Hydrographic Workflow Automation
Data Processing and QC

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Office of Coast Survey
National Oceanic and Atmospheric Administration

Origin – Issues with Consistency in Deliverables

- Data management is complex

- Many points of manual intervention during processing
  - Checking every checkbox *correctly* 100% of the time is hard/impossible
  - Training someone to check every checkbox is even harder

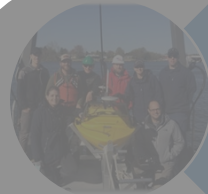- Running through different software packages to process is tedious and error prone

Concentrate Human Interaction on the "Art"

Origin - UxS Strategy
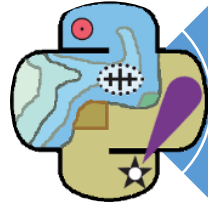
Develop Enabling Technologies
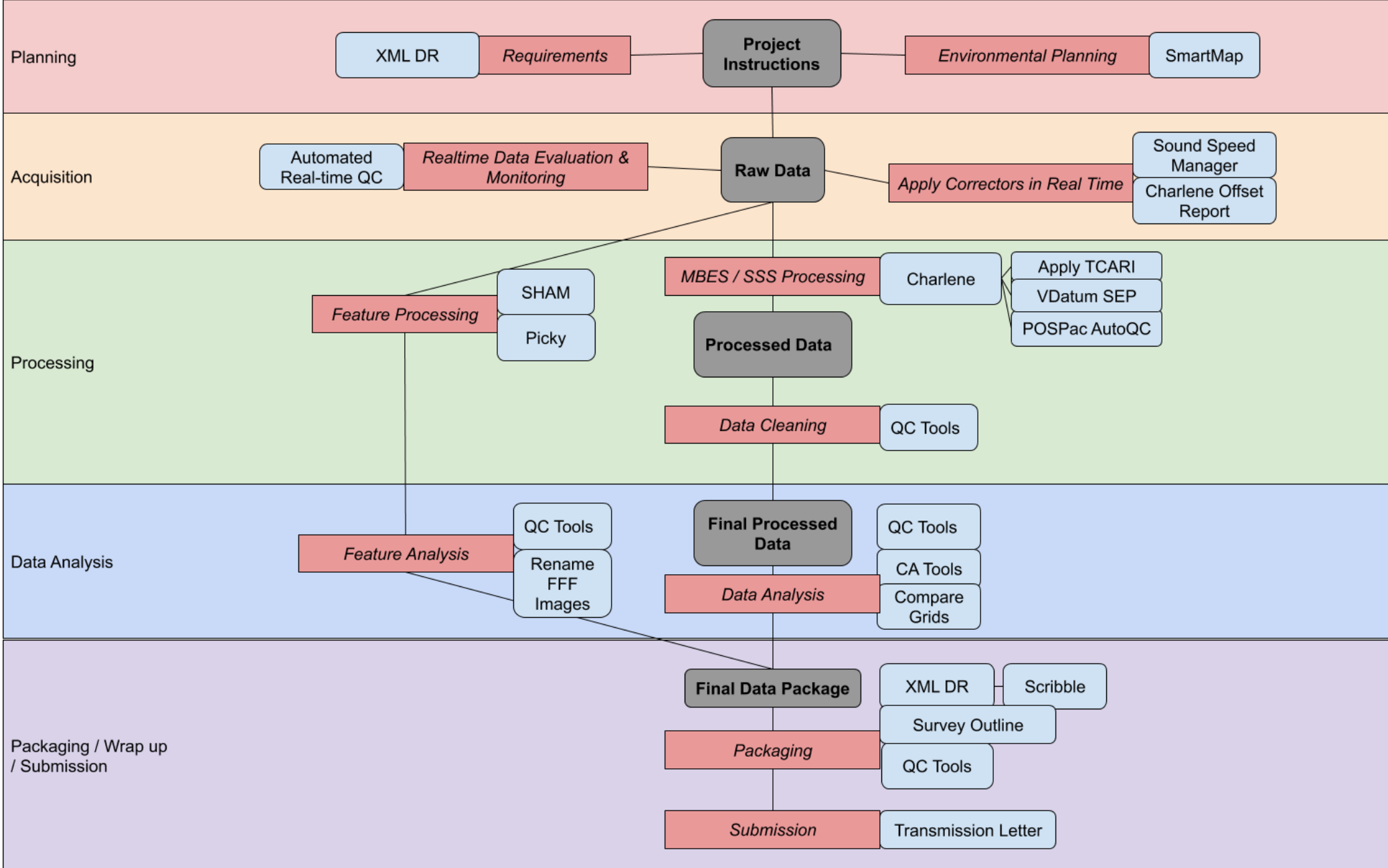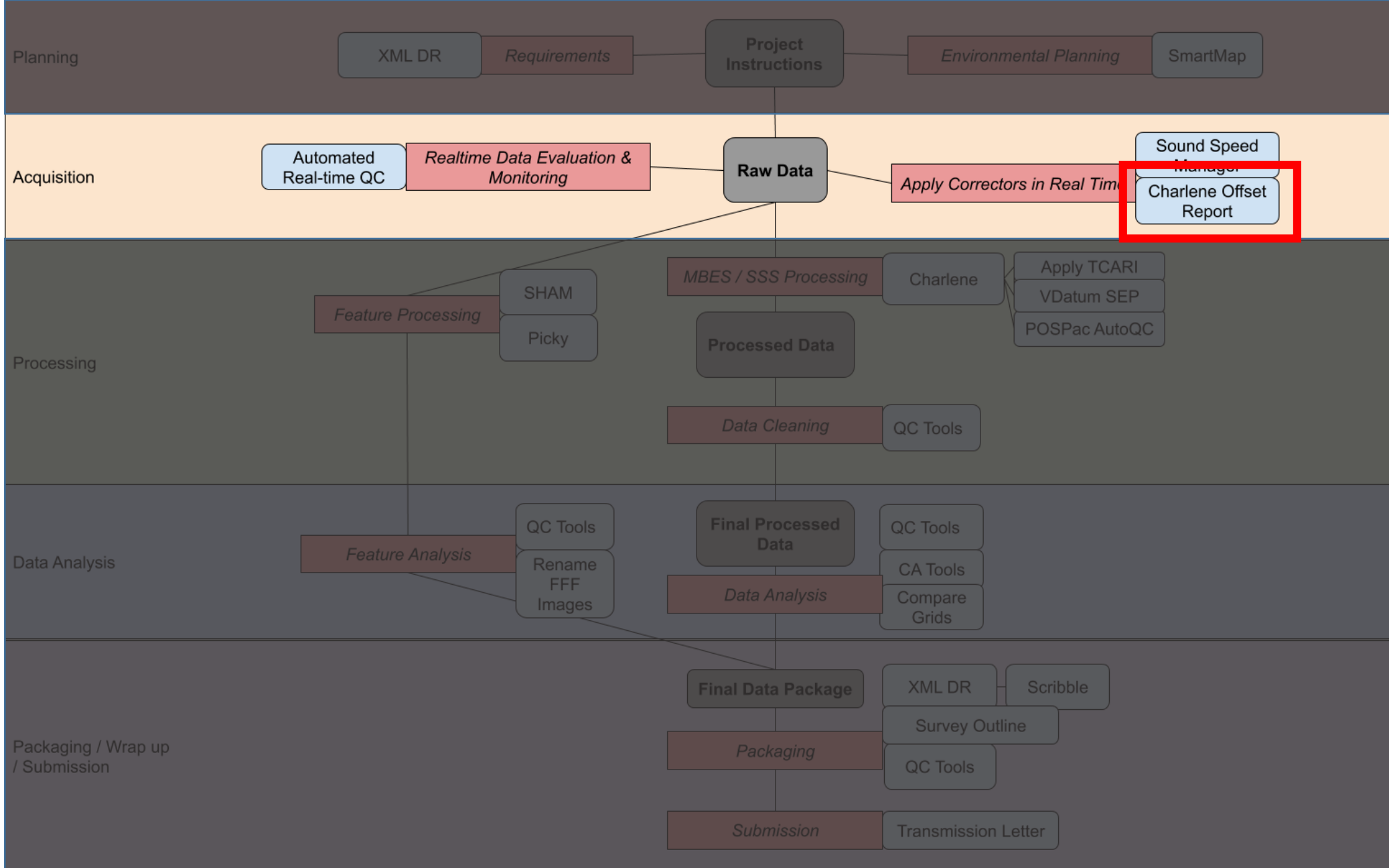
Build and Maintain Operational Expertise

Operational Innovation

Collaboration

Planning
- XML DR — *Requirements* — **Project Instructions** — *Environmental Planning* — SmartMap

Acquisition
- Automated Real-time QC — *Realtime Data Evaluation & Monitoring* — **Raw Data** — *Apply Correctors in Real Time* — Sound Speed Manager / Charlene Offset Report

Processing
- *Feature Processing* — SHAM / Picky
- *MBES / SSS Processing* — Charlene — Apply TCARI / VDatum SEP / POSPac AutoQC
- **Processed Data**
- *Data Cleaning* — QC Tools

Data Analysis
- *Feature Analysis* — QC Tools / Rename FFF Images
- **Final Processed Data** — QC Tools / CA Tools
- *Data Analysis* — Compare Grids

Packaging / Wrap up / Submission
- **Final Data Package** — XML DR — Scribble / Survey Outline
- *Packaging* — QC Tools
- *Submission* — Transmission Letter

Office of Coast Survey
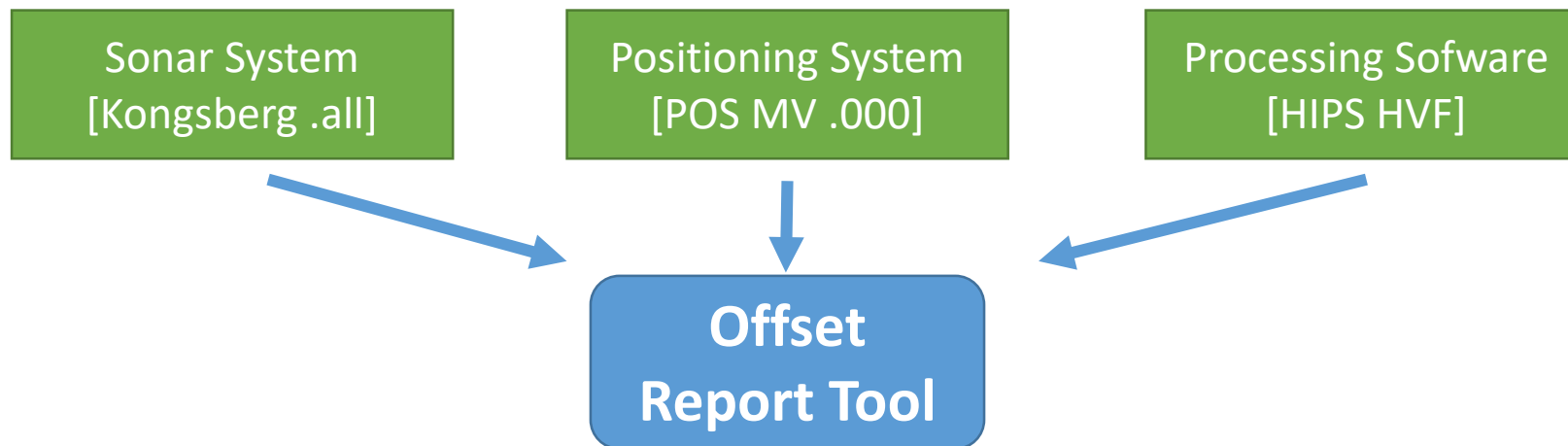National Oceanic and Atmospheric Administration

Offset Report Tool

- Difficult to determine, difficult to enter in correctly
  - Multiple systems, difference reference frames
  - Typos/transposition errors common

- Nearly impossible to track changes; ensure single value hasn't changed

Sonar System [Kongsberg .all]	Positioning System [POS MV .000]	Processing Sofware [HIPS HVF]

Offset Report Tool

	A	B	C	D	E	F	G	H	I
1	Offset Report	▓▓▓▓▓▓							Doroba Color Code (DCC)
2	Created on	2019-08-01 9:14:13							Verify all of the following with HSTB before making any modifications! Green - Passed
3	Reference Point (RP) Location	2040 Transmitter/2040c/p Transducer (TX)							Yellow - Warning
4	Sonar Type	EM2040c							Red - Failed Check
5									
6		X (+FWD)	Y (+STBD)	Z (+DOWN)	Roll	Pitch	Yaw		Notes
7	POS Ref to IMU	0.006	-0.005	-0.347					Offset from TX to top center of IMU. Assumes "Target to Sensing Centre" [0.00...
8	POS Ref to Primary GPS	4.260	-0.930	-3.005					Offset from TX to base of Port side POS antenna. Should include antenna phas...
9	POS IMU wrt ref frame				0.110	0.000	0.000		Patch test values, reverse sign and swap x and y from Caris Patch Test results. ...
10									
11		X (+FWD)	Y (+STBD)	Z (+DOWN)	Roll	Pitch	Yaw		
12	Kongs TX Offset	0.000	0.000	0.000	0.000	0.000	0.000		With TX as the ref point, offsets and angles should be zero, but can contain pat...
13	Kongs Waterline			0.000					TX to waterline from SIS, optional in NOAA workflow for SIS display. Should b...
14									
15		X (+STBD)	Y (+FWD)	Z (+DOWN)	Pitch	Roll	Yaw	StartBeamNumber	
16	Caris Trans 1	0.000	0.000	0.000	0.000	0.000	0.000		Ref point to EM2040TX. With TX as Ref point, values should be zero.
17	Caris SVP 1	0.000	0.000	0.000	0.000	-0.110	0.000		(Expected x=0.000, y=0.000, z=0.000, p=0.000, r=0.000, y=0.000) Ref point to EM...
18									Trans2 entry skipped, EM2040c
19									SVP2 entry skipped, EM2040c
20	Caris Heave	0.000	0.000	0.000					With RP at TX, should be all zeros. (Heave lever arm is from HVF RP)
21	Caris Waterline			-0.340					TX to waterline. This should be negative (above TX)
22									
23		Heave	Pitch	Roll	Draft	Waterline			
24	Caris Apply Flags	Yes	No	No	Yes	Yes			Heave/Pitch/Roll should be Apply=No, as they are already applied at SVC.
25									Waterline should be Apply=No. Draft should be Apply=Yes. SVC will apply wat...
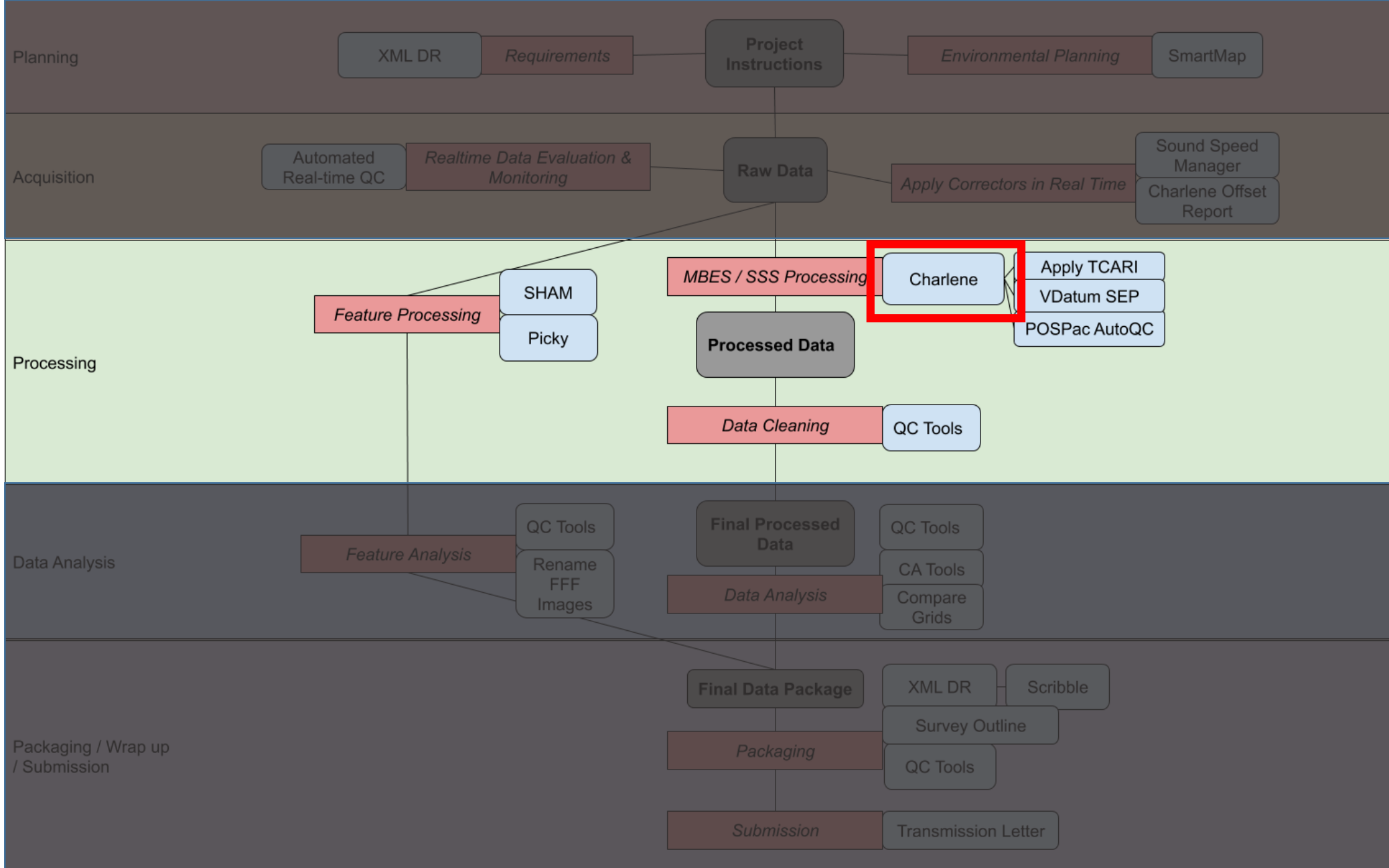
Charlene - Concept

Reduce daily processing to 'Plug in data and view results'

- Automated data management

- Set-and-forget processing, stored settings
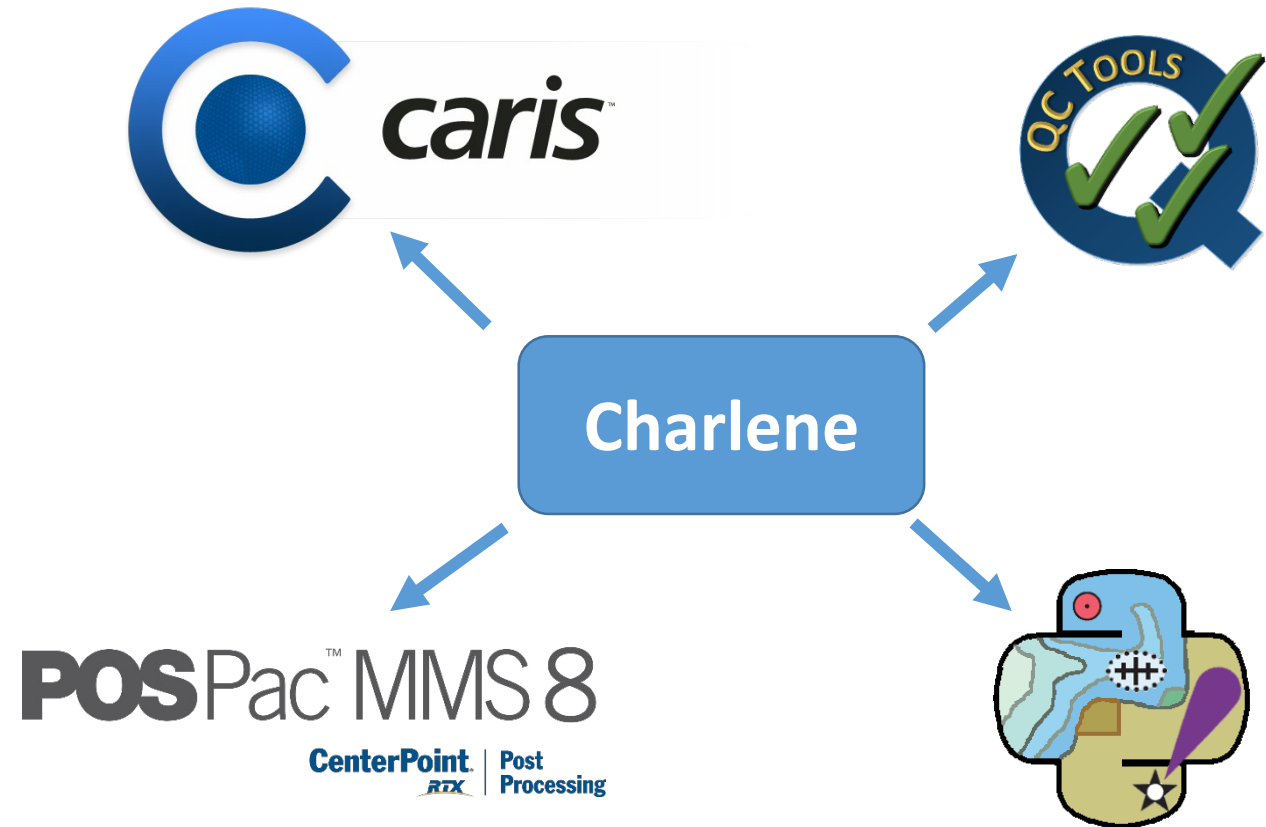
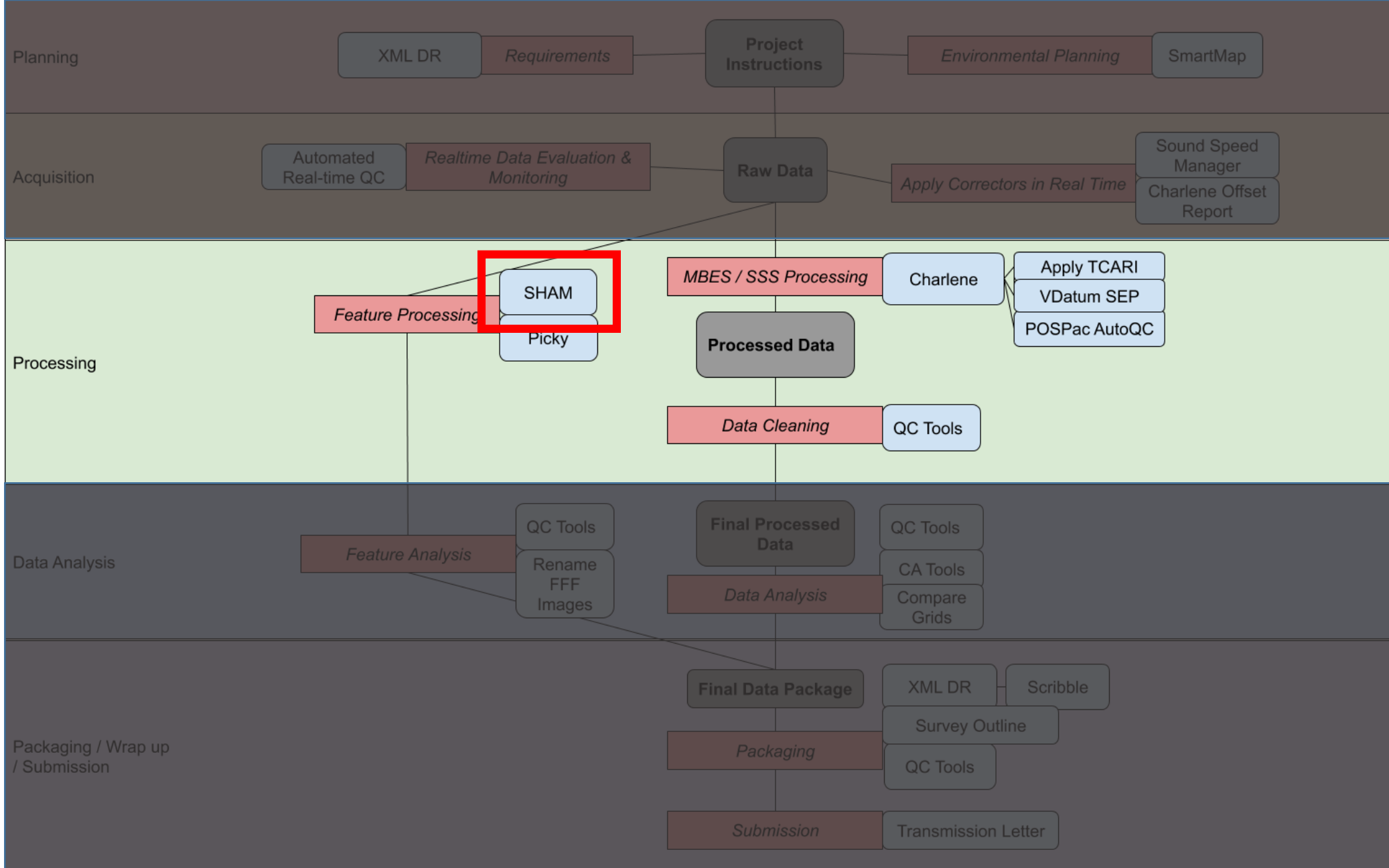- Unified interface to all software

Results

- 40 page SOP encompassed in 5 dropdown boxes
- Training can be done from a screenshot

- Checks for Common Errors:
  - Stub files
  - Datagram types
  - Presence of required files
  - Geographic locations
  - Timestamp correspondence
  - HVF Settings

Charlene

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Packaging

Submission | Transmission Letter

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National Oceanic and Atmospheric Administration
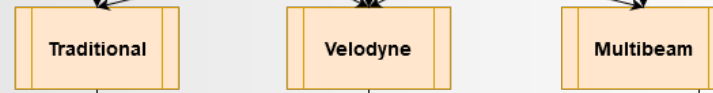
SHAM

- Automated S-57 Feature Processing
  - Translates existing methodology to ellipsoidal referencing
  - Supports multiple acquisition methods
- Remedies tedious, error prone tasks
  - Datum application
  - Rock/islet determination
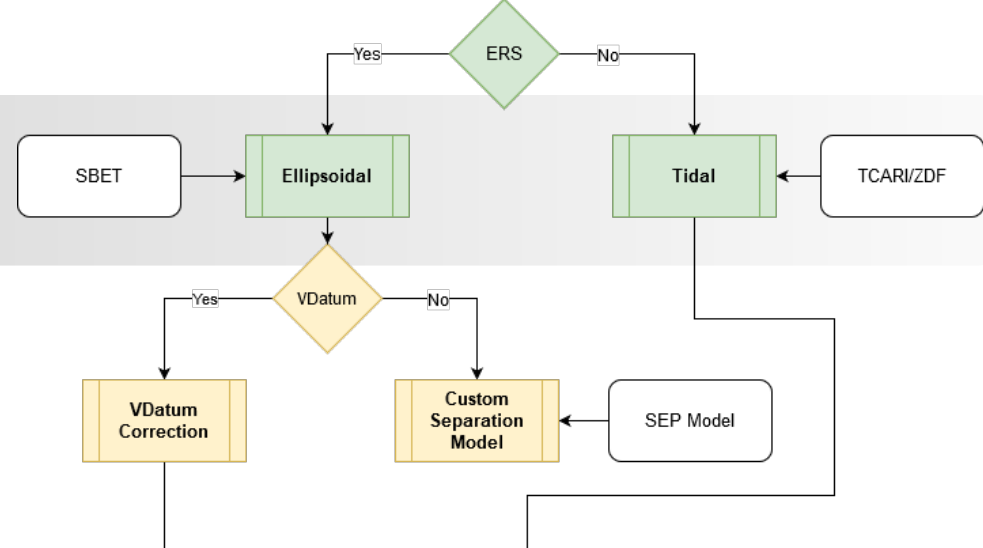 - Image naming conventions
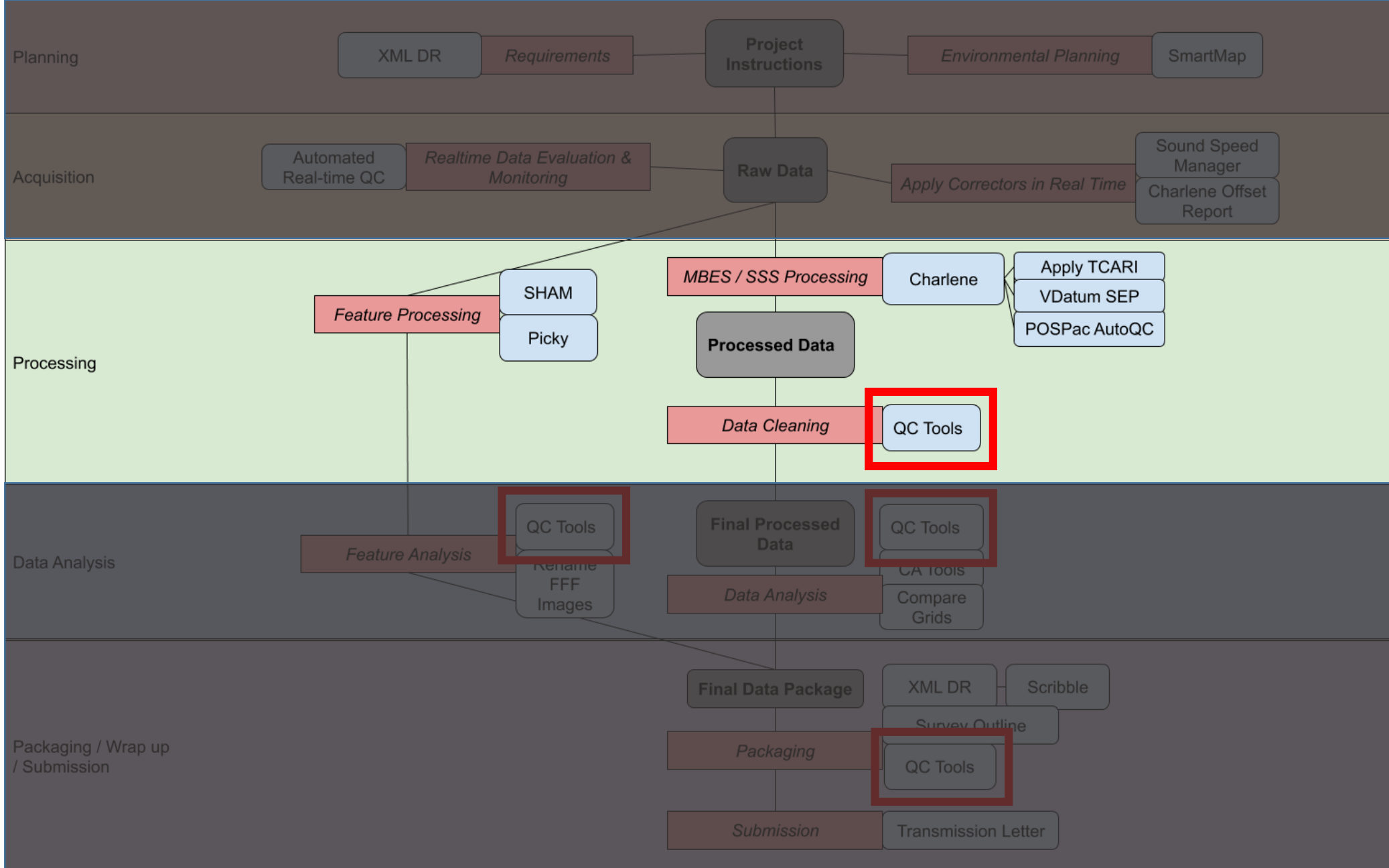 - Remarks/recommendations

Raw/Field Data

S-57 Feature File
Velodyne Lidar Hypack CSV
Images

Processing Modes

Traditional
Velodyne
Multibeam

ERS — Yes / No

Referencing Options

SBET → Ellipsoidal
Tidal ← TCARI/ZDF

VDatum — Yes / No

VDatum Correction
Custom Separation Model ← SEP Model

SHAM

Outputs

Attributed S-57 Feature File
Renamed Images

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QC Tools

Performs automated **quality control checks** on surfaces and final feature files

Quality defined by the **specifications** set forth by the **Office of Coast Survey**.

- Hydrographic Surveys Specifications and Deliverables (HSSD)
- Hydrographic Technical Directives (HTD)

QC Tools

Flier Finder — Algorithms that scan your bathymetric grid to identify potential anomalous soundings.
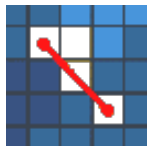
Holiday Finder — Algorithm that scans your bathymetric grid to identify holidays as defined by the HSSD.

Grid QA — Performs math on bathymetric grids to determine if density, uncertainty, resolution, etc. meet the HSSD.
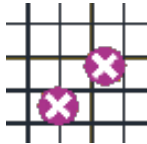
Feature Scan — Checks .000 feature file against IHO and NOAA required attribution, as prescribed by the HSSD.
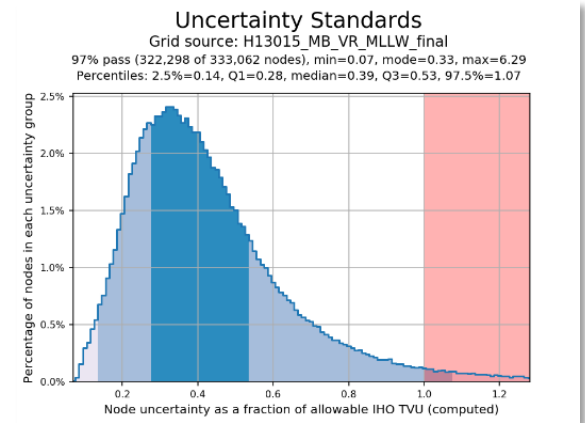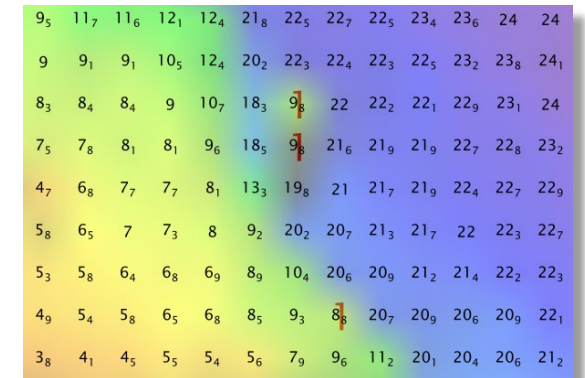
QC Tools Continued

VALSOU Check — Verifies your feature file VALSOU against designated soundings in bathymetric grid.

SBDARE Export — Exports your seabed area features and images into the format required for submission

Submission Checks — Scans your entire field submission directory against the HSSD.
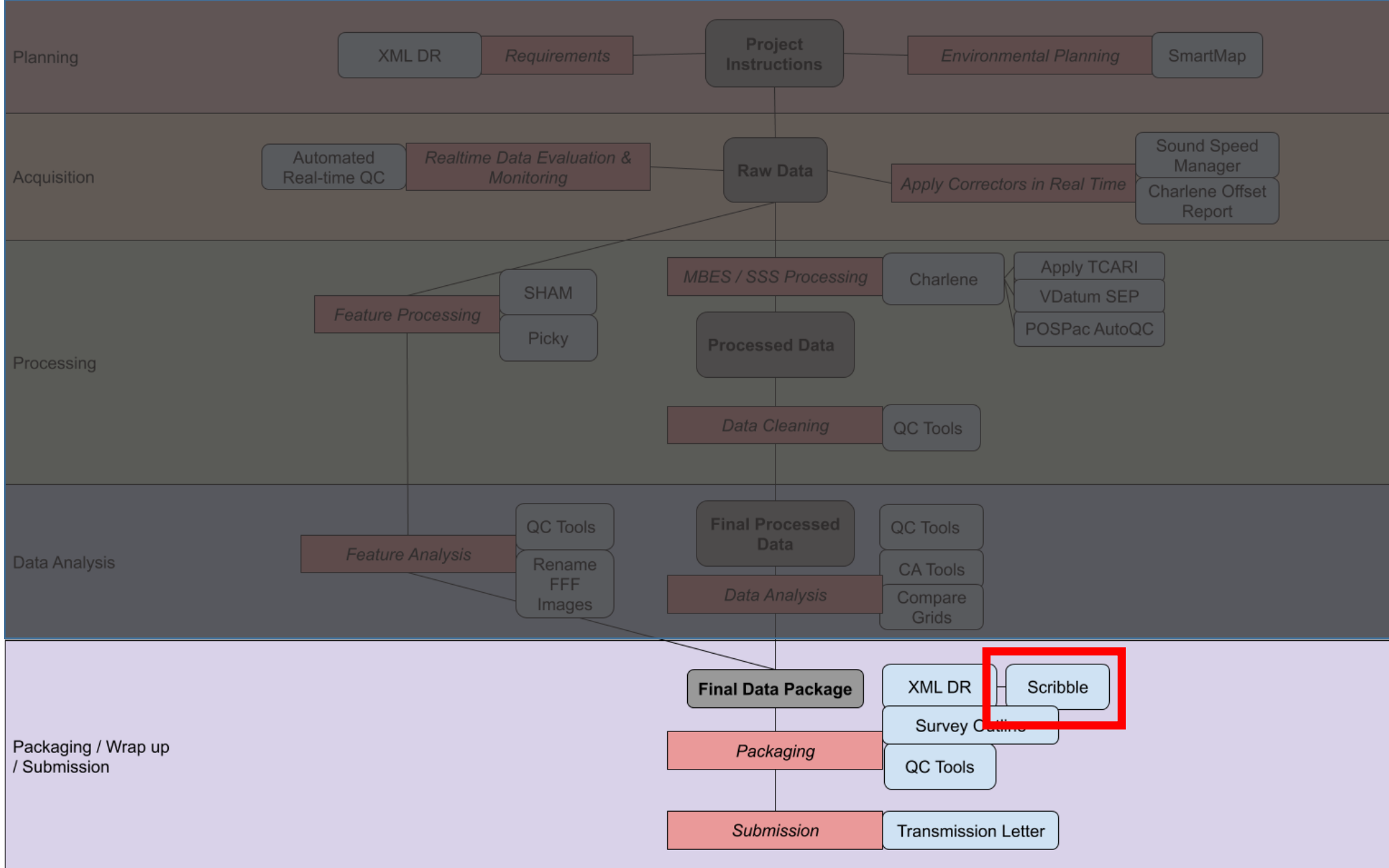
Standalone Tools
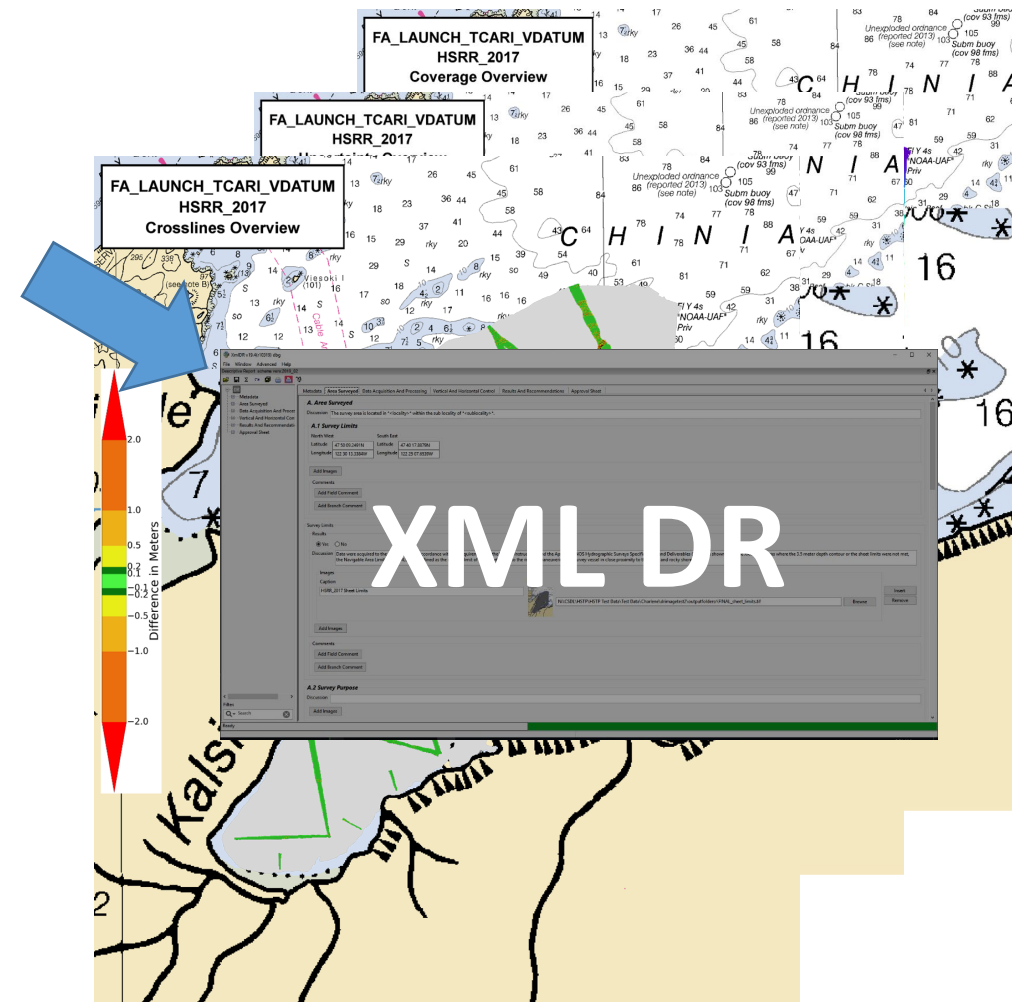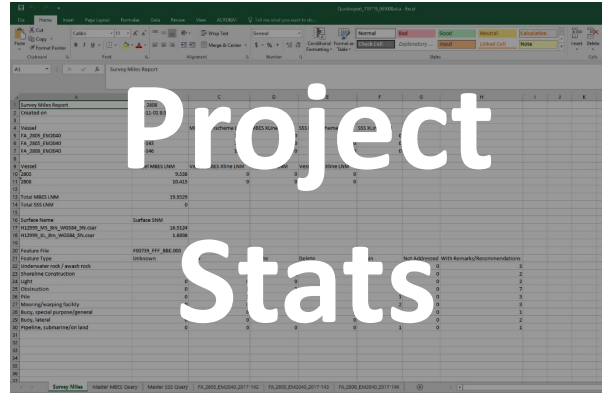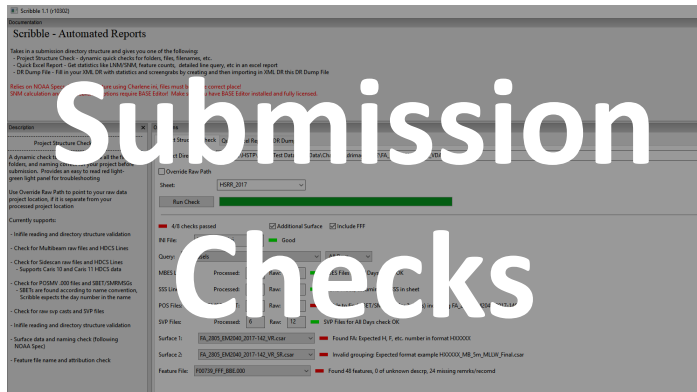
Uncertainty Calculator

Rock or Islet Oracle

Scribble – Submission & Reporting

Scribble

Submission Checks

Project Stats

XML DR

FA_LAUNCH_TCARI_VDATUM
HSRR_2017
Coverage Overview

FA_LAUNCH_TCARI_VDATUM
HSRR_2017

FA_LAUNCH_TCARI_VDATUM
HSRR_2017
Crosslines Overview

Future Development

- Packaging the workflow

- Rework of specifications for automation

- Open Source collaboration