prepared utilizing the four occupied monuments data.

4. DATA PROCESSING: The Contractor shall make the necessary computations to verify the accuracy of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey. Compute and tabulate the horizontal and vertical positions on all work performed. Review and edit all field data for discrepancies before plotting the final drawings.

4a. Furnish X, Y, Z, and descriptor ASCII file for each profile line and one X, Y, Z, and descriptor ASCII file with all profile lines included for each area.

5. CADD: The topographic and hydrographic features shall be translated or digital capture into Intergraph IGDS 3D design files according to the specifications furnished. The survey data (cover, control, site plan, plan sheets, and section drawings) shall be provided in Intergraph Microstation (PC or 32) Version 4.0 or higher, AT&T System V Unix, CLIX R3.1 Vr. 6.3.2 format as shown in the letter dated 30 September 1992. All CADD files shall be the same as shown in Enclosure 1.

5a. GLOBAL ORIGIN: The IGDS 3-D design file shall be prepared with a global origin of 0, 0, 2147483.65. Design file master units: FT., Sub units: 1,000, and positional units: 1. The file name shall be the survey number prefixed with an "Y", i.e. Y049sh1.DGN. All reference files name shall commence with the Y049\*\*.DGN also.

5b. DIGITAL TERRAIN MODEL (DTM) DATA: The Contractor shall develop and deliver a surface model of each survey area using Intergraph compatible Digital Terrain Modeling software and the model file shall have the .dtm extension. The digital terrain model shall be developed from the collected data. Breaklines should include ridges, drainage, road edges, surface water boundaries, and other linear features implying a change in slope. The surface model shall be of adequate density and quality to produce a one-foot contour interval derived from the original DTM (Digital Terrain Model) file. The contour data shall be incorporated as a reference file into the final data set (DGN file). All data used to develop the DTM shall be delivered in Intergraph 3-D design files.

5b1. CONTOURS: The contours shall be developed in the digital terrain model (DTM). The contours shall be provided in one or more master (scale 1" = 200') DGN files, attached as a reference file to all sheet files utilizing clip bounds methods. Each contour shall be drawn sharp and clear as a continuous solid line, dashed contours are not acceptable. Every index contour shall be accentuated as a heavier line than the intermediate contour line and shall be annotated according to its actual elevation above MLW. Labeling or numbering of contours shall be placed on top of the contour line, so that the elevation is readily discernible, do not break contours. Labeling of intermediate contours may be required in areas of low relief.

5c. MASTER DGN FILES:

5c1. The survey data (DTM data points) points shall be provided in one or more master DGN file (scale 1" = 200'), attached as a reference file to all sheet files utilizing the clip bounds methods.

5c2. The contours shall be provided in one or more master DGN file (scale 1" = 200'), attached as a reference file to all sheet files utilizing the clip bounds methods. "DO NOT PLOT THE CONTOURS".

5c3. The breaklines shall be provided in one or more master DGN file (scale 1" = 200'), attached as a reference file to all sheet files utilizing the clip bounds methods, "DO NOT PLOT THE BREAKLINES".

5c4. The control points shall be provided in one or more master DGN file (scale 1" = 200'), attached as a reference file to all sheet files utilizing the clip bounds methods.

5c5. The baseline shall be provided in one or more master DGN file (scale 1" = 200'), attached as a reference file to all sheet files utilizing the clip bounds methods.

5d. COVER AND CONTROL SHEET: The first sheet shall be a cover sheet showing the control sketch, survey control tabulation, sheet layout or index, legend, project location map, survey notes, north arrow, graphic scale, grid ticks, large signature title block. Tabulate, plot, and list the control used for the survey on the final drawings.

5e. PLAN SHEETS: The plan sheets shall be prepared to a scale of 1" = 200', in the Corps of Engineers format (reference letter and instruction dated September 30, 1992) showing notes, title block, grid, north arrow, graphic scale, legend, sheet index, and D. O. File Number. Sheets shall be oriented with north to the top and designed to utilize the least number of sheets. The extreme right 7 inches of the sheet shall be left blank for notes, legends, etc. The first (cover) sheet shall have large signature block. The second sheet and all sheets following shall be a continuation sheet and shall have a minimum of two notes, note 1: See Drawing number 1 for notes, note 2: Refer to Survey No. 97-096. PAPER PLOTS ONLY".

6. MAP CONTENT:

6a. COORDINATE GRID (NAD 27): Grid ticks (English) of the applicable State Plane Coordinate System shall be properly annotated at the top, bottom and both sides of each sheet. Spacing of the grid ticks shall be five (5) inches apart.

6b. CONTROL: All horizontal and vertical ground control monuments shall be shown on the maps in plan and tabulated.

6c. TOPOGRAPHY: The map shall contain all representable and specified topographic features which are visible or identifiable.

6d. SPOT ELEVATIONS: Spot elevations shall be shown on the maps in proper position. In areas where the contours are more than 3 inches apart at map scale, spot elevations shall be shown. The horizontal distance between the contours and such spot elevations or between the spot elevations shall not exceed two (2) inches at scale of delivered maps.

6e. CONTOURS: The contours shall be developed in the digital terrain model (DTM). Each contour shall be drawn sharp and clear as a continuous solid line, dashed contours are not acceptable. Every index contour shall be accentuated as a heavier line than the intermediate and shall be annotated according to its actual elevation. Whenever index contours are closer than one-quarter (1/4) inch, and the ground slope is uniform, the intermediate shall be omitted. Labeling or numbering of contours shall be placed on top of the contour line, so that the elevation is readily discernible, do not break contours. Labeling of intermediate contours may be required in areas of low relief.

6f. MAP EDIT: All names, labels, notes, and map information shall be checked for accuracy and completeness. All buildings, roads and man made features shall be labeled with the type of construction, purpose and name. All residences shall be labeled with the type of construction.

6g. SHEET INDEX AND LEGEND: On plan drawings a small scale sheet index shall be shown on each sheet of the series; highlighting the sheets in the standard manner. Planimetric and topographic feature legends shall be shown on each sheet. Contractor logo shall be shown on each drawing.

6h. MAP ACCURACY: All mapping shall conform to the national map accuracy standards except that no dashed contours will be accepted.

7. OFFICE REVIEW AND COMPUTATIONS: The Contractor shall make the necessary computations to verify the correctness of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey.

8. DELIVERIES: On completion, all data required shall be delivered or mailed to Design Branch, Survey Section at the address shown in contract, and shall be accompanied by a properly numbered, dated and signed letter or shipping form, in duplicate, listing the materials being transmitted. All costs of deliveries shall be borne by the Contractor. Items to be delivered include, but are not limited to the following:

- 8a. GPS network plan.
  - 8b. GPS raw data along with field observation log sheets filled out in field with all information and sketches.
  - 8c. Computation files with Horizontal and Vertical abstracts along with any Q1 and Q2 files.
  - 8d. Horizontal and Vertical Field Books.
  - 8e. Furnish X, Y, Z, and descriptor ASCII file for each profile line and one merged with all data collected for each area.
  - 8f. DTM File
  - 8g. DGN files to a scale of 1" = 200.
  - 8h. Advance paper plots of all plan sheets, cover sheet and control sheets for approval.
-

## Example Task Order Scope of Work--River Sections

**PROPOSED TASK ORDER NO. 26  
CONTINENTAL ENGINEERING, INC.  
DACW66-97-D-0053**

Scope of Work  
1999 Mississippi River General Hydro Surveys  
7 January 1999

1. General Scope The contractor shall perform General Hydrographic Surveys on the Mississippi River within the reaches described in the enclosures. The surveys shall include the development of digital maps reduced to the low water reference plane, color coded elevations (polyfill shapes vs triangles), checked for correctness, hard copy of each survey including the raster image, and a format developed to be directly inserted into the Regional Engineering Environmental Geographical Information System (REEGIS).

2. Survey Requirements and Specifications.

a. Miscellaneous. See Miscellaneous Survey and Specifications (MSRS), dated 4 March 1993, paragraphs 1 through 8 for A-E responsibilities in regard to Quality Assurance, Submission of Pay Estimates, Safety, Project Progress Reports, Damages, Coordination of Work, Datums, and Survey Field Notes.

b. Right of Entry. Verify right of entry with the QARs. See paragraph 9.b., MSRS dated March 1993.

c. Survey Limits. The limits for the surveys shall be the reaches as described in Encl. 1. The surveys shall extend from bank to bank at 1056-ft intervals unless otherwise required in the limit enclosure. Additional ranges shall be sounded upstream and downstream as near as safety considerations will allow to existing dikes. The ranges obtained near dikes should not be from bank to bank, but should extend a minimum of 200 feet beyond the riverward end of the dike. The data shall be obtained within the reaches described and sheets not split.

d. Existing Horizontal Control. Adequate horizontal control exists within a reasonable distance of the survey limits to perform this project. The control consists of monuments used for all river work within the Memphis District. Horizontal control shall be supplied to the respective hydrographic survey party chiefs at the Memphis District Office prior to the start of the surveys.

e. New Baseline Control. No new baseline control shall be required for this project.

f. Horizontal Computations. All horizontal data developed for this project shall be computed on the North American Datum of 1983 (NAD 83) using Universal Transverse Mercator (UTM) Zone 15 or 16 plane coordinates in U.S. Survey Feet. See MSRS, paragraph 12 for other requirements. Azimuth orientation shall be from zero North.

g. Existing Vertical Control. Adequate vertical control exists within a reasonable distance of the survey limits to perform this project within the accuracy specified. Recovery of existing vertical control shall be documented as described in MSRS paragraphs 13.a., 13.b., 13.c., and 13.d.

g. New Vertical Control. No new vertical control shall be required for this project.

h. Monumentation. No new monumentation is required under this Scope of Work.

i. Digital Map. A digital map in a separate IGDS file for each hydrographic sheet shall be required at a scale of 1:10,000 with a five-foot contour interval. An ASCII file shall be provided that includes all hydrographic data collected and edited for erroneous soundings and positions. Soundings shall be collected at intervals no greater than 50 feet. A second ASCII file shall also be provided which contains an x,y, and z coordinate at least every 100 feet along each range. A Microstation design file (.DGN) of each plotted "z" elevation at the "x" and "y" coordinate for each point found

in the second ASCII coordinate file above shall be submitted. Soundings shall be on level 49, color coded elevations and buoys on level 52. The design file shall contain horizontal and vertical control used to develop the survey. An Intergraph digital terrain model (.DTM) file shall also be provided. For all work along the Mississippi River, the 1993 Low Water Reference Plane elevation shall be used as the zero contour. Digital sheets supplied by the Memphis District reflect true elevations but shall be reduced relative to the 1993 LWRP by the contractor. They shall be developed as three-dimensional graphic elements on level 57 to be loaded as breaklines to the .DTM file. Hydrographic survey shall be performed at the locations and intervals described in paragraph 2.c. and as described below:

- (1) Ranges. The ranges shall extend from water's edge to water's edge. The coverage shall include all dike fields, chutes, sandbars and islands that can be surveyed hydrographically. In addition, all navigation buoys within the defined area shall be located by an x and y position and plotted on the maps.
- (2) Sounding data (rounded to the nearest foot) shall be plotted at intervals of  $\pm 100$  feet using a text size of 80 (using Font 10). The contour interval shall be five feet and the contours shall extend from water's edge to water's edge. The zero contour shall be a dashed (---) line. The  $-10$  contour shall be a solid line of heavier weight than the other contours. The hydrographic data may overlap with adjacent sheets. In these cases all hydro data shall be plotted on all overlapping sheets. All hydrographic maps shall be verified for accuracy by the contractor before final submittal to this office. All miscellaneous data (i.e. title blocks, gage data {furnished by Government}, slope diagrams, and data ranges were sounded) on the sheet shall be completed by the contractor.
- (3) All hydrographic survey ranges are to be sounded as nearly normal to the channel as possible. Computer generated contours cannot be developed accurately if ranges are at any noticeable angle. Where some angle cannot be avoided, range spacing should be decreased.
- (4) Each survey shall follow the REEGIS standards which are in the enclosure. Each survey shall use polyfill shapes for the color-coded contours instead of triangles.
- (5) The following files shall be submitted .DGN, .DTM and .XYZ files for the NGVD Elevation **and** for the Low Water Reference Plane.
- (6) A hardcopy plot of each completed hydrographic sheet shall be submitted containing the latitudinal and longitudinal grid, soundings, contours, color coded elevations, raster image, and title block.
- (7) Level 63 information as contained in Miscellaneous Intergraph Requirements and Specifications, dated 10 September 1992 shall be included in all files.

3. DATA SUBMISSION. The data required by these surveys shall be developed and submitted by 12 February 1999. No formal SER shall be required for this scope of work.

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## Example Task Order Scope of Work--Revetment Surveys

**PROPOSED TASK ORDER NO. 33  
EMC, INC.  
DACW66-98-D-0007**

Scope of Work  
Revetment Before Construction Survey at Norfolk-Star, MS  
Approximate River Mile 711L AHP

1. General Scope. The contractor shall perform a revetment before construction survey at Norfolk-Star Revetment, MS. The purpose of this survey is to gather information for the possible extension of Norfolk-Star Revetment. The survey will consist of baseline recovery from Norfolk-Star Revetment baseline station 84+00 to station 75+00 and the establishment of 6000 ft of new baseline upstream from station 75+00. Soundings from water's edge to 800 ft. beyond water's edge and bank sections from water's edge to 150 ft. behind top bank will also be required.

2. Survey Requirements and Specifications.

a. Miscellaneous. See Miscellaneous Survey and Specifications (MSRS), dated 4 March 1993, paragraphs 1 through 8 for A-E responsibilities in regard to Quality Assurance, Submission of Pay Estimates, Safety, Project Progress Reports, Damages, Coordination of Work, Datums, and Survey Field Notes

b. Right-of-Entry. Right-of-entry has been obtained by the Memphis District Corps of Engineers.

c. Survey Limits. The limits for baseline recovery shall be from Norfolk-Star Revetment baseline station 84+00 to station 75+00. Section limits shall be from baseline station 84+00 to 6000 ft. upstream of station 75+00. Lateral limits shall be from 150 ft. behind top bank to 800 ft. beyond water's edge. Sections shall be taken at 100-ft. intervals. A Site Map is provided in Encl. 1.

d. Existing Horizontal Control. The Norfolk-Star Revetment baseline shall be re-established from baseline station 75+00 to baseline station 84+00 in accordance with MSRS, paragraph 11.a, 11.b, 11.d, and 11.f. Paragraph 11.b shall be amended to Third Order Class 2. Adequate horizontal control exists as herein furnished within a reasonable distance of the survey limits to perform this survey to the required accuracy specifications. Existing Norfolk-Star Revetment baseline coordinates are provided in Encl. 2. Note that these coordinates are provided in NAD 83 Geographic Coordinates with Corpscon translated coordinates of Norfolk-Star Revetment baseline to NAD 83 UTM Zone 15, U.S. Survey feet.

e. New Horizontal Control. New baseline shall be established in accordance with MSRS, paragraph 11.a, 11.b, 11.d, and 11.f. Paragraph 11.b shall be amended to Third Order Class 2. The new baseline shall stem from existing baseline station 75+00 and run 6000 ft. upstream of station 75+00 along the bar at River Mile 926R AHP, to new baseline station 40+00.

f. Horizontal Computations. Horizontal data shall be computed on the North American Datum of 1983 (NAD 83) using Universal Transverse Mercator (UTM) Zone 15 plane coordinates in U.S. Survey Feet. See MSRS, paragraph 12 for other requirements.

g. Existing Vertical Control. Vertical control information is provided in Encl. 3. See MSRS, paragraph 13.a, 13.b, 13.c, and 13.d for requirements.

g. New Vertical Control. Third order vertical control shall be established on all Type G or Type F monuments and iron pins installed as described in MSRS, paragraphs 13.a and 13.d. All new vertical control documentation shall be submitted as hard copy and in digital form using previously supplied database software.

h. Monumentation. Monumentation shall be as described in MSRS, paragraph 14.a. through 14.g. and as follows:

(1). Each monument or iron pin (baseline) shall be designated by the stationing preceded by the following character:

<u>BASELINE</u>	<u>DESIGNATION</u>	<u>EXAMPLE</u>
Norfolk-Star	NS	NS 75+00

Note: There shall be a space between the prefix and the stationing, not a dash.

A River List monument/marker documentation form shall be completed in accordance with MSRS, paragraph 14.f (1) for each Monument installed. All existing and new horizontal and vertical control marks used to complete this survey shall be included in the final data submittal.

(2). Each iron pin shall be stamped as described in MSRS, paragraph 14.c.

i. Field Book Documentation.

(1). Recover/Re-establish Norfolk-Star Revetment baseline within the survey limits in accordance with MSRS, paragraphs 11.a, 11.b, 11.d, and 11.f.

(2). Establish new baseline from station 75+00 to 6000 ft. upstream of station 75+00 in accordance with MSRS, paragraphs 11.a, 11.b, 11.d, and 11.f.

(2). Obtain bank sections at 100-ft. intervals. Sections shall extend from water's edge to 150 ft. behind top bank.

(3). Obtain soundings at 100-ft. intervals. Soundings shall extend from water's edge to 800 ft. beyond water's edge.

(4). All elevations shall be referenced to National Geodetic Vertical Datum of 1929. All horizontal positions shall be referenced to the North American Datum of 1983, using UTM Zone 15 plane coordinates in U.S. Survey Feet.

(5). The 1993 Low Water Reference Plane shall be used for contouring which equals 168.40 at mile 711L AHP.

j. Digital Map. Digital maps shall be developed and provided in digital format as described in MSRS, paragraph 23.a.

3. DATA SUBMISSION. The delivery date for the final SURVEY ENGINEERING REPORT shall be 1 March 1999. See MSRS, dated 4 March 1993, paragraph 24, for additional requirements.

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## Example Task Order Scope of Work--Project Condition Survey

**TECHNICAL REQUIREMENTS**  
**JACKSONVILLE HARBOR 30, 34, 38, & 42-FOOT PROJECT,**  
**PROJECT CONDITION SURVEY, JACKSONVILLE,**  
**DUVAL COUNTY, FLORIDA**  
**(Survey No. 99-315)**

1. LOCATION OF WORK. The project is located at Jacksonville Harbor, Jacksonville, Duval County, Florida.
2. SCOPE OF WORK.
  - 2a. The service to be rendered by the Contractor includes obtaining hydrographic survey data as shown on Enclosures 1(Plan drawings), and 2. Enclosure 3 is the technical requirements and Enclosure 4 is control monuments descriptions.
  - 2b. The services to be rendered by the Contractor include all the work described in these technical requirements. Details not specifically described in these instructions are nevertheless a firm requirement if they can be identified as an item, or items, commonly a part of professional grade work of a comparative nature.
  - 2c. The Contractor shall furnish all necessary rights-of-entry, materials, labor, supervision, equipment, and transportation necessary to execute and complete all of the work required by these specifications.
  - 2d. The Corps of Engineers, Survey Section shall be contacted the same day that the Contractor plans to commence the work.
  - 2e. Rights-of-Entry must be obtained verbally and recorded in the field book before entering on the private property. Enter in the field book the name and address of the property owner contacted for rights-of-entry.
  - 2f. COMPLIANCE. Surveying and Mapping shall be in strict compliance with EM-1110-1-1000 for Photogrammetric Mapping, EM-1110-1-1002 Survey Markers and Monumentation, EM-1110-1-1003 NAVSTAR Global Positioning System Surveying, EM-1110-1-1004 Deformation Monitoring and Control Surveying, EM-1110-1-1005 Topographic Surveying, EM-1110-2-1003 Hydrographic Surveying, EM-1110-1-2909 Geospatial Data and System, (Tri-Service) A/E/C CADD Standards, (Tri-Service) Spatial Data Standards, Related Spatial Data Products and Chapter 177, Chapter 472, and Chapter 61G17 of the Minimum Technical Standards set by the Florida Board of Professional Surveyors and Mappers.
    - 2f1. STANDARDS FOR DIGITAL GEOSPATIAL METADATA. Metadata are "data about data". They describe the content, identification, data quality, spatial data organization, spatial reference, entity and attribute information, distribution, metadata reference, and other characteristics of data. Each survey project shall have metadata submitted with the final data submittal. Furnish a digital file using CORPSMET 95 (Metadata Software) with the appropriate data included. Enclosure 5 is an example of the metadata file printed. Point of contact in survey section is Mr. Bill Mihalik at 904-232-1462.
  - 2g. All digital data shall be submitted on CD-ROM's.
3. FIELD SURVEY EFFORT. Obtain the hydrographic survey data for Cuts 3-19, Cuts 39-55, Terminal Channel, Cuts A, F & G as shown on Enclosures 1, and 2. Enclosure 3 is the control monument descriptions, Enclosure 4 is the technical requirements.
  - 3a. CONTROL.
    - 3a1. The Horizontal datum shall be NAD 1927. The vertical datum shall be NGVD of 1983. All control monuments shall be verified both horizontally and vertically by a control survey. All control surveys shall be Third Order, Class II accuracy. All Positions will be tied to the state plane coordinate system, zone 0901 Florida East.
    - 3a2. The basic control network shall be accomplished using precise differential carrier-phase Global Positioning System (GPS). Differential GPS baseline vector observations shall be made in strict accordance with the criteria contained in the engineering manual EM-1110-1-1003 and with the Geometric Geodetic Accuracy Standards And Specifications For Using GPS Relative Positioning Techniques by Federal Geodetic Control Committee, version 5.0.
    - 3a3. Network design, station and baseline occupation requirements, for static and kinematic surveys, satellite observation time per baseline, baseline redundancies, and connection requirements to existing networks, shall follow the criteria given in the above said engineering manual. A field observation log shall be completed at each setup in the field.

3a4. GPS derived elevation data shall be supplied in reference to the above said datum. Existing benchmark data and stations shall be used in tandem in a minimally constrained adjustment program to model the geoid. All supporting data used in vertical adjustment shall be submitted.

3a5. Existing Corps of Engineers control data shall be tied into subject survey net. The GPS network shall commence from the control shown on Enclosure 2. All established or recovered control shall be fully described in accordance with the Technical Requirements of this contract. All control surveys shall be Third Order, Class II accuracy. The Contractor shall submit the field data and abstracts for the control networks to Survey Section for computation before commencing the mapping. The monument designations shall be furnished as requested. All horizontal and vertical control (double run forward and back) established shall be a closed traverse or level loop no spur lines, with third order accuracy. All horizontal and vertical control along with baseline layouts, sketches, and pertinent data shall be entered in field books. All monuments, survey markers, etc., recovered shall be noted on the copies of control descriptions. Control points established or recovered with no description or out-of-date (5 Years old) description shall be described with sketches for future recovery use. All original field notes shall be kept in standard (pocket size) field books and shall become the property of the Government. The first four pages of the field books shall be reserved for indexing and the binding outside edge shall be free of all marking.

3b. TIDE STAFF: Staff shall be located in the immediate vicinity of the work areas. The gauge shall be referenced MLW as shown on Enclosure 2 (Tide staff locations)

3c. The limits of the hydrographic survey are: Jacksonville Harbor, Cut-3 thru Terminal Channel, Cut-A, Cut-F & Cut-G. Take hydrographic cross-sections for the reaches listed below.

<i>Cut</i>	<i>Beginning Station</i>	<i>Ending Station</i>	<i>Azimuth</i>	<i>Sta. Interval</i>
3	0+00.00	300+00.00	96-53-41	100 feet
4	0+00.00	15+38.67	86-36-47	100 feet
5	0+00.00	13+58.23	66-17-49	100 feet
6	0+00.00	24+72.08	42-22-17	100 feet
7	0+00.00	28+21.83	21-18-33	100 feet
8	0+00.00	24+66.35	40-38-49	100 feet
9	0+00.00	24+23.63	65-36-03	100 feet
10	0+00.00	7+77.36	86-22-43	100 feet
11	0+00.00	6+08.86	98-23-01	100 feet
12	0+00.00	4+96.23	107-14-12	100 feet
13	0+00.00	18+14.83	116-51-38	100 feet
14/15	0+00.00	47+62.29	129-38-26	100 feet
16	0+00.00	13+31.28	120-17-44	100 feet
17	0+00.00	10+92.08	108-32-47	100 feet
18	0+00.00	8+98.59	91-46-22	100 feet
19	0+00.00	9+27.10	76-50-50	100 feet
39	0+00.00	36+57.85	60-42-50	100 feet
40	0+00.00	19+94.59	87-46-43	100 feet
41	0+00.00	29+54.53	114-28-25	100 feet
42	0+00.00	159+16.21	79-14-02	100 feet
43	0+00.00	21+57.00	112-50-00	100 feet
44	0+00.00	49+31.81	146-25-58	100 feet
45	0+00.00	40+47.22	136-44-10	100 feet
46	0+00.00	20+64.07	127-12-22	100 feet
47	0+00.00	14+95.67	107-30-00	100 feet
48	0+00.00	13+45.42	88-10-39	100 feet
49	0+00.00	20+41.57	68-43-49	100 feet
50	0+00.00	82+30.97	58-32-58	100 feet
51	0+00.00	58+57.42	16-40-20	100 feet
52	0+00.00	15+69.24	08-59-20	100 feet
53	0+00.00	12+92.85	342-49-45	100 feet
54	0+00.00	10+48.52	333-10-31	100 feet
55	0+00.00	40+11.32	309-07-42	100 feet
Term Ch	0+00.00	186+21.19	10-00-41	100 feet
A	0+00.00	53+10.21	161-45-23	100 feet
F	0+00.00	25+48.02	36-37-57	100 feet
G	0+00.00	149+36.21	17-11-17	100 feet

Coverage should extend a minimum of 200-feet outside channel limits, wideners, and turning basins in all directions. Ensure that lines extend sufficient distance to cover Coal Terminal and proposed settling basin (enclosure 2) which are both adjacent to Cut-42. Coverage in proposed settling basin should extend a minimum of 400-feet in all directions as shown on enclosure.

3d. Priorities are given for this project as follows:

1. Terminal Channel, from Sta. 164+56 to southern terminus.
2. Cut-42 to Sta. 164+56 of Terminal Channel.
3. Cut-14/15 to Cut-19.
4. Cuts A, F & G
5. Cut-19 to Cut-42
6. Bar Cut-3 to Cut-14/15.

Once a priority is completed, mapping should be done and submitted as stated above .

3g. NAVAIDS. All Navigation's Aids (NAVAIDS) shall be located with coordinate positions (GPS) in or adjacent project area. Fixed NAVAIIDS shall be positioned four to five times and floating NAVAIIDS shall be positioned one time, with wind and tide direction recorded. Note type and condition of NAVAIIDS within the project limits. Warning signs, lights, and any existing regulatory markers, (information signs) within the project limits shall be positioned four to five times. Locate all NAVAIIDS in the entrance channel.

3h. DGPS. The hydrographic positioning system shall be a Differential Global Positioning System utilizing the USCG Nav-beacon system as the reference station. The positioning system shall be checked with two control monuments and recorded along with setup data (input data to the GPS) in the field book. Hydrographic survey log sheets shall be filled out and submitted along with the field book.

3i. SOUNDING POLE 6" DISK. Utilize a 6 inch diameter disk attached to the bottom of the sounding pole or lead line at all times when collecting conventional soundings.

3j. Breakline. Breaklines shall be located for all natural or man-made features as needed. The breaklines shall be located with X, Y and Z and identified.

3k. DATA COLLECTION (TOTAL STATION). Data collection will be allowed for data points only, showing all instrument positions, calibration, backsites and closing readings in the field book.

4. DATA PROCESSING. The Contractor shall make the necessary computations to verify the correctness of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey. Compute and tabulate the horizontal and vertical positions on all work performed. Furnish X, Y, and Z points file for each profile line with descriptors shown for all land features located west of and including the monument at point collected, landward side (one file with land, one file with water, one with land and water data merged). Review and edit all field data for discrepancies before plotting the final drawings. Tabulate a list of the tide staff locations and bench mark designations used for the survey. Furnish ASCII X, Y, Z files with negative sign if elevation is negative.

5. CADD. The survey data shall be translated or digital capture into Intergraph IGDS 3D design files according to the specifications furnished. The survey data (cover, control, site plan, plan sheets, and section drawings) shall be provided in Intergraph MicroStation (PC or 32) Version 4.0 or higher, AT&T System V Unix, CLIX R3.1 Ver. 6.3.2 format as shown in the letter dated 30 September 1992.

5a. GLOBAL ORIGIN. The IGDS 3-D design file shall be prepared with a global origin of 0, 0, 2147483.65, Design file master units: FT., Sub units: 1,000, and positional units: 1. The file name shall be the survey number prefixed to an "A," i.e., A315.DGN. All reference file names shall commence with the A315 also.

5b. Digital Terrain Model (DTM) Data. The Contractor shall develop and deliver a surface model of the survey area using Intergraph compatible Digital Terrain Modeling software and the model file shall have the .dtm extension. The digital terrain model shall be developed from cross sections, spot elevations, and breaklines. Breaklines should include ridges, drainage, road edges, surface water boundaries, and other linear features implying a change in slope. The surface model shall be of adequate density and quality to produce a one foot contour interval derived from the original DTM (Digital Terrain Model) file. The contour data shall be incorporated as a reference file into the final data set. All data used to develop the DTM's shall be delivered in Intergraph 3-D design files.

5b1. Contours. The contours shall be developed in the digital terrain model (DTM). The contours shall be provided in one or more master data base DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods. Each contour shall be drawn sharp and clear as a continuous solid line, dashed contours are not acceptable. Every index contour shall be accentuated as a heavier line than the intermediate and shall be annotated according to its actual elevation above NGVD Whenever index contours are closer than one-quarter (1/4) inch, and the ground slope is uniform, the intermediate shall be omitted. Labeling or numbering of contours shall be placed on top of the contour line, so that the elevation is readily discernible, do not break contours. Labeling of intermediate contours may be required in areas of low relief.

5c. MODEL DGN FILES (SCALE 1:1). The overall hydrographic data (collected data points) shall be provided in one or more master DGN file attached as a reference file to all sheet files utilizing the clip bounds methods. The project depth (30, 34, 38, & 42-

foot) contours shall be provided in one or more master DGN file attached as a reference file to all sheet files utilizing the clip bounds methods. The control data points shall be provided in one or more master DGN file attached as a reference file to all sheet files utilizing the clip bounds methods.

5d. COVER AND CONTROL SHEET. The first sheet shall be a cover sheet showing the control sketch, survey control tabulation, sheet layout or index, legend, project location map, survey notes, north arrow, graphic scale, grid ticks, and large signature block. Tabulate, plot, and list the horizontal control used for the survey on the final drawings. In addition show a table on this sheet showing the X and Y coordinates, station and elevation for each point and monument.

5e. PLAN SHEETS. The plan sheets shall be prepared to a scale of 1"=100', in the Corps of Engineers format showing notes, title block, grid, north arrow, graphic scale, legend, sheet index, and D. O. File Number. The data shall be plotted at 12.5-foot intervals. The extreme right 7 inches of the sheet shall be left blank for notes, legends, etc. The second sheet and all sheets following shall be a continuation sheet and shall have a minimum of two notes, note 1: See Drawing number 1 for notes, note 2: Refer to Survey No. 99-315.

5f. Section Views. The sections shall be extracted and displayed from the digital terrain model (DTM OR TNT) utilizing INROADS OR INXPRESS. The sections shall be generated or extracted along the same azimuth as the section was collected in the field. The sections shall be displayed at a 10 to 1 vertical exaggeration. The planimetric lines (alignment of extraction), alignment, stations, and cross sections shall be displayed in one DGN file. Paper plots "**NOT REQUIRED**".

#### 6. Map Content.

6a. Coordinate Grid (NAD 83). Grid ticks (English) of the applicable State Plane Coordinate System shall be properly annotated at the top, bottom and both sides of each sheet. Spacing of the grid ticks shall be five (5) inches apart.

6b. Control. All horizontal and vertical ground control monuments shall be shown on the maps in plan and tabulated.

6c. Topography. The map shall contain all representable and specified topographic features, which are visible or identifiable.

6d. Spot Elevations. Spot elevations shall be shown on the maps in the proper position.

6e. Contours. The contours shall be developed in the digital terrain model (DTM). The contours shall be provided in one or more master data base DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods. Each contour shall be drawn sharp and clear as a continuous solid line, dashed contours are not acceptable. Every index contour shall be accentuated as a heavier line than the intermediate and shall be annotated according to its actual elevation above mean sea level. Whenever index contours are closer than one-quarter (1/4) inch, and the ground slope is uniform, the intermediate shall be omitted. Labeling or numbering of contours shall be placed on top of the contour line, so that the elevation is readily discernible, do not break contours. Labeling of intermediate contours may be required in areas of low relief.

6f. Map Edit and Accuracy. All names, labels, notes, and map information shall be checked for accuracy and completeness. All commercial buildings, roads and man made features shall be labeled with the type of construction, purpose and name. All residences shall be labeled with the type of construction. All mapping shall conform to the national map accuracy standards except that no dashed contour line will be accepted.

7. Office Review and Computations: The Contractor shall make the necessary computations to verify the correctness of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey. The contractor shall submit the original field notes and horizontal and vertical abstract (computation abstract) to Survey Section for final computation before mapping commences.

8. DELIVERIES: On completion, all data required shall be delivered or mailed to Design Branch, Survey Section at the address shown in contract, and shall be accompanied by a properly numbered, dated and signed letter or shipping form, in duplicate, listing the materials being transmitted. All costs of deliveries shall be borne by the Contractor. Items to be delivered include, but are not limited to the following:

8a. GPS network plan, (before GPS work commences).

8b. GPS raw data along with field observation log sheets filled out in field with all information and sketches.

8c. Computation files with Horizontal and Vertical abstracts along with any Q1 and Q2 files.

8d. Horizontal and Vertical Field Books.

8e. Furnish X, Y, and Z ASCII file for the longitudinal centerline.

8f. DTM Files (one overall and one per cut)

8g. DGN files. (scale 1" = 100')

8h. Plans plots at a scale of 1" = 1'00. 1 copy is requested with a contour shown inside channel at project depth. Project depth is 42-feet from Sta. 0+00 of Bar Cut-3 to Sta. 210+00 of Bar Cut-3, 38-feet from Sta. 210+00 of Bar Cut-3 to Sta. 164+56 of Terminal Channel, 34-feet from Sta. 164+56 of Terminal Channel to terminus of Terminal Channel, and 30-feet in Cut-A, F, G.

8i. Volumes: Perform necessary calculations to compute volume of material above project depth (plus 1 & 2-feet below) over surveyed area. Provide a spreadsheet showing computed results.

8j. Furnish a digital file using CORPSMET 95 (Metadata Software) with the appropriate data included.

8k. Raw Hypack Log Files.

Enclosures (withdrawn in example)

## 22-11. FFP and IDC Contract Pricing

A number of methods are used for scheduling hydrographic survey rates in a FFP contracts or IDCs. The three most common methods are (1) daily rate and (2) cost per work unit rate. The daily rate basis is the cost for a complete hydrographic field crew (including all instrumentation, transport, travel, and overhead) over a nominal 8-hr day. (Daily crew rates are derived from hourly labor and equipment rates. Either daily and/or hourly rates may be used in the IDC price schedule). The cost per work unit rate basis is effectively the daily rate divided by an average production rate for a specified item of survey work. Fixed rates can then be established for items such as river sections, overbank sections, 1,000-ft offshore cross sections, linear units (miles) of sounding, square units (square miles) of sounding, per traverse mile, or any other desired unit. Labor rate contracts may be based on either pricing method. Each of these unit pricing methods have advantages and drawbacks which need to be considered prior to determining which method to use.

*a. Daily rate.* This method is used on the vast majority of USACE contracts. It provides the most flexibility for IDC contracts, especially when individual project scopes are expected to vary widely. It is, therefore, considered a more accurate method of determining costs for individual task orders. One disadvantage is that a more detailed independent government estimate (IGE) must be developed for each task order placed against an IDC. The estimator must be thoroughly familiar with the project and survey procedures.

*b. Cost per work unit rate.* This unit price basis is by far the simplest to administer. It is, in effect, like a GSA Schedule catalogue that allows ordering of services based on simply computed quantities. If all task order projects have relatively constant scopes (i.e., project sites, surveying requirements, and access are similar), this method should yield similar costs to those of a daily rate basis. This pricing method assumes that hydrographic surveying productivity is constant (or will average out over the long term), regardless of project site constraints, weather, and other factors. This may or may not be a valid assumption. Unless such variations are accounted for in the price schedule, a modification to the basic contract may be required. Arriving at this rate basis requires an initial computation of the daily rate, then a determination of an average productivity rate for the field crew. Given all the project-dependent variables, development of average productivity rates is difficult and requires considerable expertise on the part of the government estimator. As a result, cost per work unit rate estimates tend to become worst-case costs that can be abnormally high in some instances. Consequently, work unit rates are rarely used in the Corps.

## 22-12. Preparing Independent Government Estimates for Hydrographic Survey Services

To develop the price schedule for either FFP contracts or IDC contracts, an independent government estimate (IGE) must be prepared for all technical disciplines, equipment, instrumentation, plant, travel, and other items that will be used in the contract. For a FFP contract, the total of all these individual cost items is used to arrive at an overall project (contract) cost, and forms the basis for negotiating with the contractor. For IDC contracts, individual line items on the price schedule are estimated and negotiated with the contractor, and make up the contract schedule of prices. This IDC schedule is then used for Task Order labor and equipment rates. The daily (or hourly) rate for a surveying crew may be estimated using the following outline. Other breakdowns may be employed to arrive at a cost per crew day, per crew hour, or per unit of work. The crew personnel size, floating plant, depth recorders, data processing systems, vehicles, etc., must be explicitly indicated in the draft contract specifications, with differences resolved during negotiations. Options to add additional specialized survey equipment (along with personnel and/or transport) must be accounted for in the estimate and unit price schedule. A contractor's cost proposal should follow the same general format used by the government's IGE, if possible.

- I. Direct labor. Labor or salary costs of survey technicians, including applicable overtime or other differentials necessitated by the work schedule.
- II. Overhead on direct labor.
- III. General and Administrative (G&A) overhead costs.
- IV. Material costs. Include drafting supplies, field books, etc.
- V. Travel and transportation costs. Crews' travel, per diem, etc., which includes all associated costs of vehicles used to transport personnel and floating plant to/and from the job site.
- VI. Other costs. Include floating plant costs and cost of survey equipment and instrumentation, such as hydrographic positioning systems and depth recorders. Instrumentation and equipment costs should be amortized down to a daily rate, based on average utilization rates, expected life, etc. Exclude any instrumentation and plant costs covered under General and Administrative (G&A) accounts--interest, maintenance contracts, etc.
- VII. Profit. (For IDC profit is either factored in the unit prices or computed separately for each task order).

### **22-13. Estimating Daily Unit Cost Rates for Indefinite Delivery Contracts**

Most IDC for hydrographic survey services contain price schedules for the major line items that will be used in subsequent task orders. These line items may be broken out by individual labor and equipment and/or combined for a fully equipped survey crew. The method used is dependent on local preference or use. Most USACE commands tend to compute the daily rate for a complete survey crew and make minor adjustments to that rate, depending on the unique task order scope. Plant and equipment rental rates can represent the major cost item on a hydrographic survey team, especially if the automated survey instrumentation is factored into this rate. Often the plant rental costs far exceed survey crew labor costs. Daily costs for a survey vessel in the 40- to 65-ft-long range can run between \$1,500 and \$5,000 per day (1999 dollars). Smaller launches (18 ft to 26 ft) are far less--typically \$300 to \$1,000 per day. Labor costs for survey crew personnel usually range between \$500 and \$2,000 per day, depending on number of party members, complexity of equipment operated, and geographical area. Thus, a fully automated hydrographic survey team can cost between \$800 and \$7,000 per day to field. In preparing an IGE, unit costs may be determined from a variety of internal or external cost sources--see EP 715-1-7.

*a. Labor rates.* Field crew personnel costs include direct labor, fringe benefits, and G&A overhead costs. Estimates of labor rates may be obtained from a variety of publications that detail rates by geographical area--see EP 715-1-7. Equivalent General Schedule rates may also be used in estimating labor rates if they are representative of the private sector in the locality where the work is performed.

*b. Travel costs.* Normally, travel costs are computed for each job based on the current Joint Travel Regulation rates. Vehicle costs may be included under this category or computed under "Other Costs."

*c. Other costs.*

(1) Floating plant rental rates. The costs of comparable Corps-owned plant may be used in arriving at an IGE for contracted work. Commercial vessel rental rates may also be used. In the Corps, the daily plant rental and survey equipment rental rates are developed at the time of purchase and are periodically

updated based on actual utilization rates as charged against projects. Plant rental rates are recomputed at least annually, or more often if utilization changes significantly. Various Plant Replacement and Improvement Program (PRIP) costs make up this expense; however, such accounting methods are not used by private contractors. In addition, vessel operator labor rates are often incorporated into the plant rental rate. Corps field survey crew labor costs are separate expense items that may be used for comparable estimates.

(2) Survey instrumentation and equipment. survey equipment--particularly major items such as multibeam systems, CADD stations, or side scan--are often broken out separately in the contract price schedule. Costs for each equipment item are reduced to a daily rate based on original purchase cost, depreciation, estimated annual utilization, operation and maintenance (O&M), and other factors. Associated costs, such as insurance, maintenance contracts, and interest, are presumed to be indirectly factored into a firm's G&A overhead account. If not, such costs must be directly added to the basic equipment depreciation rates shown. Other equally acceptable methods for developing daily costs of equipment may also be used, such as manufacturer or third-party vendor daily/monthly rental rates. Equipment utilization and life cycle estimates do represent a large variable in an IGE. Typically the IGE is subsequently revised (during negotiations), based on actual rates as determined from the contractor's proposal and from detailed cost analysis and field price support audits.

The following example depicts a unit price IGE computation for a hydrographic survey crew equipped for multibeam and side scan surveys. Either the total (fully equipped) crew day rate or the rates for some selected items may be used for negotiating the final price schedule ("Schedule B") in a hydrographic survey services IDC. Similar computations would be performed for other major line items that would be included in the IDC, e.g., Project Manager, CADD Workstation Operator, Drafter, Hardware/software, etc.

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**SAMPLE IGE COMPUTATION FOR 3-MAN MULTIBEAM/SIDESCAN SURVEY CREW**

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**LABOR**

Supervisory Survey Tech (Party Chief)	\$42,776.00/yr (based on GS 11/5)	
Multibeam Operator		
Overhead on Direct Labor (36%)	\$15,399.36/yr	
G&A Overhead (115%)	<u>\$49,192.40/yr</u>	
Total:	\$107,367.76/yr	\$411.57/day
Survey Technician	\$35,355/yr (based on GS 9/5)	
@ 151% O/H (36%+115%)	\$88,741.05	\$340.17/day
Survey Aid/Boat Operator	\$23,332/yr (based on GS 5/5)	
@ 151 % O/H	\$58,563.32	\$224.49/day

Total Labor Cost for 3-Man Multibeam Crew/day: **\$976.23**

**TRAVEL**

Per Diem (Nominal): 3 @ \$ 88/day  
(subject to JTR adjustment on task orders)

Total Travel Cost/day: **\$264.00**

**PLANT, FLOATING**

Survey Vessel 32-foot:  
\$100,000 @ 5 yrs @ 100 d/yr      \$ 200/day  
Fuel, O&M, etc                      \$ 25/day

Total Plant Cost/day: **\$ 225.00**

**SURVEY INSTRUMENTATION & EQUIPMENT**

Echo Sounder (DESO) \$30,000 @ 5 yrs @ 50 d/yr	\$120/day
DGPS Carrier Phase Positioning Sys \$120,000 @ 4 yrs @ 100 d/yr	\$300/day
INS RPH Motion sensor \$35,000 @ 5 yrs @ 100 d/yr	\$ 70/day
Multibeam System (complete) \$250,000 @ 5 yrs @ 100 d/y	\$500/day
Side Scan Sonar (complete system) \$75,000 @ 5 yrs @150 d/yr	\$100/day
Total Station (RTK), rods, etc. \$32,000 @ 5 yrs @ 120 d/yr (rental rate: \$60/d)	\$ 53/day
Tide Gage, Auto Telemetry (Manufacturer rental rate)	\$ 22/day
Survey Vehicle \$40,000 @ 6 yrs @ 225 d/yr plus O&M	\$ 40/day
Misc Materials (field books, survey supplies, etc)	\$ 25/day

Total Instrumentation & Equipment Cost/day: **\$ 1,230.00**

Subtotal : \$ 2,695.23  
Profit @ 10.0% \$ 269.52

Total Estimated Cost per Day -- 3 man Multibeam/Side Scan Survey Crew **\$ 2,964.75**

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**22-14. Contract Price Schedule**

The various personnel, plant and equipment cost estimates like those shown in the sample IGE above are used as a basis for negotiating fees for individual line items in the basic FFP or IDC contract. During negotiations with the A-E contractor, individual components of the IGE and the contractor's price proposal may be compared and discussed. Differences would be resolved in order to arrive at a fair and reasonable price for each line item. Computations similar to those shown in the above example would be performed for auxiliary home office direct support functions (e.g., drafter, CADD operator, etc.). The contract may also schedule unit prices based on variable crew sizes and/or equipment and may include non-hydrographic survey functions such as control surveys. A typical negotiated IDC price schedule (i.e., Section B - supplies or services and prices/costs) is shown below. This sample contract schedule is representative of those line items that might be used in a IDC covering Florida and the Caribbean area. Each Corps district has its unique requirements and therefore line items used in schedules will vary considerably. The contract specifications would contain the personnel and equipment requirements for each line item.

**CONTRACT SCHEDULE B--HYDROGRAPHIC SURVEYING SERVICES  
INDEFINITE DELIVERY CONTRACT**

ITEM	DESCRIPTION	UNIT OF MEASURE	UNIT PRICE
1001	4-Man Topographic Survey Party	CD	\$ 885.00
1002	5-Man Hydro Survey Party w/boat	CD	\$1,382.00
1002a	4-Man Hydro Survey Party w/boat	CD	\$1,200.00
1002b	3-Man Hydro Survey Party w/boat	CD	\$1,000.00
1002c	2-Man Hydro Survey Party w/boat	CD	\$ 784.00
1003	Survey Aid	CD	\$ 144.00
1004	Per Diem (Florida)	MD	\$ 78.00
1005	Project Manager	MD	\$ 335.00
1006a	Project Manager (Per Diem-Florida)	MD	\$ 78.00
1007	CADD Operator/Draftsman	MD	\$ 300.00
1008	Computer (Person)	MD	\$ 238.00
1011	Establish Control Monument	EA	\$ 25.00
1012b	Extra Vehicle	DY	\$ 100.00
1013	Air Boat (Florida w/operator)	DY	\$ 130.00
1014	Marsh Buggy (Florida w/operator)	DY	\$ 160.00
1016	Side Scan w/Operator	HR	\$ 120.00
1018	Multibeam w/Operator	HR	\$ 130.00
1019	Magnetometer w/Operator	HR	\$ 120.00

NOTES:

Abbreviations: CD = Calendar Day MD = Man Day DY = Day EA = Each HR = Hour  
Prices include overhead and profit.

**22-15. Task Order Time and Cost Estimates**

Once unit prices have been negotiated and established in the basic IDC schedule as illustrated in the above sections, each IDC task order is negotiated primarily for effort, i.e., time. The process for estimating the time to perform any particular survey function in a given project is highly dependent on the knowledge and personal field experience of the government and contractor estimators. The negotiated fee on a task order is then a straight mathematical procedure of multiplying the agreed-upon effort against the established unit prices, plus an allowance for profit if not included in the unit rates. An IGE is required for task orders over \$100,000, along with a detailed profit computation, documented records of negotiations, etc. The scope is attached to a DD 1155 order placed against the basic contract. If a preliminary site investigation is scheduled for this project, any such adjustments should be investigated and resolved prior to negotiating subsequent task

orders for the various phases of the work, to the maximum extent possible. As such, the negotiated costs for the subsequent work phases would be considered fixed price agreements. Any later adjustments to these agreed to prices would be issued in the form of modifications to task orders (i.e., change orders), and would have to be rigorously defended as significant, unforeseen changes in the scope. The contractor would be expected to immediately notify the contracting officer (KO) or Contracting Officer's Technical Representative (COTR) of the need for cost adjustments.

The example below illustrates a time and cost IGE for a task order under an IDC using the unit prices taken from the sample contract schedule in paragraph 22-14. The contractor's proposal for this work would follow a similar process. Subsequent Task Order negotiations would primarily focus on significant differences in time estimates for the various phases of the work. This assumes the scope of work is clearly defined in the Request for Proposal. Uncertain scopes would have to be resolved during negotiations and the IGE amended accordingly.

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**Sample Task Order Time and Cost Estimate--Multibeam, Tag Line, and Side Scan Surveys at OCONUS Location--for Dredging Contract Plans & Specifications**

Preliminary Site Investigation and Inspection. A separate task order will be issued for the contractor's Project Manager to accompany the government COTR to the project site, to perform a general reconnaissance, recover control, select tide gage location, obtain berthing and fuel access, etc; and refine estimates of the time and cost to perform the subsequent phases of the work. A five-day trip is estimated, including travel time; allowing over 3 days in country.

Project Manager (1005)	\$ 355.00/MD	
Per Diem-OCONUS (1006b)	\$ 110.00	
Vehicle (1012b)	<u>\$ 100.00</u>	
	\$ 565.00/MD	
5-days @ \$565.00/MD		\$2,825.00
R/T Air Fare		<u>\$1,200.00</u>
	<u>Total Estimated Cost:</u>	<u>\$4,025.00</u>

Geodetic Control Surveys. Geodetic control surveys are performed by the 5-man hydrographic survey crew as the initial phase of work after arrival in country. The full hydrographic survey crew rate (computed later) is charged since this equipment is on location. Data are reduced/computed in field by the survey crew.

<u>Time estimates:</u>		
Observe primary baseline & set control point (includes absolute PLGR observations)	0.5 DY	
Observe supplementary control (calibration point tag line control, etc.)	1.0 DY	
Establish tag line baselines along piers	<u>1.5 DY</u>	
	3.0 DY	
3.0 Days @ \$3,199/CD		<u>\$9,597.00</u>

Vertical Control Surveys and Tidal Gaging. Concurrent with the geodetic control surveys, a tide gage and staff is established the 5-man hydrographic survey crew as the initial phase of work after arrival in country. The full hydrographic survey crew rate is charged since this equipment is on location. The field crew computes preliminary tidal datums.

<u>Time/cost estimates:</u>		
Construct & establish tide gage at CG pier: (set benchmarks, staffs, run levels, etc.)	1.5 DY	
1.5 Days @ \$3,199/CD		\$4,798.50
Recording tide gage rental rate (project)		\$2,000.00
Set horiz/vert monuments 6 @ \$25 ea		\$ 150.00
Final tidal computations/analysis (office)		
2.0 Days @ 238.00/DY (1008)		<u>\$ 476.00</u>
	Total:	<u>\$7,424.50</u>

Alternate Option--Combine Site Inspection and Control Surveys. The site inspection and horizontal & vertical control surveys could be performed in advance of and independent from the hydrographic phase, by an advance 3-man topographic team which includes the Project Manager. Total estimated cost for this option is \$15,437--a savings of \$5,770 over the proposed estimate.

Multibeam and Side Scan Surveys for Charting/Plans & Specifications. This represents the major line item of work. Crew transport and vessel mob/demob to OCONUS are included as fixed line items to this estimate.

(1) Daily Rate Computation. The cost of a multibeam/side scan survey crew is taken directly from the fixed negotiated rates in the IDC contract schedule, and modified as needed for the particular project. The final crew day (CD) rate will be used to estimate all work phases. The field survey crew is comprised of 5 individuals: (1) Boat Operator, (2) Hydrographer/Party Chief, (3) Survey Computer/CADD Operator, (4) Multibeam/Side Scan Operator, and (5) a Survey Helper (shore-based DGPS & tide gage operator).

<u>5-Man Hydro Survey Party (1001)</u>	\$1,382.00
- less 2-survey helpers @ \$144 ea (1003)	(\$ 288.00)
- add Multibeam/Side Scan Sys w/oper use higher Multibeam rate (1018) for either system --\$130/hr	\$ 1,040.00
-add field CADD Oper/Surv Comp (use 1007)	\$ 300.00
-add DGPS Sys- 2 units (1015)	\$ 205.00
-add Per Diem (OCONUS) 5 persons @ \$112 ea	<u>\$ 560.00</u>
Total Daily Rate:	<u>\$ 3,199.00</u>

(2) Multibeam Coverage Estimate. The estimated amount of lineal multibeam survey coverage was estimated using average depths for various sections of the project area; from which average multibeam line spacings and lineal coverages (in km) were estimated based on maximum allowable multibeam swath coverage limits--see Appendix \* to this estimate. An additional 10% was added for turns and other lost time plus 5% for cross-check lines. From Appendix \*, estimated lineal multibeam track is:

Area A:	400 Km
Area B:	140 Km
Area C:	<u>75 Km</u>
Total:	615 Km

Estimated time (CD) to perform work:

615 Km @ 8 Km/hr @ 6 hr/DY = 12.8 CD --

Add 2 additional days for contingencies -- Use 15 CD

(6 hr/DY is assumed effective production in a typical 8 to 10 hr day--less calibration, fueling, etc)

Total Estimated Cost for Multibeam Surveys (field ops):15 CD @ \$3,199/DY: \$47,985.00

(3) Side Scan Sonar Surveys. Based on an effective line spacing of 80 meters, and a speed of 9 Km/hr to obtain 1-meter resolution, the estimated time to obtain 200% side scan coverage of the project area is 10 days--see Appendix \* to this estimate for detailed computations.

Estimated Field Cost: 10 DY @ \$3,199/CD = \$31,990.00

Offshore Navigational Aid Location. Locate approximately 20 offshore floating aids, daymarks, etc.; positioned to hydrographic survey accuracy levels:

1 DY @ \$3,199/CD: \$3,199.00

h. Geotechnical Investigation, Bottom Samples and/or Probing. Obtain dry probings and samples at approximately 10 locations in proposed navigation channel.

2 DY @ 3,199.00/CD: \$6,398.00

i. Port Facility Surveys (Tag Line). Approximately 1,200 meters of baseline needed to cover the two existing piers indicated in the attached drawings (south face of north dock and both sides of southerly pier). Hubs marked at 20 m increments, or approximately 60 tagline points.

Set baselines, mark hubs, topo , etc:	1.5 days
Tagline 10 to 25 meters off bulkhead at 5 m increments:	<u>2 days</u>
Total:	3.5 days

Est Cost: 3.5 days @ \$3,199/CD: \$11,196.50

Disposal Area Surveys. Assuming single beam coverage at 25 meter spacing (worst case), survey time is estimated at:

1000/25 +1 = 41 lines; 41 lines @ 1200 m ea = 49.2 Km  
49.2 + 10% (turns/reruns) = 55 Km  
55 Km / 10 Km/hr = 5.5 hr .... use 1 Day

1 DY @ \$3,199/CD = \$3,199.00

Travel, Mobilization & Demobilization.

Crew Travel: R/T Air Fare CONUS - OCONUS	
5 persons @ \$1,200 ea	\$ 6,000.00
Survey Vessel Mob/Demob--barge shipment from SE CONUS to OCONUS	\$20,000.00
Mob/demob crew prep, labor, outfitting, etc 5 @ \$3,199	<u>\$15,995.00</u>
Total:	<u>\$41,995.00</u>

Office Data Reduction, Processing, Plotting. Includes all phases of work, such as preparing final smooth sheets (2 ea), plans & specifications drawings (7 ea), final track plots (2 ea), swath coverage plots (2 ea), side scan coverage plots (2 ea), digital plot files, final descriptive reports, etc. Note that a significant portion of this work will be performed in the field given a CADD operator is assigned to the crew to perform these activities. USACE data processing requirements represent only 15% of the total costs, given extensive data and report documentation required under the Chart Update phases of the work. Most of this effort is billed at the skilled CADD technician rate (\$300/DY).

Survey computer (1008): 10 days @ \$238/DY	\$ 2,380.00
CADD Operator (1007): 80 days @ \$300/DY	<u>\$24,000.00</u>
Total:	<u>\$26,380.00</u>

Estimated Quantity Computations. Office survey computer time to prepare templates and compute dredged quantity estimates for various channel alignments/depths:

Survey Computer (1008): 5 days @ \$238/DY	<u>\$ 1,190.00</u>
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Project Manager Supervision & Inspection (Office). Licensed Project Manager periodic inspection and review of office data processing, plotting, computations, quantity computations, final reports, submittal activities, etc. Does not include normal supervision which is already in G&A overhead.

Proj Mgr (1005): 20 DY @ \$355.00	<u>\$ 7,100.00</u>
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Topographic Mapping and Shoreline Surveys. Not applicable. DMA/NIMA data added during office CADD processing phase.

Total Cost Summary--Phase I

Prelim Site Invest & Insp	\$ 4,025.00
Geodetic Control Survey	\$ 9,757.00
Vert Cont & Tide Gaging	\$ 7,424.50
Multibeam Surveys	\$47,985.00
Side Scan Surveys	\$31,990.00
NAVAID location	\$ 3,199.00
Geotech Invest	\$ 6,398.00
Tagline & Pier Topo Surveys	\$11,196.50
Disposal Area Surveys	\$ 3,199.00
Mob/Demob/Travel	\$41,995.00
Office Data Processing	\$26,380.00
Quantity Comps	\$ 1,190.00
S & A	\$ 7,100.00
Topo Mapping/Shoreline	<u>N/A</u>
Total Estimated Cost:	<u>\$201,839.00</u>

## 22-16. Firm Fixed Price Contract Price Schedule

FFP contracts for hydrographic survey services require similar IGE and A-E contractor time and cost computations as those shown above for IDC task order rates and times. Typically, for a FFP contract, costs are reduced to a daily rate for field survey effort and hourly rates for office supervision and data processing disciplines. Given the estimated/negotiated quantities for each phase of work by line item, the lump sum job cost is arrived at. The following example depicts a final negotiated price schedule for a FFP contract where the unit price contains all overheads and profits.

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### Sample Firm Fixed Price Contract Schedule -- Dredging Measurement & Payment Support Surveys

Item	Quantity	Unit	Unit Price (\$)	Total (\$)
Single Beam Surveys:				
Labor	660	CD	3,464.35	2,286,471.00
Survey Vessel	660	Days	761.20	502,392.00
Equipment-Office	660	Days	227.70	150,282.00
Direct Costs	660	Days	132.71	87,588.60
Multibeam Surveys:				
Mobilization	660	Days	20.76	13,701.60
System	660	Days	920.70	607,662.00
Side Scan Sonar:				
900,000 sq m	1	Job	16,025.00	16,025.00
2,500 sq m	4	Job	5,342.00	21,368.00
Aerial Photography (Upland Disposal Area)	30	ea	1,661.00	<u>49,830.00</u>
Total Cost (Project)				<b>\$3,735,320.20</b>

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## 22-17. Cost Per Work Unit Schedule

If a cost-per-work-unit fee structure is desired on an IDC, the computed daily/hourly crew rates and other applicable cost items can be divided by the estimated daily/hourly productivity in order to schedule work units. Typical work unit measures are cross-section, coverage area, lineal miles of sounding, and deliverable drawing/sheet. Both the estimated crew daily rate and the estimated productivity rates are subject to negotiation. An infinite number of work unit measures could be formed, given the variety in units of measure, survey classifications, expected local conditions, etc. Use of work unit rates is obviously restricted to individual project areas where work is fairly repetitious, e.g., dredging measurement & payment cross sections, beach renourishment sections. The following example illustrates how a cost per unit of work schedule can be developed for a typical dredging survey.

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**Example Computation of a Cost per Cross-Section Rate**

Daily Crew Rate (Labor+ O/H+Plant+Equipment)	\$2,964.74
Office Data Processing:	
CADD Operator	
2.25 days processing for each survey day	
\$485.00/d (labor incl G&A) @ 2.25 d	\$1,091.25
Office Equipment (CADD, Printers, Software, etc)	
\$59.00/d @ 2.25 d	\$ 132.75
Project Management	
\$600.00/d (labor & G&A) @ 0.2 d	<u>\$ 120.00</u>
	Subtotal: \$4,308.74
	Profit (10%): <u>\$ 430.87</u>
 Total Estimated Cost per Day:	 \$4,739.61
 Estimated daily productivity: 35 channel cross sections per day	
 Unit Rate per Cross Section: \$4,739.61/35 sections =	 \$135.42/Section

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Cross sections would be itemized in the IDC contract schedule at the above rate. A task order for an After Dredge acceptance section of 30 defined cross sections could then simply be issued for \$4,066.60 (30 @ \$135.42)--eliminating any need for a detailed IGE.

## **22-18. Labor Hour Contracts for Surveying Services**

Fixed-price task orders under IDC are effectively used to provide a substantial amount of surveying and mapping services in USACE. However, fixed-price task orders are not usually appropriate for quality assurance and payment surveys of ongoing dredging and construction projects since the duration of the survey work is not within the control of the survey contractor. The surveyor contractor's progress is dependent on the progress of the dredging or construction contractor, which in turn, depends on weather, equipment malfunctions, unforeseen site conditions, material availability, labor problems, and many other factors. In such cases, a labor-hour task order is a very useful contracting mechanism. Labor-hour contracts (guidance also applicable to task orders) are covered in Federal Acquisition Regulation (FAR) Subpart 16.6. Labor-hour task orders are appropriate when the uncertainties involved in contract performance do not permit costs to be anticipated with sufficient accuracy or confidence to use a fixed-price task order. The contractor is required to apply its best efforts, but is not obligated to complete the assigned work within the contract ceiling price. Hence, a higher level of surveillance is required by the Government to ensure the contractor is performing as efficiently as possible. No special approvals are required to use labor-hour task orders, but the contracting officer must execute a determination and findings for the contract file explaining why a fixed-price order was not suitable. There is no true negotiation, but rather an agreement on a realistic ceiling price considering the most likely conditions. All hourly costs for personnel and equipment (including overhead and profit) are already established in the contract. The Government buys a certain amount of effort and has considerable control over how that effort is expended toward completion of the specified task. The Government can direct the contractor to start, pause and stop work, within reasonable limitations. However, the Government bears the cost for disruptions in work. A labor-hour task order has the flexibility to follow

the progress of the dredging or construction, without unfairly holding the survey contractor to a fixed price. The most cost-effective situation is where there is more than one project in the same area that can be surveyed using one task order. If there is a delay on one project, the survey crew can relocate to another project and resume work with minimal lost time. The following is an example of a Labor Hour task order scope:

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### LABOR HOUR TASK ORDER

Furnish all personnel, plant, equipment, transportation and materials necessary to perform, process and deliver the survey data described herein for dredging payment surveys in the following work areas in accordance with the general instructions and conditions set forth in Contract DACWXX-XX-D-XXXX:

- [List projects or work areas. Attach marked-up maps if needed. Describe work.]

Since it is not possible to accurately estimate the extent or duration of this work, this order will be issued on an estimated, not-to-exceed basis. The estimated quantities and ceiling price in accordance with the established contract rate schedule are as follows:

3-Person survey crew @ \$[____]/hour x [____] hours:	\$ _____
Project manager @ \$[____]/hour x [____] hours:	\$ _____
Ceiling price:	\$ _____

It is estimated that this work will begin about [\_\_(date)\_\_] and be completed about [\_\_(date)\_\_]. The contracting officer's representative (COR) at the [\_\_\_\_\_] Project Office will advise the contractor at least [\_\_\_\_] hours in advance of when work must begin. The contractor may be directed to stop work at any time due to circumstances beyond the Government's control. If work is stopped at a work area, the contractor may be directed to relocate and start (or continue) work at one of the other work areas covered by this order, or to demobilize and return to the contractor's office. The contractor will be compensated at the hourly contract crew rate while stopped, relocating to another work area, demobilizing, or remobilizing (if required). There will be no compensation while the contractor is demobilized. The COR will advise the contractor at least [\_\_\_\_] hours in advance of when the contractor must remobilize and resume work.

The contractor will prosecute the work diligently and efficiently under the general direction and oversight of the COR. The contractor will provide a daily report, describing the work performed and hours worked, to the COR for certification. The daily reports will be used by the contractor to prepare monthly payment vouchers. With each monthly payment voucher, the contractor will estimate monthly and total earnings in the succeeding month, expressed both as total dollars and a percentage of the ceiling price.

The contractor will immediately notify the COR in writing when total estimated earnings reach 85 percent of the ceiling price. Also, if at any time the contractor projects that the total estimated earnings to complete the work will exceed the ceiling price, the contractor will promptly notify the COR and give a revised estimated total price with supporting reasons and documentation. The contracting officer will increase the ceiling price in writing if warranted or limit the work so as to remain within the current ceiling price. Exceeding the ceiling price is at the contractor's own risk.

[Insert technical requirements and deliverables.]

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### 22-19. Verification of Contractor Cost or Pricing

Regardless of the contract price method used, it is essential (but not always required) that a cost analysis, price analysis, and field pricing support audit be employed to verify all cost or pricing data submitted by a contractor, particularly major cost items such as equipment and plant. Actual utilization rates and reduced

costs per day must be verified. Some operation and maintenance costs may be directly charged, or portions may be indirectly included in a firm's G&A overhead account. In some instances, a firm may lease/rent survey instrumentation (e.g., multibeam systems) or plant equipment in lieu of purchase. Current rental rates average 10 to 15 percent per month of the purchase cost. Rental would be economically justified only on limited-scope projects and if the equipment is deployed on a full-time basis. Whether the equipment is rented or purchased, the primary (and most variable) factor is the equipment's actual utilization rate, or number of actual billing days to clients over a year. Only a detailed audit and cost analysis can establish such rates and justify modifications to the usually rough assumptions used in the IGE. In addition, an audit will establish any nonproductive labor/costs, which are transferred to a contractor's G&A. Given the variable equipment costs and utilization rates in hydrographic surveying, failure to perform a detailed cost analysis and field pricing support audit on contracted hydrographic services will make the IGE difficult to substantiate.

## **22-20. Contract Quality Control and Quality Assurance**

Under the Corps professional contracting system, contractors are responsible for performing all quality control (QC) activities associated with their work. The Corps is responsible for quality assurance (QA) oversight of the contractor's QC actions. Therefore, Corps QA or testing functions should be focused on whether the contractor meets the required performance specification (e.g., depth accuracy), and not the intermediate surveying or compilation steps performed by the contractor. As a result, for surveys procured using the Brooks A-E Act qualifications-based selection method, Corps representatives are not stationed aboard contractor survey vessels to observe work in progress (i.e., perform QC activities)--the contractor was selected as being technically qualified to perform the work; including all QC associated with it. Corps-performed field testing of a contractor's work is an optional QA requirement, and should be performed only when technically and economically justified. Such Corps testing of a contractor's hydrographic survey data submittal rarely occurs in practice.

## **22-21. Contractor Performance and Responsibility**

*a.* All surveying firms awarded contracts by the Corps are given official performance evaluations at the end of the contract period. These performance evaluations are maintained in a centralized Department of Defense (DOD) data base (at the Corps Portland District) for a period of six years. Performance evaluations contain both overall ratings (exceptional to unsatisfactory) and narrative comments on specific items that reflect on contractor performance. Adverse narrative comments typically focus around late deliveries, although poor quality of work may also be covered. These performance ratings are used by Corps and other Federal agencies when evaluating prospective A-E contractors. An unsatisfactory or marginal rating in this system can often preclude selection on future contracts; thus, an rebuttal process has been established for firms to protest less than satisfactory ratings.

*b.* A-E contracts contain a standard responsibility clause to cover deficiencies and other like problems. This clause is applicable to hydrographic surveyors and reads in part:

"Responsibility of the Architect-Engineer Contractor (Federal Acquisition Regulation 52.236-23): The Contractor shall be responsible for the professional quality, technical accuracy, and the coordination of all designs, drawings, specifications, and other services. ... The Contractor shall, without additional compensation, correct or revise any errors or deficiencies in its ... drawings ... and other services. ... Neither the Government's review, approval, or acceptance of, nor payment for, the services under this contract ... shall be construed to operate as a waiver of any rights ... the Contractor shall be and remain liable to the Government ... for all damages to the Government caused by the Contractor's negligent performance of any of the services furnished under the contract."

c. The above "liability" clause clearly provides that a surveyor is responsible for the technical adequacy and accuracy of his work. It also obliges the firm to correct or revise any errors or deficiencies without charge. It also provides that the firm may be liable for all damages caused by negligent performance.

d. The vast majority of errors/omissions are readily corrected by the contractor without invoking this formal clause. This clause is invoked primarily for design defects discovered during construction. Failure to readily correct errors/omissions is usually reflected in an adverse Performance Evaluation, which obviously will impact future selections. Thus the contractor has special incentive to correct any deficiencies as rapidly as possible. This may involve resurveying an entire area.

e. In assessing liability, the key word is "negligent" performance. A hydrographic surveyor (either government employee or contractor) is not considered "negligent" if they performed the work using the ordinary skill, knowledge, and judgment ordinarily possessed by members of the profession; and that reasonable and ordinary care and diligence was used in performing the work. In addition, the level of government supervision, inspection, and review is a factor. Excessive Corps inspection and review will, in effect, transfer risk (liability) from the contractor to the Government. For example: A contractor is directed by the Corps scope of work to run channel cross-sections at a specific 200-foot spacing using a single beam echo-sounder. Should an undetected rock falling between these sections later cause significant damage to a passing vessel and/or the environment, the contractor could not be held negligent for this event (or subsequent damages) if he followed recognized technical standards for this work. Even if a full-bottom multi-beam or side scan survey had been performed over this area, and the rock was missed, negligence would still be difficult to substantiate if the contractor performed the work with ordinary and customary skill, diligence, and care--comparable to that of any other government or private surveyor.

f. An A-E firm is liable to correct the work due to an error or omission, and to pay for any additional cost to the government for implementing these corrections. Additional costs are those in excess of what they would have been had the work been performed correctly. For example: A contractor performs a survey that is later used in contract plans and specifications. After the dredging contract is awarded, it is discovered the survey contained a constant 1-foot (0.3 m) error due to incorrect (i.e., "negligent") setting of the tide gage, causing a 30% overage error in the estimated quantities for the project, ultimately causing the dredge contractor to under-bid the job. The dredging contractor files a claim and successfully negotiates a higher unit price due to this quantity error. The original survey contractor could not be held liable for the difference in unit price because had the contract been advertised with the correct (i.e., reduced) estimated quantities, a higher bid rate would have been anticipated. However, the surveyor would be liable for government expenses incurred in negotiating these construction changes. Had a survey error caused over placement of material in a disposal area, and this material had to be later removed, then the survey contractor would be responsible for all this excess effort. In cases such as these, it behooves the A-E contractor to work closely with the construction contractor in order to minimize losses. A-E contractors carry "errors and omissions" insurance to cover these situations--usually with a substantial deductible. Surveying firms usually carry only about \$500,000 in coverage--e.g., to cover constructing a house on an incorrectly staked-out lot. Thus, such insurance is meaningless in the case of a \$500 million oil spill event. The government, in effect, holds the ultimate liability.

g. Instances of actual A-E liability due to erroneous surveys are rare--especially in offshore construction/dredging work. Errors and omissions are usually caught and corrected well before construction. Most problems of this nature involve topographic site plan drawings for construction, where underground utility features are "missed" by the surveyor. Both Corps crews and contractor survey crews are equally susceptible to errors and omissions.

## **22-22. Mandatory Requirements**

There are no mandatory technical requirements contained in this chapter. Mandatory requirements associated with A-E contracting are contained in applicable procurement regulations.