Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
F00699_MB_50cm_MLLW	CUBE	0.5 meters	2.47 meters – 19.28 meters	NOAA_50cm	Object Detection Coverage
F00699_MB_50cm_MLLW_Final	CUBE	0.5 meters	2.47 meters – 19.28 meters	NOAA_50cm	Finalized Object Detection Coverage

Table 5: F00699 submitted surfaces

G. Vertical and Horizontal Control

The vertical datum for this project is Mean Lower Low Water (MLLW) determined through Elipsoidally Referenced Survey (ERS) methods and the application of VDatum.

Real-time kinematic (RTK) correctors were acquired during acquisition via the Texas Department of Transportation's (TX DOT) Real Time Network (RTN) to allow for instantaneous MLLW water level values for soundings using NOAA's VDatum model toolset. TX DOT granted DEA a temporary emergency RTN license to support the survey effort. RTK correctors from TX DOT were input into a secondary GPS receiver installed directly over the vessel reference point. This receiver provided vertical control and allowed for real time corrections in Hypack when using Geoid12b and the NOAA VDatum model. Primary positioning used differential GPS, which was fed directly in the Applanix POS/MV. All previously submitted data products used ERS methods for the water level corrections.

These data use ERS and the NOAA VDatum model (LATXwest01_8301) which allowed for real-time tide values in the Hypack HSX data.

The horizontal datum for this project is North American Datum of 1983 (NAD83). Differential GPS (DGPS) was the primary method of horizontal positioning. Table 5 lists the DGPS station was used for horizontal control.

DGPS Station	Frequency
Angleton, TX (ID 247)	301 kHz

Table 6: F00699 DGPS Station

Data provided to USACE through HSD Operations Branch was projected to Texas South Central Zone (4204) in U.S. Survey Feet and depths in feet.

H. Additional Results

The sounding density requirement of 95% of all nodes, populated with at least five soundings per node, was verified by exporting the density child layer of the finalized CUBE surface to an ASCII text file and compiling statistics on the density values. More than 96% of all the final CUBE surface nodes contained five or more soundings.

Crosslines were run across the entire survey area to provide a varied spatial and temporal distribution for analysis of internal consistency within the survey data. Crosslines acquired for F00699 totaled 9.38% of mainscheme acquisition.

Crossline analysis was performed by computing a 50-centimeter CUBE surface from the crossline data. The surface was then differenced from a 50-centimeter surface comprised of all mainscheme, fill, and

investigation data. The resultant difference surface was exported using the Base Surface to ASCII function and statistics were compiled on the ASCII data.

Results from the crossline to mainscheme difference analysis are depicted in Table 6. Outliers from the difference analysis were reviewed in HIPS subset editor and found to be on the steep slopes of the channel edge or because of sound speed artifacts.

Mean:	0.05 m
Minimum:	-1.04 m
Maximum:	0.97 m
Standard Deviation:	0.09 m
Number of Nodes:	3,493,197

Table 7: F00699 Crossline Statistics

To determine if surface grid nodes met International Hydrographic Organization (IHO) Order 1 specification, a ratio of the final node uncertainty to the allowable uncertainty at that depth was determined. As a percentage, this value represents the amount of error budget utilized by the uncertainty value at each node. Values greater than 100% indicate nodes exceeding the allowable IHO uncertainty.

For the 50-centimeter Object Detection Coverage multibeam surface, the allowable uncertainty utilized ranges from 52% to 298%. The mean allowable uncertainty for the surface is 55% with a standard deviation of 0.026. In total 0.05% out of 17,137,468 nodes fail to meet specification.