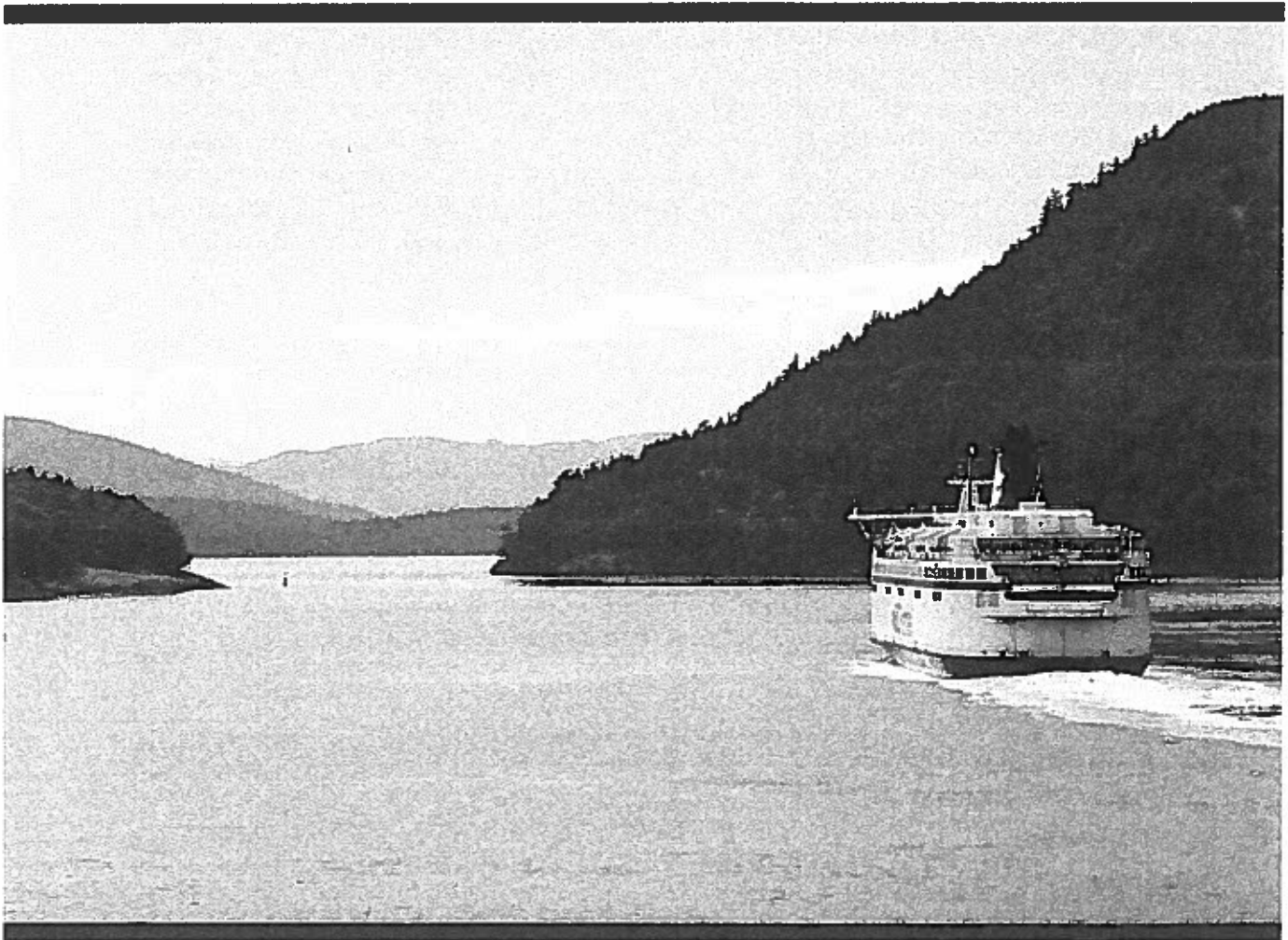


# MARINE CFO



**RFP 91113 for the Time Collection and Crew Scheduling (TCCS) Software Selection Project**

*PREPARED BY LAURA MARTIN FOR*

**BCFerries**



BC Ferries and VerticalLive already have a strong connection, through our relentless commitments to our customers, and to continued innovation. We are both vigilant in our efforts to improve safety and to provide exemplary customer service, thus insuring the products delivered to our clients are unequaled in quality. I believe those characteristics would be an excellent starting point in a collaborative effort toward RFP 91113 for the Time Collection and Crew Scheduling Software Selection project.

For our MarineCFO product, our mission is to provide technology leadership and digital transformation solutions to the maritime industry, enabling our customers to operate more safely, securely, and profitably. Over the years, VerticalLive via the MarineCFO offering has remained dedicated to developing our people, crafting innovative solutions and strengthening our services, thus building mutually beneficial relationships with our clients. We pride ourselves on offering the most comprehensive suite of cloud, hybrid and mobile applications available to the marine transportation industry. The MarineCFO Business Framework will allow us to deliver integrated and flexible solutions that extend our base product with configurations to meet BC Ferries' specific requirements. Our Business Framework programmatically creates and manages the solutions we provide, allowing for quick integration and interface with other systems and configuration versus customization of our products.

We are pleased to respond to BC Ferries' RFP 91113 for the Time Collection and Crew Scheduling Software Selection project. I am confident our unique solutions, combined with our experience and services would be a perfect match to help to BC Ferries achieve its goals.

I offer BC Ferries my personal assurance that the answers provided in the attached submission are true and valid, and that BC Ferries will receive stellar products and services from the VerticalLive team. We are excited for the future and the opportunity to work with BC Ferries on this project, and are committed to not only meeting, but exceeding your expectations.

Sincerely,

s. 22

Laura Martin  
VP of Sales & Client Services  
VerticalLive, Inc.

VerticalLive

1340 W Tunnel Blvd Suite 450 • Houma LA 70360 • 1 (866) 9MARINE • 1 (866) 962 7463  
www.MarineCFO.com • sales@marinecfo.com



## Table of Contents

1.0	EXECUTIVE SUMMARY.....	2
2.0	PROPONENT INFORMATION.....	3
3.0	REFERENCES.....	7
4.0	SUBCONTRACTING.....	11
5.0	PROPONENT DEMONSTRATION.....	11
6.0	PROPOSAL OVERVIEW.....	11
7.0	PROPONENT VIABILITY AND STABILITY.....	18
8.0	ENVIRONMENTAL RESPONSIBILITY .....	18
9.0	OTHER .....	18
	<b>APPENDIXES.....</b>	<b>20</b>
	Appendix A VerticalLive, Inc. Certification of Incorporation	
	Appendix B VerticalLive MarineCFO Training Plan	
	Appendix C VerticalLive Trust Privacy and Compliance	
	VerticalLive Whitepaper Securely Connected Vessels	
	Appendix D MarineCFO Project Execution Schedule and Commissioning Plan	
	Appendix E TCCS-91113_RFP-Pricing-Matrix-MarineCFO	
	Appendix F Product Resource Documents for Configuration Proposed	
	Appendix G Endurance Crew Management Reports List	
	Appendix H - Additional Documents	

## 1.0 EXECUTIVE SUMMARY

1.1 In response to RFP 91113 for the Time Collection and Crew Scheduling (TCCS) Software Selection project, VerticalLive, Inc. proposes the MarineCFO Endurance suite of products for implementation. Specifically, the MarineCFO Endurance Crew Management module, coupled with Vessel 365, our on-board solution. This combination of technologies, along with a mobile application for disseminating employee schedules and for employee communication in general, will provide BC Ferries the workflow requested via RFP 91113.

1.2 VerticalLive is excited for the opportunity to establish a partnership with BC Ferries, by leveraging our MarineCFO Endurance product line. Many prestigious organizations have put their faith in us, including

s. 21, s17

among others. We have worked with clients in almost every aspect of the industry, from blue to brown water, inland to offshore and domestic to foreign fleets. As a result, our teams are highly experienced, and we have an intimate knowledge of the industry and how to successfully develop and implement our solutions for our clients.

Our approach has been to develop solutions that are much more than typical software applications. We empower our clients with a logical combination of software, cloud, and mobile components that provide them a turnkey solution to better manage and automate their business

VerticalLive proposes implementation of MarineCFO Endurance Crew Management, with specific workflows configured per the requirements set forth in this RFI. Additional workflows will be availed to employees via a mobile application for publishing of schedules and relaying of information. Additionally, Vessel 365 should be utilized on-board the ferries for viewing of information such as Landed Crew Lists, Emergency Duty Lists, Muster List setup and Work Orders.

## 2.0 PROPONENT INFORMATION

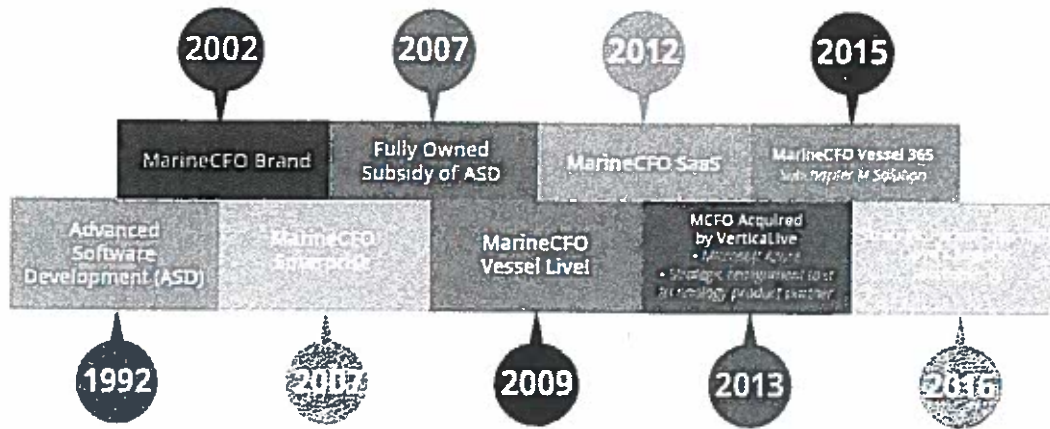
### 2.1 Provide Proponent company profile including:

- Organization Profile
  - Company name (legal name): VerticalLive, Inc.
  - Phone: 866-9-Marine
  - Fax: 985-718-0815
  - Email: [lmartin@marinecfo.com](mailto:lmartin@marinecfo.com)
  - Address: 1340 W. Tunnel Blvd., Suite 450 • Houma, Louisiana 70360
  - Contact for requesting bids (title), (telephone) and (fax):  
Laura Martin, VP of Sales & Client Services  
Direct line: s. 22  
Email: [lmartin@marinecfo.com](mailto:lmartin@marinecfo.com)
  - Parent company name (if applicable): N/A
  - Subsidiaries (if applicable): N/A
  - Form of business (sole proprietor), (partnership) or (corporation): Corporation
  - Certificate of incorporation: Included as Appendix A.
  - Number of employees: 12
  - Stock symbol (if applicable): N/A
  - VerticalLive was incorporated in 2008 but the history of the company goes back to the late 1990's when the company's founder, Dean Shoultz launched a company named Advanced Software Development (ASD). Based in Houma LA, Advanced Software produced a product called UA Business Software. UA was an on-premise, client/server accounting/ERP product that competed successfully against products like Great Plains and SAP. In its heyday, Advanced Software had almost 4,000 customers globally and a partner channel of over 250 partners.

In the mid-2000's, a local UA customer by the name of s. 17, s. 21 came to ASD looking for product enhancements to help run their extremely successful offshore supply vessel company. These requested enhancements related to crew scheduling, vessel maintenance and operations including billing and dispatching and were embarked upon to help streamline operations, reduce billing turnaround, and facilitate growth. Shortly after delivering the solution, two other

s. 17, s. 21

prominent maritime transportation companies approached ASD for similar products. Recognizing a trend and a market need, MarineCFO was launched. Very quickly, MarineCFO became one of the preeminent providers of software to both the inland and offshore marine transportation markets.



In 2008, with the advent of the internet and software-as-a-service (SaaS), VerticalLive was formed with the mission to migrate UA and MarineCFO to the cloud and specifically, the Microsoft Azure cloud.

In 2016, the web-based version of MarineCFO was released, dubbed Endurance, which included all three original modules (crew scheduling, vessel maintenance and operations), as well as an on-board component, called Vessel 365.

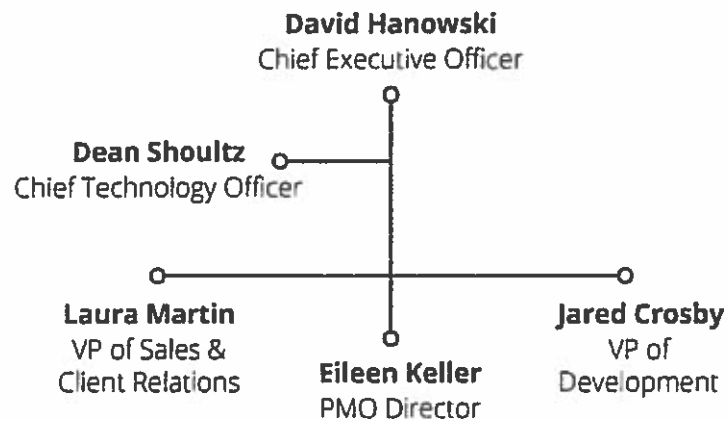
MarineCFO quickly grew and has doubled its client base since the release of Endurance and has added some very high-profile customers including s. 21, s.17 and s. 21, s.17

Although primarily focused on MarineCFO, VerticalLive also provides software to shipyards which includes some of the largest in the United States.

- o List the sales and support offices and locations: All functions of VerticalLive are housed in the Houma, LA location.
- o Description of Proponent’s corporate organizational structure, a definition of the lines of business, geographic locations of offices and a functional organizational chart for the product’s development and

support teams: VerticalLive's organizational structure is relatively flat. Although we do have other product lines, 80% of our focus is on maritime software. Our main product line is MarineCFO and the web-based Endurance products are where nearly all our product development resources are dedicated.

We have three main areas within the company: Product Development, Project Management Office (PMO) and Sales & Marketing.



Within product development we have programmers that will typically be specialized in one or more areas. For example: database expertise, user interface, application services, etc.

Our PMO team is responsible for Project Management, Technical Support and Quality Assurance. We believe that separating quality assurance and having it more closely aligned with project management introduces quality and quality measurement at the front of a project rather than the end, where many custom software development shops place it.

We use Scrum/Agile methods and Microsoft's Team Foundation Services to organize our projects and to provide transparency to the customer.

- o A description of the current customer base: Most of our customers are vessel operators who operate in the US in either the inland brownwater or offshore supply vessel markets. Our customer base of vessel operators has more than doubled in the last 2 years.

s. 21, s.17

We've also begun work on a solution for s.17, s.21  
They are slightly different than our current customers in that they don't own any vessels but are tasked with ensuring vessels working near the pipeline have crew that are trained to respond in the event an incident occurs in and around the pipeline. As with s. 21, s.17 our standard product has been configured to meet some of their specific requirements.

- There is no current or pending litigation against VerticalLive, Inc.
- Information on material change in the company's financial position or future viability: VerticalLive has a growing list of customers that provide recurring revenue. Almost every penny of profit is reinvested into growth. Our current recurring revenues support our ongoing business operations and we will continue to invest in growth.
- Organization Financials
  - VerticalLive, Inc. does not typically share our financial statements, as we are a privately-held company.

**2.2 Provide Proponent personnel profiles including:**

- BC Ferries requires a key individual who would be involved in supporting the project prior to "go live", for whom a firm commitment of availability can be made. This individual will be contracted for one (1) year, with the option to extend for one (1) additional year.
  - VerticalLive offers a team of project managers to facilitate the implementation of MarineCFO for its customers. At this time, we believe one or both of the following individuals will be assigned to the BC Ferries project (a firm commitment will be made if the contract is awarded to us);



- Eileen Keller, PMO Director – experienced Project Manager having been involved with the company since s. 22. She brings s. 22 with the VerticalLive product line to your implementation.
  - Cassie Porche, Project Manager – an application developer by trade, who brings her development experience to the VerticalLive PMO Team. Cassie has been with our organization for s. 22 and has managed large clients such as s. 17, s. 21 and s. 21.
- List personnel used in the development of the proposal response:
    - Laura Martin, VP of Sales & Client Services
    - David Hanowski, CEO
    - Dean Shoultz, CTO
    - Jared Crosby, VP of Development
  - The following personnel will be involved in training BC Ferries throughout the MarineCFO Implementation:
    - Eileen Keller, PMO Director
    - Cassie Porche, Project Manager
    - Laura Martin, VP of Sales & Client Services
  - All employees listed reside in the Houma, Louisiana area.
  - VerticalLive employees are not unionized.

**3.0 REFERENCES**

3.1 List three firms where the proposed solution has been successfully implemented. The references should be one that similarly reflects the business requirements described in this RFP and that of the operational and technical complexity of the BCF Time Collection and Crew Scheduling environment.

Reference 1	
Organization name, location, and type.	s. 17, s. 21

Reference 1	
Name, title, and telephone number of an authorized contact.	
Description of system installed (include module(s) and version(s)).	
The date operations began on the system.	
Operational statistics (i.e. transaction volumes, # users, etc.)	

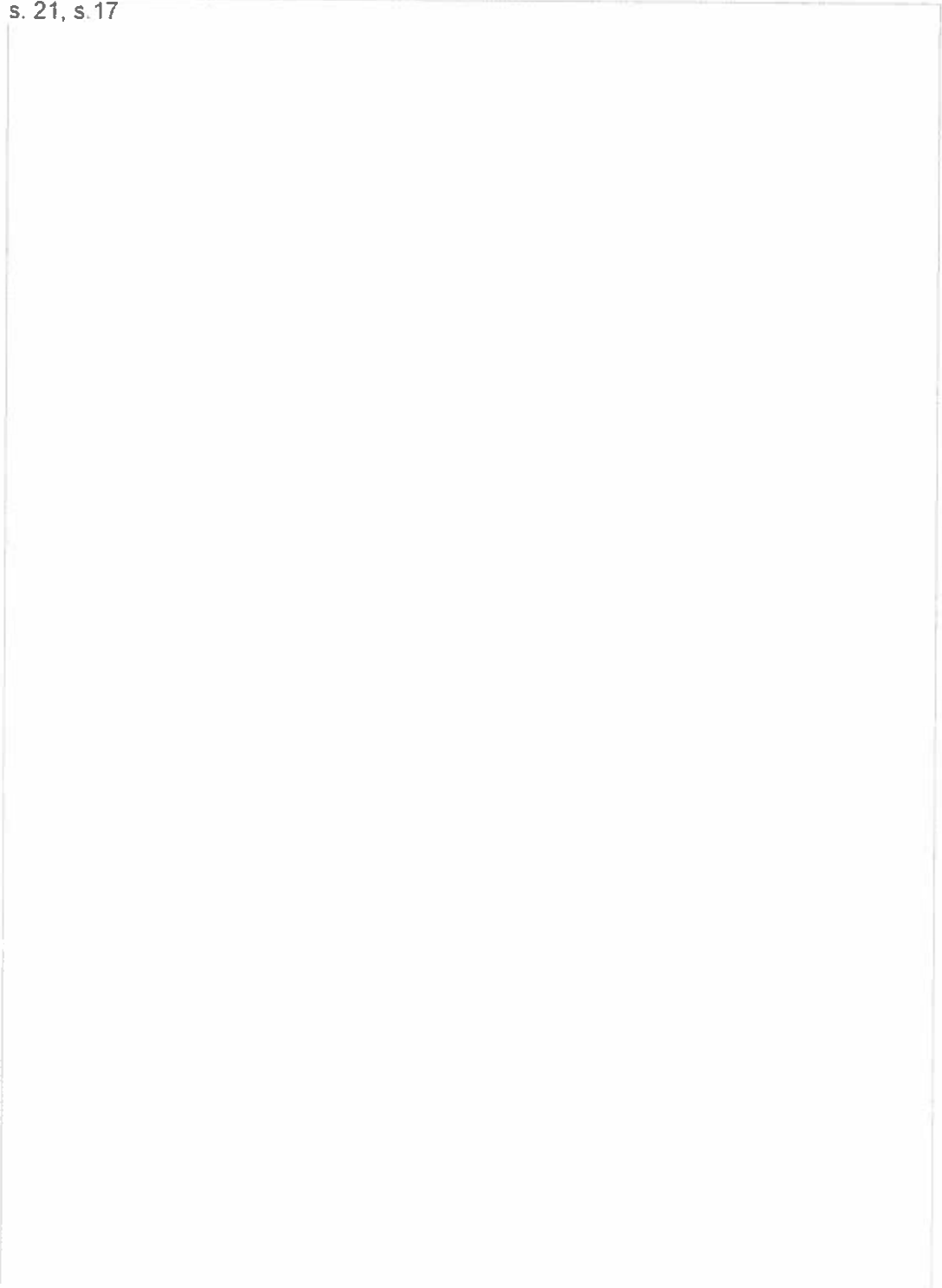
Reference 2	
Organization name, location, and type.	
Name, title, and telephone number of an authorized contact.	
Description of system installed (include module(s) and version(s)).	
The date operations began on the system.	

Reference 2	
Operational statistics (i.e. transaction volumes, # users, etc.)	s. 21, s.17

Reference 3	
Organization name, location, and type.	
Name, title, and telephone number of an authorized contact.	
Description of system installed (include module(s) and version(s)).	
The date operations began on the system.	
Operational statistics (i.e. transaction volumes, # users, etc.)	

3.2 Please provide an example of a situation where the proposed solution was not successful and / or had major project delays, missed milestones, delayed implementation, budget over-runs. Please provide information on how the project was rescued including re-planning, risk management, customer communication and other turn around actions employed.

s. 21, s. 17



#### 4.0 SUBCONTRACTING

4.1 No subcontractors are planned for this project.

#### 5.0 PROPONENT DEMONSTRATION

5.1 During the RFP evaluation, a shortlist may be generated by BC Ferries. Proponents on the shortlist will be required to provide further input, based on the following criteria.

- VerticalLive, Inc. is available to provide on-site demonstrations of MarineCFO the week of August 20<sup>th</sup>, 2018, per the RFP schedule set forth. Previously scheduled travel limits us to being available this week only.

#### 6.0 PROPOSAL OVERVIEW

Detail features of the proposal outlining the specifics of how it will meet BC Ferries' needs. Diagrams of architecture, workflows and concepts, as well as screen captures, to aid in understanding of the solution are required.

VerticalLive is excited for the opportunity to establish a partnership with BC Ferries, by leveraging our MarineCFO Endurance product line. We have worked with clients in almost every aspect of the industry, including our flagship ferry operations client, s. 21, s. 17 [redacted]. As a result, our teams are highly experienced, and we have an intimate knowledge of the industry and how to successfully develop and implement our solutions for our clients.

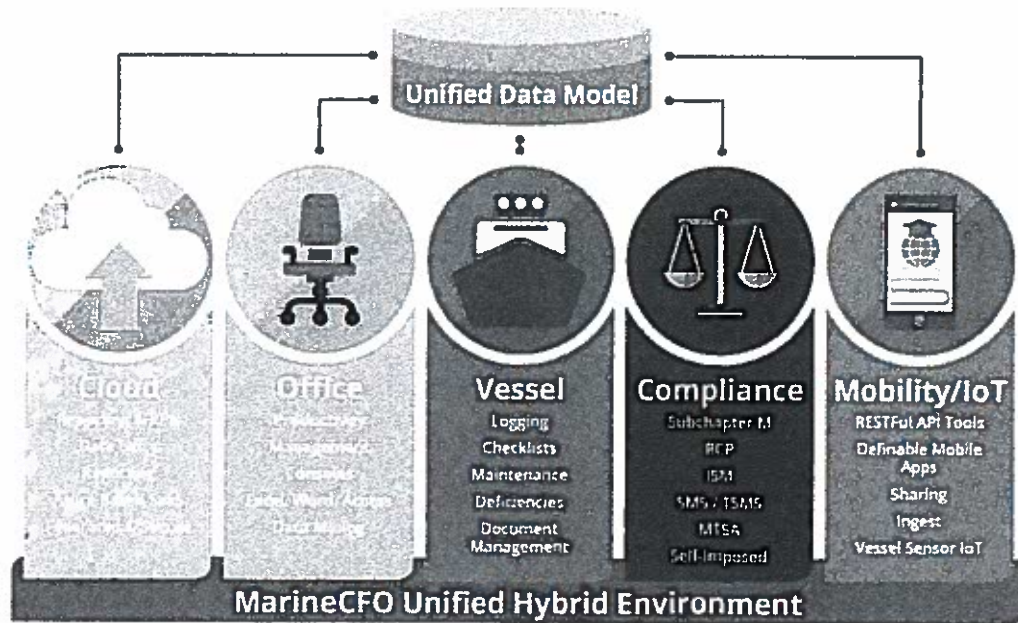
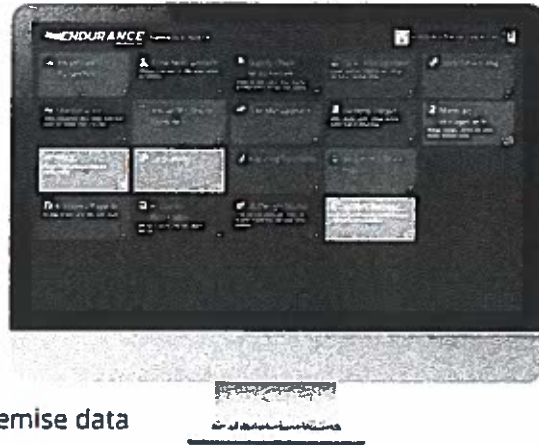
Our approach has been to develop solutions that are much more than typical software applications. We empower our clients with a logical combination of software, cloud, and mobile components that provide them a turnkey solution to better manage and automate their business

VerticalLive proposes implementation of MarineCFO Endurance Crew Management, with specific workflows configured per the requirements set forth in this RFI. Additional workflows will be availed to employees via a mobile application for publishing of schedules and relaying of information. Additionally, Vessel 365 should be utilized on-board the ferries for viewing of information such as [redacted] s. 15, s. 17, s. 21

MarineCFO allows users to access the solution and the relevant data in different ways, such as through a browser or mobile device, while still providing them

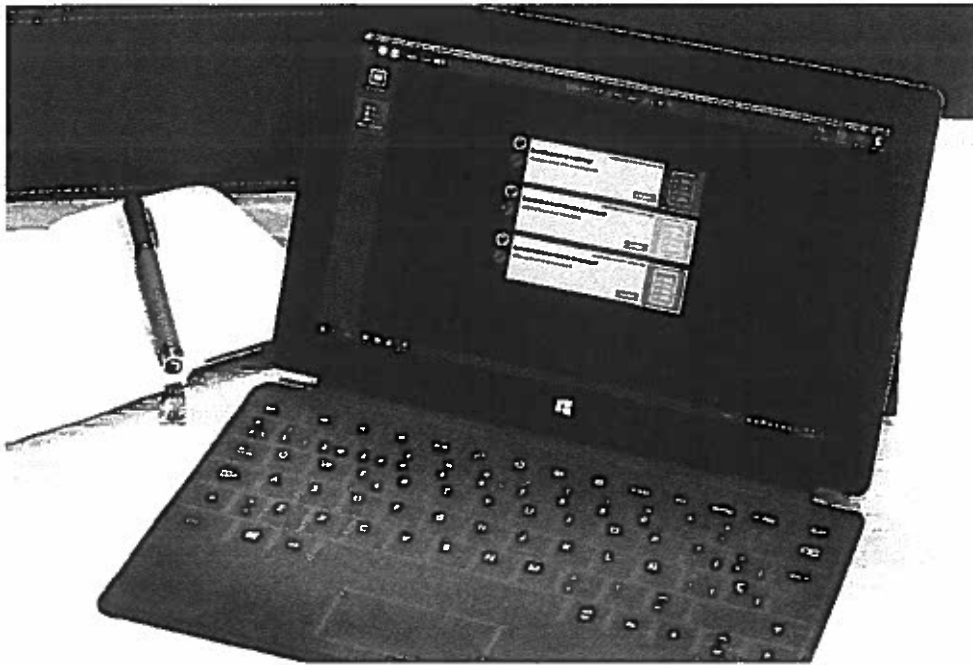
access to key information and processes relevant to their roles within the organization.

- 100% Cloud Based
  - Access from anywhere
  - Secure
- Dashboards
- Lightweight entry
- Connected to Enterprise
- Feature-rich
- Technology
  - Microsoft Azure
  - Mobile, Tablet, PC
  - Data adapter to sync on premise data
  - MarineCFO Mobile Extensions



For this reason, MarineCFO can be referred to as a “hybrid” solution that leverages the power of the internet via cloud and mobile applications. This strategy more accurately reflects the real world for marine companies, where some personnel are working on a PC, and others have their mobile phone while working on a vessel, often thousands of miles away. We feel this hybrid approach profoundly distinguishes MarineCFO from our competitors.

Vessel 365 is our new generation fleet optimization technology engineered by VerticalLive, for MarineCFO in cooperation with class societies, operators, consultants, crew, and others. The cutting edge onboard application bundles eLogs, Safety Assessments, Planned Maintenance, Notifications, & Document Management into an easy-to-use and highly configurable vessel/shore replication system.

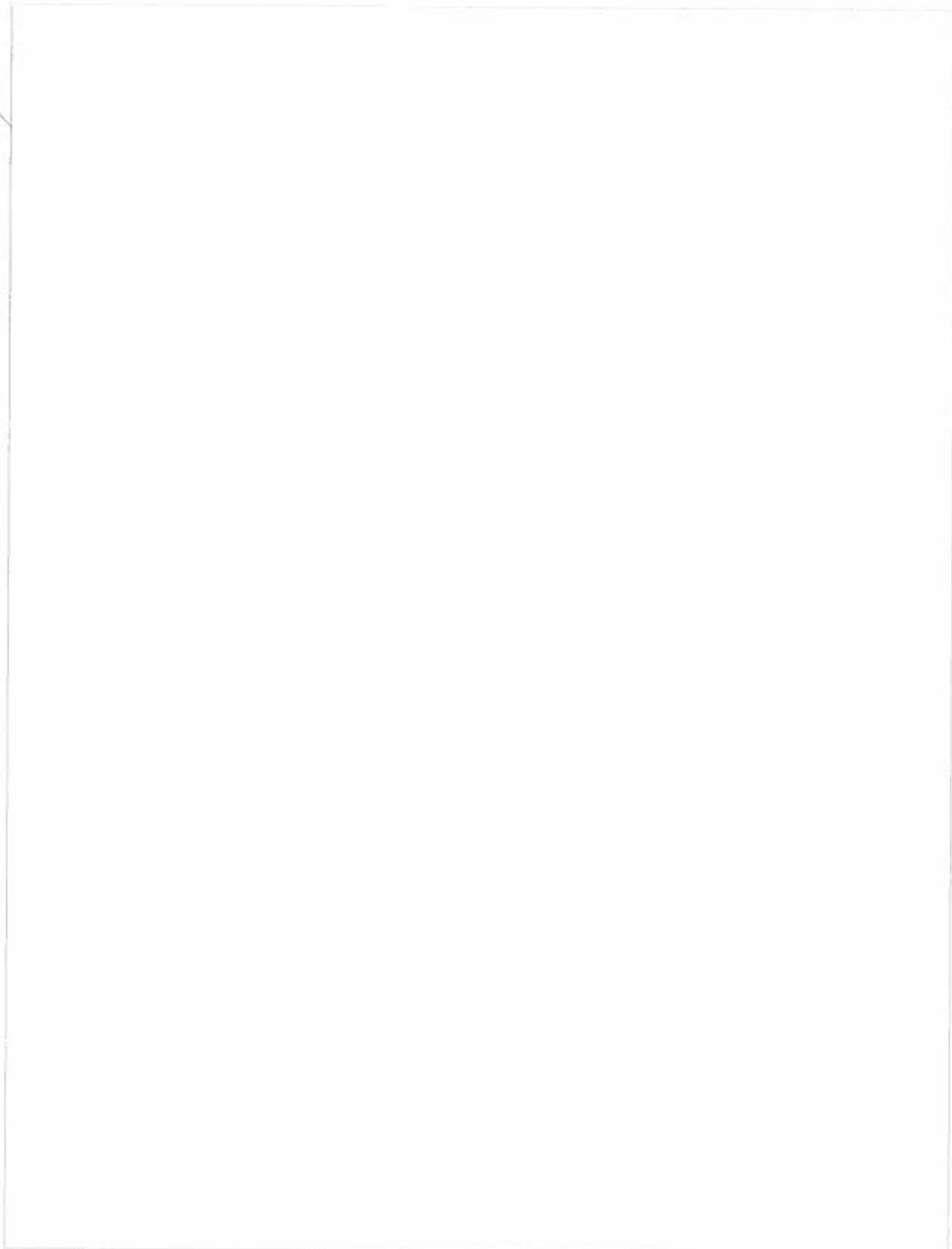
**Vessel 365 Features**

- Document Management
- Checklists
- Planned Maintenance
- Deficiency and Nonconformities
- Notifications and Alerts
- Logging
- Reporting
- Analytics

**Vessel 365 Attributes**

- Easy to use
- Reliable
- Compliance-oriented
- Configurable
- Various regulatory bodies
- Regional needs
- Operational needs
- Customer-driven needs
- Secure and encrypted
- Scalable

s.17, s.21





**Process Stages**

Section 21, section 17



The implementation timeline varies, and historically can happen anywhere from 1 week to one year. The major factors include integrations with other systems, configurations, customizations, and BC Ferries's requirements for a staged rollout. We will determine and provide a detailed timeline during the deep-dive discovery stage, and report to client on a regular basis during implementation.

MarineCFO Project Managers have significant experience managing complex implementation projects to completion and ensuring all milestones are met on time and within the proposed budget. Our project managers will provide technical direction and control for the project team to ensure all tasks are completed on time and to ensure that the final agreed schedule is met. The project manager will also provide the required tools and documents necessary for project planning, communications, reporting, meetings, issues logs and change control documentation.

s17, s.21

Our OpsGen product works in a similar way to produce highly scalable RESTful API's. These API's provide the backbone for mobility extensions, sharing of information between third parties, and innovation.

Both the VerticalLive Business Framework and OpsGen are graphical, SaaS environments used primarily by the MarineCFO Development team. These tools can also be made available to the IT Team at BC Ferries, if desired. This would allow BC Ferries the ability to add their own customizations over time and as needed. These tools also over built-in DevOps processes, facilitating development, testing, beta, production, and other environments.

Proponents are required to complete and include the following documents, and/or provide the following information with their submission:

**6.1 Detailed Requirements**

- Included digitally only on root directory of jump drive – "TCCS-91113\_RFP-Detailed-Requirements\_V2-MarineCFO.xlsx"

**6.2 Additional Training Requirement**

- Included as Appendix B – "TCCS-91113-Training Plan-MarineCFO.pdf"

**6.3 Additional Information Privacy Requirements**

- Included as Appendix C – "VerticalLive Trust Privacy and Compliance.pdf" and "VerticalLive-Whitepaper-Securely-Connected-Vessels.pdf"

**6.4 Additional Information Security Requirements**

- Included as Appendix C – "VerticalLive Trust Privacy and Compliance.pdf" and "VerticalLive-Whitepaper-Securely-Connected-Vessels.pdf"

#### 6.5 Maintenance and Support Requirements

- VerticalLive, Inc. intends to adhere to all requirements outlined in "Attachment A – BC Ferries Software License and Services Agreement (COTS Software) Template, Schedule C – Maintenance and Support."

#### 6.6 Warranty Requirements

- VerticalLive, Inc. intends to adhere to all requirements outlined in "Attachment A – BC Ferries Software License and Services Agreement (COTS Software) Template, Schedule C – Maintenance and Support."

#### 6.7 Insurance Requirements

- VerticalLive, Inc. intends to adhere to all requirements outlined in "Attachment A – BC Ferries Software License and Services Agreement (COTS Software) Template, Schedule C – Maintenance and Support."

#### 6.8 Commissioning Plan Requirement

- Commissioning Plan is included in Project Execution Schedule Appendix D – "TCCS-91113\_RFP-Project-Execution-Schedule-MarineCFO.pdf" and digitally as "TCCS-91113\_RFP-Project-Execution-Schedule-MarineCFO.mpp."

#### 6.9 Costs

##### 6.9.1 Fixed Price Components

##### 6.9.2 Time and Materials Component

- All pricing is included in Appendix E – "TCCS-91113\_RFP-Pricing-Matrix-MarineCFO.xlsx."
- Product Resource Documents supporting items listed in the Custom and Third-Party Software Costs section of Addendum D – "TCCS-91113\_RFP-Pricing-Matrix-MarineCFO.xlsx" are included as Appendix F.

- Project Execution Schedule is included as Appendix D – “TCCS-91113\_RFP-Project-Execution-Schedule-MarineCFO.pdf.”

## **7.0 PROPONENT VIABILITY AND STABILITY**

- 7.1 VerticalLive, Inc. will gladly submit to questions posed after completion of the RFI process, should you choose us as a potential short-list vendor.

## **8.0 ENVIRONMENTAL RESPONSIBILITY**

- 8.1 VerticalLive, Inc. is committed to minimizing its impact on the environment through waste and emission reduction, energy efficiency, promoting sustainable practices both internally and amongst clients and suppliers, and by meeting or exceeding all environmental legislation that relates to our operations.

## **9.0 OTHER**

- 9.1 As indicated in Part A – Administration and General Conditions, Section 18 – Conflict of Interest, Proponents must include information on any individuals utilized in the preparation of the proposal where a potential conflict of interest may arise.
- Currently, no potential conflicts are evident to VerticalLive, Inc.
- 9.2 Confirm acceptance of the contract terms set out herein and / or any amendments or additional terms not previously set out, inclusive of the attached BC Ferries Software License and Services Agreement, (COTS Software)
- VerticalLive, Inc. confirms acceptance of the contract terms set out herein and in any and all amendments to the documents transmitted via RFP 91113 – TCCS Software Selection.
- 9.3 Proponents are asked to comment on the RFP management plan, RFP activity schedule, and requirements listed in this RFP. These comments may include concerns about the project requirements, ideas for solving a requirement in a new way, or project requirements that were not made but should be considered.
- Currently, no concerns exist nor are potential conflicts evident to VerticalLive, Inc.

9.4 Proponent may use this section to bring any other matter to BC Ferries' attention, which would further support the proposal and / or assist in BC Ferries' evaluation process.

- Additional documents to support implementation are found in Appendix G.

# Delaware

PAGE 1

*The First State*

I, HARRIET SMITH WINDSOR, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF INCORPORATION OF "VERTICALIVE INC.", FILED IN THIS OFFICE ON THE SIXTEENTH DAY OF OCTOBER, A.D. 2008, AT 2:53 O'CLOCK P.M.

A FILED COPY OF THIS CERTIFICATE HAS BEEN FORWARDED TO THE NEW CASTLE COUNTY RECORDER OF DEEDS.



4612624 8100

081043743

You may verify this certificate online  
at [corp.delaware.gov/authver.shtml](http://corp.delaware.gov/authver.shtml)

Section 22

Harriet Smith Windsor, Secretary of State

AUTHENTICATION: 6915275

DATE: 10-16-08

# **Training Plan**

## **BC FERRIES TCCS PROJECT**

**This training plan is provided as a resource to the BC Ferries TCCS Software Selection project team to outline training practices undertaken during the implementation phases of the previously named project. As this document is updated, throughout the course of the project, the version numbers will be updated and tracked with appropriate approvals from BC Ferries staff, as well as team members involved in the project at VerticalLive, Inc.**

## DOCUMENT HISTORY

Document Version: 1

Date: 07/31/2018

### Revision History

Version	Date	Changes	Reason
1	07/31/2018	Initial document	

### Approval History

Milestones	Version	Review Dates	Action Taken
Internal VerticalLive approval	1	07/31/2018	Laura Martin
BC FERRIES approval			



## **INTRODUCTION**

The purpose of this document is to outline the training practices embodied by VerticalLive, Inc. These standard training practices will be utilized throughout the implementation of MarineCFO for the TCCS Project, should MarineCFO be the product-of-choice for BC Ferries.

### **Background and Scope**

BC Ferries has released an RFI to procure a new Time Collection and Crew Scheduling Solution (TCCS). This document details how training will be conducted on MarineCFO Endurance and related products to meet the workflow demands detailed in the RFI.

It is the desire of VerticalLive to utilize existing internal project methodology to engage BC Ferries throughout the development / configuration processes detailed in the TCCS project. As an organization, we believe this facilitates project success in a very tangible way; therefore, various levels of training will take place. Training during the development / configuration process will be on-going, typically weekly, as the project progresses.

## **INSTRUCTIONAL ANALYSIS**

### **Needs and Skills Analysis**

Throughout the Needs Analysis phase of the implementation of MarineCFO Endurance, Subject Matter Experts (SMEs) will be identified, and their unique skillsets documented. These individuals will be trained as trainers, to provide internal support for the TCCS Project. In addition, these SMEs will assist in identifying the user-groups to be trained prior to go-live.

### **Development Approach**

As the product is configured, documentation will be created, including testing and training plans. These testing and training plans will be disseminated to the SMEs for BC Ferries internal testing and future training needs.

## **INSTRUCTIONAL PLANNING**

### **Goal Setting**

A training rubric is an innovative tool that will be used to determine the deliverables to be met during each session. This rubric will define criteria and measurable parameters to meet for each group of trainees. Training should not progress past each step in the rubric, until its predecessor is complete, and understanding is affirmed.

## **INSTRUCTIONAL METHODS**

### **Training Methodology**

Training will be scheduled with the project lead and SMEs, and detailed plans made for each group of trainees. The trainer will utilize the course-specific training plans to create resources for dissemination to the trainees. Examples are PowerPoint presentations, system manuals, and how-to-videos. Training can be conducted virtually, or on-site.

### **Virtual Training**

Virtual Training is utilized during the implementation phase, to train SMEs for testing and approval of development / configuration tasks. These virtual training sessions are typically conducted weekly via screen share sessions, whereby high-level users of the system are oriented to new functions and processes and are then tasked with working through these processes to test the validity of the configuration.

### **On-the-Go Training**

On-the-Go Training can be utilized to train users who are traditionally not sitting behind a desk in your office(s). With On-the-Go training, a link to very specific, role-based instructional videos are texted or emailed to trainees. Once the training video is watched, the trainee is presented with a scenario that tests their knowledge. Results are logged, and notification of completion is emailed to instructors and/or SMEs.

### **On-site Training**

On-site Training will occur in the immediate period prior to go-live on the MarineCFO Endurance product. This will be detailed training with the affected user-groups, as defined by each functional group's SME.

On-site training typically occurs for one (1) week prior to go-live, with multiple members of the MarineCFO Implementation Team on-site. As training occurs in a group format, other members of the Implementation Team "float," as needed to assist BC Ferries users one-on-one, as they return to their desks to test features and functions explained during training.

During on-site training, trainers will employ methods such as:

- Scenario-based role-playing
  - Trainers work with SMEs in advance to map out scenarios that will test the knowledge of the course attendees. As a rubric goal is completed, a scenarios are laid out to attendees and someone from the group must "drive" the solution within MarineCFO.
  - A vessel captain, for instance, will be asked to practice what happens when an employee on the Landed Crew List does not report for duty. How will he manipulate the Crew List in Vessel 365 to insure the schedulers on shore are notified of this information?
  - A scheduler gets a call-in and must use the Employee Finder to find a suitable replacement for the employee who called in.
- Game-playing with awards
  - Jeopardy: The trainers and SMEs come up with a series of answers, wherein the questions relate to how a problem is solved in MarineCFO. The Jeopardy board is formatted in a PowerPoint, and each trainee must chime in if he/she knows the answer. Points are accumulated, and the winner receives some form of award. A gift card or free lunch, perhaps.
  - Wheel of Fortune: An online site is used to allow each trainee to spin a wheel, where a question resides on each slice of the wheel, along with a prize. If the trainee answers the question properly, he/she wins the prize associated with that slice of the wheel.

### **Training Database**

VerticalLive, Inc. will maintain a test version of the production database for BC Ferries, to insure live data is not used during training. This will allow the trainer and trainees to enter data and utilize actual setup data, while not affecting information in the production database. The idea is to give trainees the look and feel of the production data, while leaving the production data in pristine condition.

## **TRAINING RESOURCES**

### **Resources and Facilities**

Training resources and facilities will differ based on whether training is virtual or on-site.

#### **Virtual Training Resources and Facilities**

Virtual Training will require an internet connection and installation of either Skype for Business, Chime or connection to join.me (or BC Ferries connection solution of choice) for screen share capabilities. BC Ferries will be responsible for insuring group virtual trainings take place in a location that allows the trainees clear and unfettered view of the training as it progresses. Should training be delivered via training videos, a computer with video playback and sound capabilities will be necessary.

#### **On-site Training Resources and Facilities**

On-site Training will require the trainer the ability to connect to BC Ferries internet. In addition, BC Ferries will provide a screen and projector or large monitor and all cabling necessary for connection to these devices.

### **Schedules**

All training will be scheduled with appropriate SMEs and training plans disseminated ahead of said training to allow for BC Ferries internal preparations.

## **EXAMINATION AND FEEDBACK**

### **Examination**

Utilizing MarineCFO's Vessel 365 product, a checklist is created to allow users to take a quiz on the content that was presented in his/her training session. This process not only orients the trainee to the Vessel 365 product, but it examines their knowledge related to the training conducted. Because the answers are archived in the BC Ferries MarineCFO tenant, the MarineCFO Implementation Team and BC Ferries' SMEs can review answers and determine where training is failing or succeeding.

### **Feedback**

Also utilizing MarineCFO's Vessel 365 product, a checklist is created to allow users to provide feedback on the training received. The answers are archived in the BC Ferries MarineCFO tenant, therefore, the information is minable and allows for internal process improvement and repeated use of the feedback checklist.

## **FUTURE TRAINING**

All training materials, including but not limited to PowerPoint presentations, outlines, and videos will be provided to BC Ferries for their internal document library. This will allow SMEs to train new hires, and to conduct refresher training as the needs arise. VerticalLive, Inc. is available for future training as requested, under the terms of a standard Services Agreement.

## APPENDIX A: TRAINING SCHEDULE

TASK	TYPE OF TRAINING	DURATION OF TRAINING
s.17, s.21		



# **Vessel Communications & Maritime Cybersecurity**

**Dean Shoultz**

MarineCFO Chief Technology Officer

January 2017

## Acknowledgements

This document was initiated by MarineCFO in response to customer requests for technical guidance on vessel communications options and cybersecurity. While the MarineCFO product Vessel365 is used as an example throughout, this document can also serve as a good source for generic information on the subject for any operator.

## Feedback

Please send comments or suggestions about this document to the MarineCFO Team feedback alias ([info@marinecfo.com](mailto:info@marinecfo.com)).

MarineCFO is a line of integrated business solutions designed to assist with the management and regulatory challenges of marine transportation related companies.

U.S. and Canada Toll Free 1-866-962-7463

Worldwide +1-985-876-0099

[www.marinecfo.com](http://www.marinecfo.com)

### Legal Notice

The information contained in this document represents the current view of MarineCFO on the issues discussed as of the date of publication. Because MarineCFO must respond to changing market conditions, it should not be interpreted to be a commitment on the part of MarineCFO, and MarineCFO cannot guarantee the accuracy of any information presented after the date of publication.

This White Paper is for informational purposes only. MARINECFO MAKES NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE INFORMATION IN THIS DOCUMENT.

Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced, stored in or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of MarineCFO.

MarineCFO may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from MarineCFO, the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

© 2016 MarineCFO. All rights reserved.

MarineCFO, MarineCFO Endurance, MarineCFO Enterprise, and Vessel365 are trademarks of MarineCFO.

All other trademarks are property of their respective owners.

## Preface

As improvements to communication technologies, sensors, and vessel electronics continue to progress, operators are more motivated than ever to provide reliable communication solutions to their fleet. The wide range of options and variables involved in creating a “connected vessel” can be overwhelming, and these options vary dramatically in costs, reliability, capability, and security.

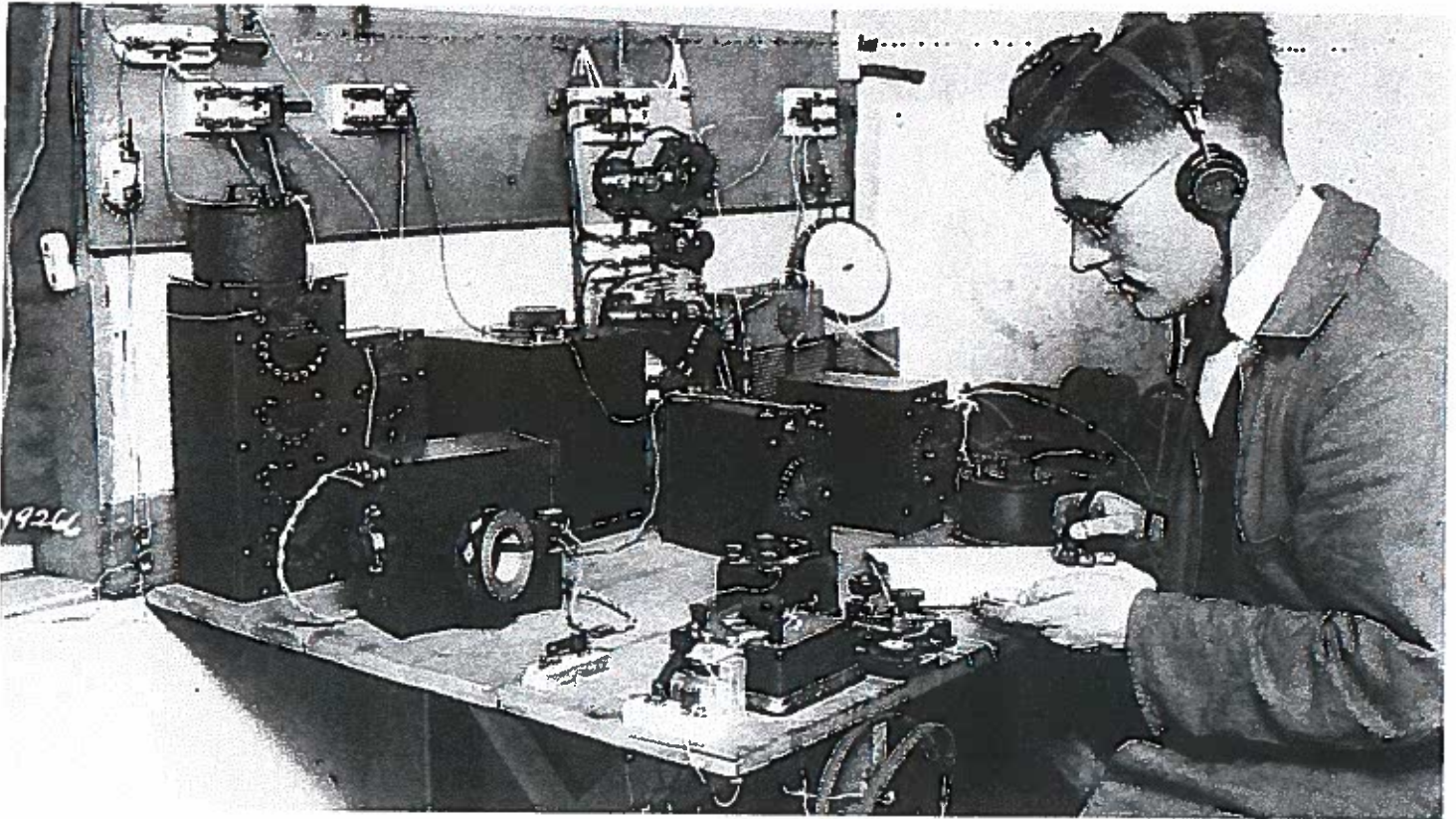
While increased connectivity can lead to a safer, more automated vessel, so too increases the risk of a cybersecurity breach. Historically, cybersecurity was not a major concern for the marine industry, but with the advent of autonomous vessels, sensor-driven predictive analytics, and remote control technologies, the risks associated with an attack are high. For that reason, implementing a connectivity solution must also take cybersecurity into consideration.

This document is designed to serve as a practical guide that helps operators make better decisions on how to best provide connectivity to their fleet, while also factoring in cybersecurity.



## Contents

Introduction.....	5
Drivers for the Adoption of Vessel Communications.....	6
Safety and Distress.....	7
Compliance and Regulatory Requirements.....	7
Navigational Aids.....	8
The Internet of Things (IoT), Predictive Analytics, and Machine Learning.....	10
Operations.....	12
Entertainment.....	12
Photos and Video Monitoring.....	12
Voice and Data Communication Technologies.....	13
Radio.....	14
Mobile Satellite Systems (L-band).....	15
Mobile.....	15
Notes on the Limitation of Mobile as a Distress Technology.....	16
Satellite VSAT.....	17
Cybersecurity.....	18
Current Challenges in the Marine Industry.....	19
Types of Attacks.....	19
Vulnerable Onboard Systems.....	21
Mitigation Strategies.....	22
Selecting the Appropriate Communication Solution.....	25
Vessel Types and Machinery.....	26
Job Functions.....	26
Operational Waterways.....	26
Costs.....	27
Business Continuity.....	27
Vessel365 and Related Applications.....	29
Architecture.....	30
Smart Client.....	30
Encryption and Compression.....	30
Calculating Costs and Data sizes.....	31
Sensor Integration.....	32
APPENDIX A: References.....	33



## Introduction

Communication technology advancements between the mid-19<sup>th</sup> and early 20<sup>th</sup> century had a profound effect on the safety of ships and their crews. For millennia, when a vessel left the safety of port, it was for all practical purposes on its own. An incident that occurred at sea almost never ended well, whether it involved a problem with the ship itself, the health of a crew member, or unexpected weather conditions.

During this period, the pioneering work of scientists like Samuel Morse and Guglielmo Marconi made it possible for vessels to communicate with the shore and nearby ships. While crude by today's standards, technologies like the spark-gap generator pictured above allowed an onboard radio operator to both send and receive messages using Morse code. The ability for a ship to send a distress signal changed the game, and untold thousands of lives were saved accordingly.

Today as in the past, shipboard technologies continue to improve. While many of the motivations for a connected vessel remain the same, new reasons exist as well. Distress signals are still vital but can now include precise locations on the earth's surface using GPS coordinates, dramatically improving the efficiency of a search and rescue mission (SAR). Fast forward 100 years, and modern crew members want to send an email or speak to a family member, too.



## Drivers for the Adoption of Vessel Communications

Many operators now see their vessels as branch offices of the company. They are the location where most of the company's business transactions take place, where its primary assets are utilized and maintained, and where the bulk of its employee's work. Companies often create Wide Area Networks (WAN's) to electronically unite offices and shore-side facilities, but increasingly, those networks now include the mobile fleet as well.

## Safety and Distress

Starting in the early 1900's, the primary motivation to equip a vessel with communications was to provide improved safety for the crew and her passengers. These vessels used the Morse telegraph to transmit information, (Morse visual signaling started in 1844) and if a ship found itself in peril, it could now send out a distress signal and potentially receive assistance.

That same spirit of safety has come a long way, and in 1988 GMDSS was introduced to make ship rescues easier. SOLAS (Safety of Life at Sea), Chapter IV, defines the GMDSS functionality standard and communication equipment applicable to vessels above 300 tons that undertake international voyages. GMDSS is primarily radio based using VHF, MF, and HF, and does not offer data transmission. Digital GMDSS systems that utilize satellite, such as Inmarsat, offer very limited data transmission primarily to support the sending of distress messages only.

GMDSS is an international standard maintained by the IMO, a United Nations agency, and is designed to support alerting, geographic positioning of the vessel in stress, search and rescue coordination, homing, safety broadcasts, general communications, and bridge-to-bridge communications.

Cospas-Sarsat is an internationally maintained satellite-based search and rescue system, established by Canada, France, the United States, and Russia. Collectively these countries developed the 406MHZ Emergency Position-Indicating Radio Beacon (EPIRB) which operates with Cospas-Sarsat.

Other technologies that currently provide additional protection to modern mariners include the NAVTEX alerting system, Inmarsat satellite based systems, and High Frequency (HF) radio.

## Compliance and Regulatory Requirements

A more modern driving force for the adoption of on-vessel communications is the need to conform to an increasing number of industry, customer, or governmental based regulations. For example, the United States Coast Guard (USCG) passed Subchapter M (SubM) in July of 2016. SubM affects nearly 6000 vessels that primarily operate within the inland United States waterway system.

For the first time in USCG history, SubM officially recognizes and supports the concept of an electronic record, in contrast to the centuries old manual, paper logs. Vessel activities, such as safety drills, maintenance tasks performed, and job related events, can all be stored in a database that resides on the vessel. The USCG reserves the right to interrogate and audit these records to look for objective evidence in the event of an incident with the vessel, or to confirm that the vessel is operating under the spirit of its Safety Management System (SMS), or Towing Safety Management System (TSMS).

This has led some operators to think in terms of taking the records generated on the vessel and migrating them to the shore to drive automation around maintenance, billing, and dispatching. To support that model, operators need communications with the vessel to both receive those records and also push tasks and notifications back to the vessel.

## Navigational Aids

Communications are also used by navigation systems, and to report information back to regulatory authorities, including:

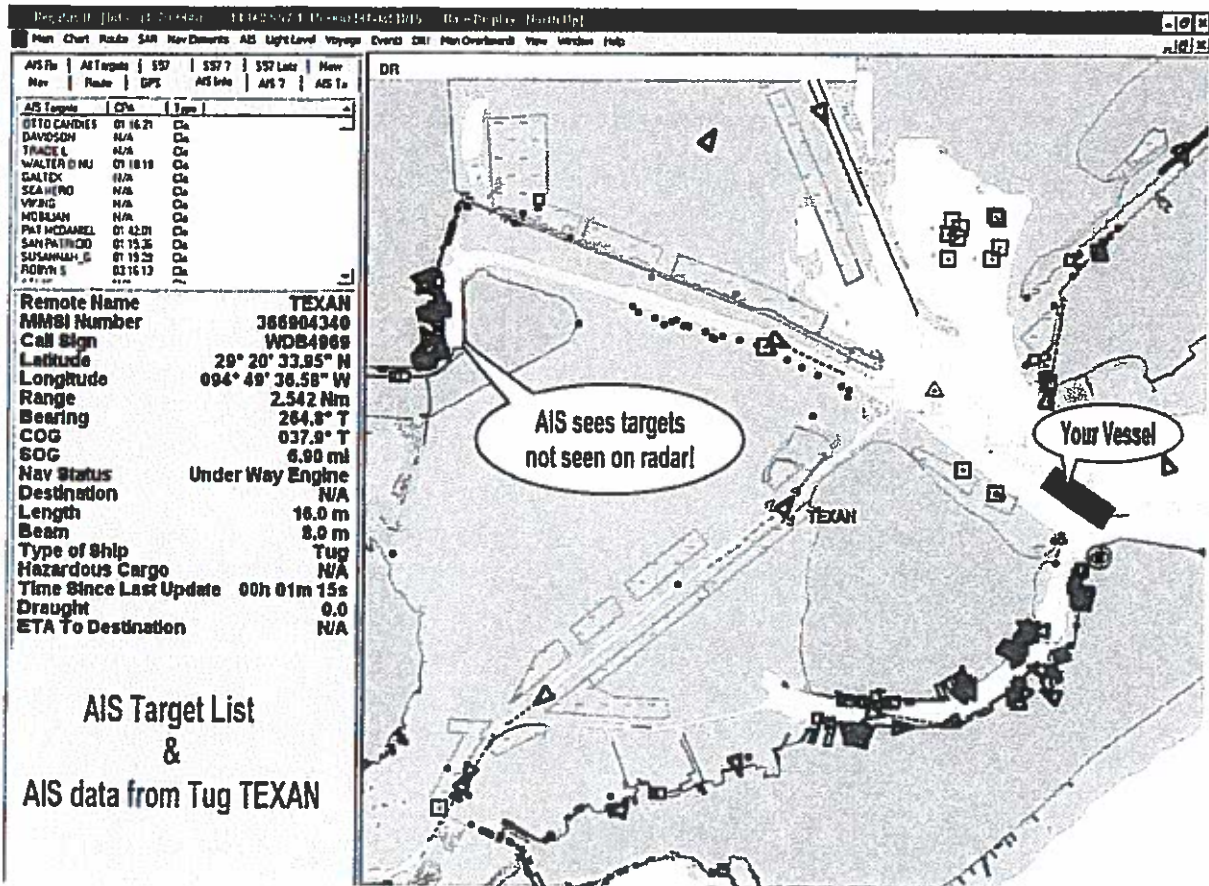
- Virtual Buoys (eATON's)

Traditional ATON's (Aid to Navigation) are physical structures that assist a captain by identifying lanes of passage based on water depth, underwater obstructions to be avoided, and similar purposes. Unlike the static paper charts used for centuries, modern navigation systems thrive on real-time, dynamic data often maintained by third parties, and communications are used to send updated navigation information to the vessel. Recently, that model also began to include Virtual Buoys. From a captain's perspective, a virtual buoy appears as an icon on the navigation system, perhaps representing the presence of another vessel nearby, or a recently discovered underwater obstruction. Virtual buoys are dramatically reducing fogbound collisions and allisions, so the need for a reliable communication pipeline to the vessel to render these virtual buoys, in near real-time, is critical for improved safety.

- Automatic Identification System (AIS)

The Automatic Identification System (AIS) is an automatic tracking system used on ships and by vessel traffic services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships, AIS base stations, and satellites.





AIS Target List & AIS data from Tug TEXAN

### What You See on AIS

- Voice Communications

Voice communications allow the vessel to communicate with the shore, emergency authorities, pleasure crafts, colleagues, or nearby vessels. This vital line of communication can provide critical and timely information as to weather conditions, route choices, or other incidental hazards to navigation.

- Long Range Identification and Tracking (LRIT)

Established by the International Maritime Organization (IMO), this standard mandates that a vessel reports its geographic location to its flag administration four times a day.

- Vessel Traffic Service (VTS)

Used by harbor or port authorities to manage incoming or outbound traffic, this system is similar to the system air traffic controllers use. It typically operates using radar, CCTV, AIS, or VHF. VTS is governed by SOLAS, Chapter V, Regulation 12, together with the Guidelines for Vessel Traffic Services [IMO Resolution A.857(20)] adopted by the International Maritime Organization on 27, November, 1997.

## The Internet of Things (IoT), Predictive Analytics, and Machine Learning

The internet and cloud have revolutionized many industries, and while there is still a long way to go to realize its full benefit, so too will it have a profound effect on the marine transportation industry.

More and more things in our lives are now “connected” to the internet. Our doorbell allows us to see and speak to a visitor even when we are thousands of miles from home. Our car can receive roadside assistance with the push of a button, and our refrigerator can email us when the water filter needs to be changed.

Most modern vessels have sensors on-board, whether they come built into OEM equipment like an engine, or if they were added during the original construction or a repowering. Some vessels have many thousands of sensors measuring things like temperature, hull vibrations, runtime hours, fuel consumption, and when a bilge pump activates. Traditionally these sensors were designed to culminated in the wheelhouse to alert the captain of anomalies. Most of the data collected by these sensors, often voluminous amounts of it, were at best archived somewhere on the vessel, or more typically, not preserved at all. Some companies would send a person out, occasionally, to fetch the data and burn it to a DVD for some future, unknown potential use.

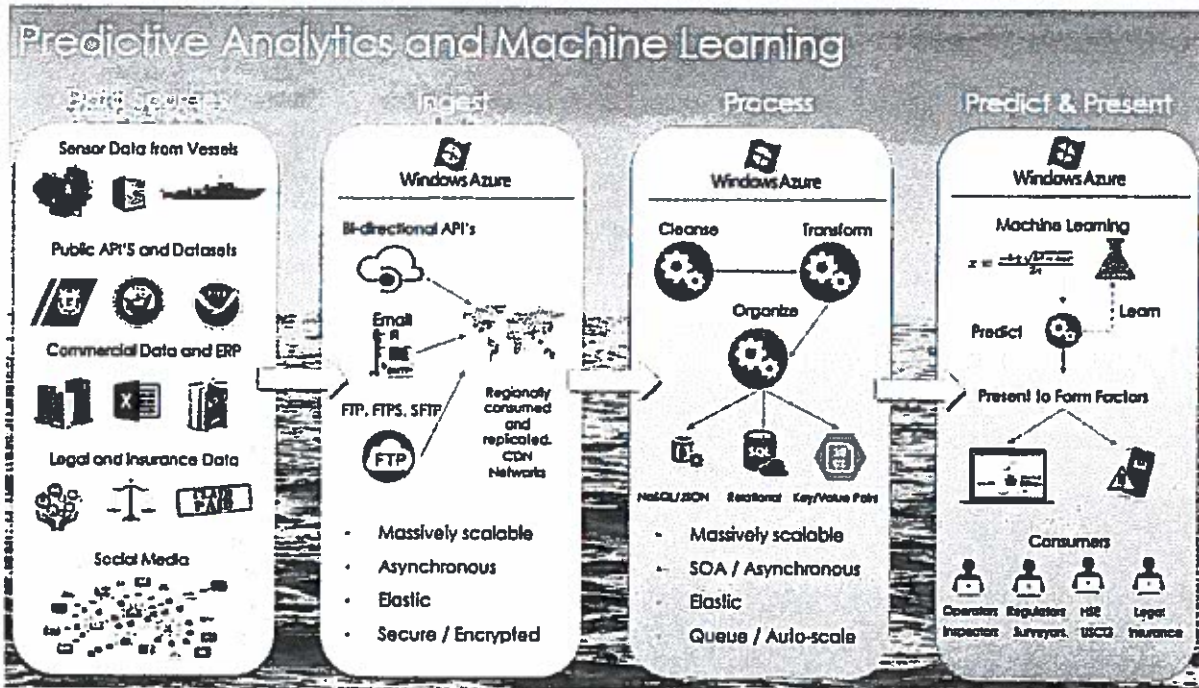
With the advent of the public cloud, larger data pipes to the vessel, and the inexpensive nature of storing large volumes of data, it now makes sense to consider transmitting this data to the cloud or internal server for a variety of purposes, such as monitoring asset usage in a conditional maintenance strategy, or tracking runtime hours in a waterway segment for precise tax calculations.

Sensor set-points are the thresholds defined for each sensor that when exceeded or triggered, alert the captain or crew, typically via an alarm or another indicator in the wheelhouse. For example, a vibration sensor may be attached to the hull wall near an engine. Normally the vibration stays within a fixed range, but when it goes outside of that range, the captain is alerted.

A limitation caused by a lack of communications is that usually, by the time the measured vibrations goes outside of the known-good range, damage to the engine has already occurred or is now imminent. Set-points are often configured pessimistically as to not generate false alarms or heckle the captain. In

reality, the abnormal vibration started trending much earlier, often months earlier, likely indicating a problem with the bearings. If the sensor data had been shipped to the shore daily, a different set-point could have been used by a person behind a desk, and the problem could have been identified much earlier. A day of downtime is costly, and worse, machinery failure could affect human safety. Proactively dealing with the situation as opposed to reactively responding to it could save both money and lives.

More recently, machine learning can apply proven algorithms to sensor data accumulated over time to predict machinery failures, human-error accidents, and related situations. For that reason, migrating the data from the vessel to long-term storage onshore is often useful and cost-justifiable to operators. Not only can these algorithms interrogate sensor data, but they can now integrate with other sources of data to add more meaningful variables to calculations. For example, NOAA atmospheric and ocean condition data could be married to the crew's social media and training data, and factored in with sensor data, to more accurately predict incidents.



*A common IoT vessel architecture used to drive a predictive analytics scheme, using the Microsoft Azure public cloud as an example*



## Operations

Another use of vessel communications is to support the use of software applications and devices that automate the functional purpose of the vessel. Those systems typically include:

- Electronic logging applications, such as Vessel365
- Operational computer systems that manage the job function of the vessel, such as a tow diagram
- Cargo and logistics monitoring applications
- Fuel monitoring solutions
- Transmission of captured data, such as scientific research vessels, environmental, or seismic data
- Reporting notable vessel activities to customers in real-time, such as the delivery of goods or the pickup of crew members
- Dispatch communications between the vessel and shore-side personnel

These systems will vary from operator to operator and are largely determined by their particular line of business, such as transporting cargo, moving passengers, or doing scientific research. Each system will also have a varying degree as to the amount of data it requires. For example, electronic logging systems will require a relatively small data pipe, whereas vessels that scientifically collect data will require a much larger one.

## Entertainment

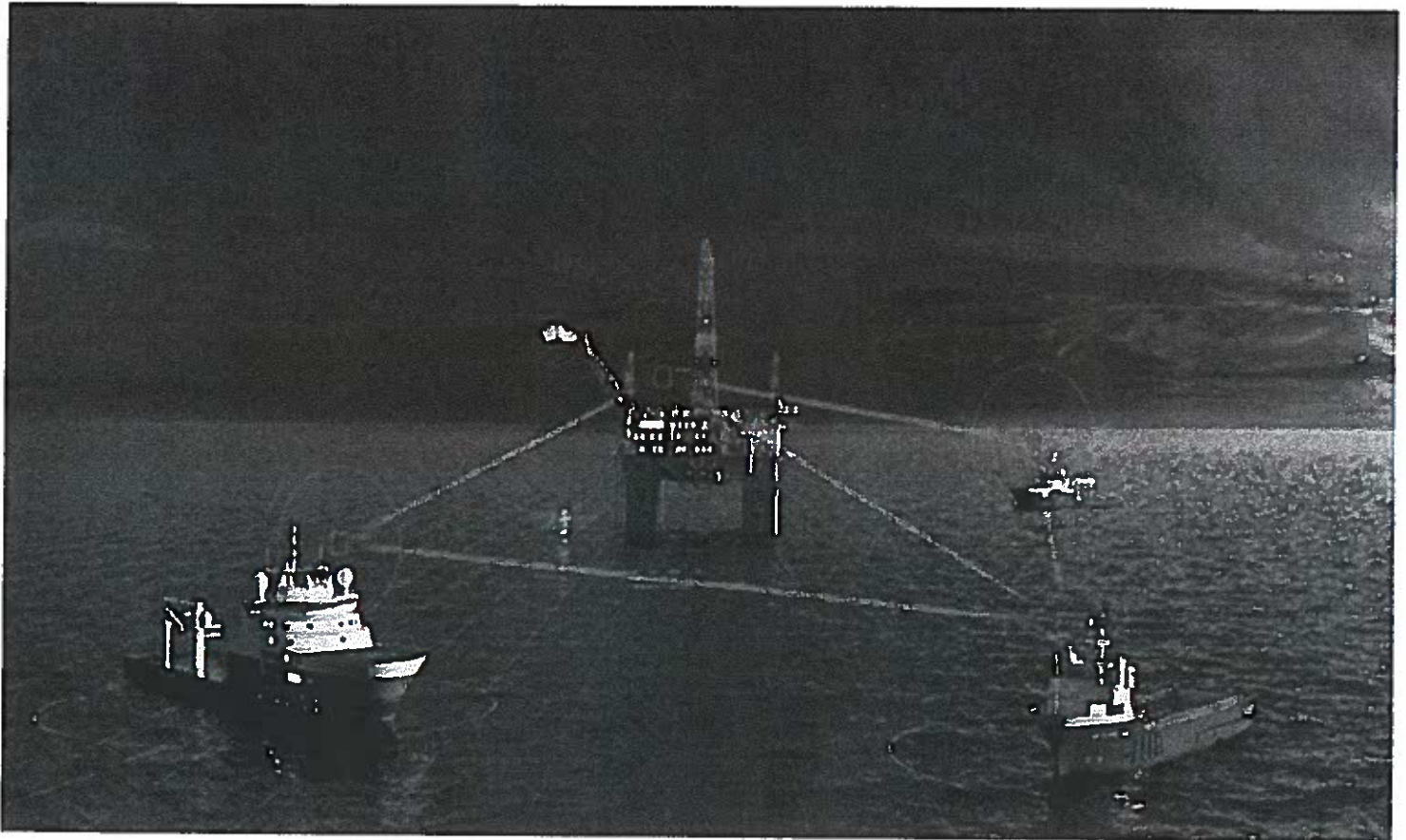
Some vessels will also use connectivity to provide entertainment to crew members or passengers.

Examples include:

- Onboard Wi-Fi for the crew to use for their cell phone or personal device
- Television feeds
- Subnetworks to provide Wi-Fi to passengers
- IP based telephony

## Photos and Video Monitoring

Some operators also benefit from live video feeds from the vessel. Shore-side personnel can monitor crew activities in real-time for safety purpose. Engineers can evaluate vessel issues, such as nonconformities and deficiencies, by evaluating video or photos from observations made by crew members. They can often make a more accurate assessment of a particular situation and respond accordingly.



## Voice and Data Communication Technologies

Modern operators often face a daunting challenge in determining what is appropriate for their specific needs. Variables include operational and job requirements, startup and recurring costs, reliability, uptime guarantee, bandwidth needs, and the geographical areas and waterways in which the vessel operates.

Some systems offer regional support, whereas others offer global coverage. Some have fixed costs data plans, while others are costly and charge for the number of characters transmitted. Solutions vary in resiliency as well, where one may go down for days at a time after a hurricane, while others practically never go down. Each of these systems have their own pros and cons, and it is vital for operators to select

the solution best suited for their particular needs, to both control costs and to also deliver the required level of operational service to the vessel.

## Radio

Radio systems VHF, MF, and HF, are common place in the marine industry and provide the following communication services:

- Two-way voice communications
- Distress alerting
- Telex with printing. Telex is an international system of telegraphy with printed messages transmitted and received by teleprinters using the public telecommunications network.

The typical range for the different radio bands are as follows:

BAND	FREQUENCY	TYPICAL RANGE FROM BASE STATION
VHF	30-300 MHz	74-110 KM / 40-60 Nautical Miles
MF	300Khz-3Mhz	275-370 KM / 150-200 Nautical Miles
HF	3-30 MHz	Worldwide during optimal conditions

Radio services are often maintained by maritime authorities and typically free, but as a result, there has not been a lot of innovation around using radio waves to transmit data. Initiatives like Packet Radio and VHF Data Exchange may make the use of radio to transmit data a more viable solution in the near future. So, while radio can provide an excellent solution for voice and telex, it does not currently offer a good data solution.

## Mobile Satellite Systems (L-band)

Companies like Inmarsat, Iridium, Thuraya, OrbComm, DirectTV, and others maintain satellite based systems that offer a variety of communication packages and solutions for marine transportation companies. Their satellites operate in different levels of stationary orbit and generally provide reliable services covering the vast majority of the world's navigable waters.

Their solutions are typically proprietary.

As an example of the types of services these providers offer, Inmarsat provides the following services, along with others:

- **FleetBroadband**  
Delivers global voice and broadband data, with a range of capabilities and antenna sizes.
- **SwiftBroadband**  
Provides high-quality voice and high-speed data, simultaneously, through a single antenna on a global basis.
- **Low Profile BGAN**  
Remote controlled broadband service with lie-flat antenna that delivers high-speed IP communications for covert and discreet operations.
- **Fleet Media**  
Maritime entertainment solution that brings films, sports and TV shows to your crew on-demand, anywhere at sea.
- **Fleet One**  
Satellite voice and data services for fishing, merchant and leisure vessels of any size.

Iridium, Thuraya, and others have similar packages that offer Broadband, Data, and voice solutions for vessel operators.

## Mobile

Land-based mobile technologies have experienced rapid growth in the last 20 years, primarily to support the proliferation of smart phones and related devices. Given the proper antenna configuration and power, current technologies such as 4G can work over a range of 100Km, or 50 nautical miles. Some systems can reach offshore as far as 120 km, making them a viable solution to operators working within that range of the shore.

Mobile based solutions, including the use of air cards or mobile “hot spots” can provide useful data and voice solutions for operators that work along coastal waters on inland river systems. Many now offer unlimited data plans with guaranteed data speeds.

Wi-Fi is another technology useful to some operators, particularly those operating around ports or harbors. Some standards such as IEEE 802.11 and IEEE 802.16 can offer ranges up to 15 km and data speeds between 512 kbps-8Mbps.

Some companies provide regional cellular services that are designed to cover a particular area at sea where vessel traffic is high. For example, Broadpoint operates a cellular network in the U.S. Gulf of Mexico that targets the OSV (Offshore Supply Vessels) market which services the oil production platforms in the area. Unlimited voice and text packages start at US \$79 per month, and data packages starting at 1 GB per month for US \$119. These solutions are relatively reliable and offer compelling costs/value propositions to operators.

## Notes on the Limitation of Mobile as a Distress Technology

The United States Coast Guard does not endorse cellular phones as a primary means of distress notification in the maritime environment. Cell phones have several shortcomings in the maritime environment that can delay search and rescue authorities.

During a search and rescue (SAR) case, the Coast Guard attempts to broadcast as much information as possible about the case. These broadcasts provide information to mariners that may be in the vicinity of the SAR case so that they can respond appropriately. A cell phone limits communications between the Coast Guard and the mariner in distress, because other possible rescuers in the area are not immediately made aware of the SAR case. In contrast, a marine radio call allows all other mariners in the area to overhear the distress call and respond if possible.

Most cellular phones are designed for a land-based service. Their offshore coverage is limited and may change without notice.

Locating a cellular caller can be difficult. If you don't know your position precisely, the Coast Guard may have difficulty locating you.

Two United Nations-chartered organizations, the International Maritime Organization and the International Telecommunications Union, are responsible for defining and regulating maritime telecommunications systems. The most current system adopted by these two organizations is the Global Maritime Distress and Safety System, or GMDSS. Morse wireless telegraphy, used by ships for distress and safety communications since the beginning of the century, was discontinued by the USCG in 1995, and ceased worldwide on February 1, 1999. Many people owe their lives to this system.

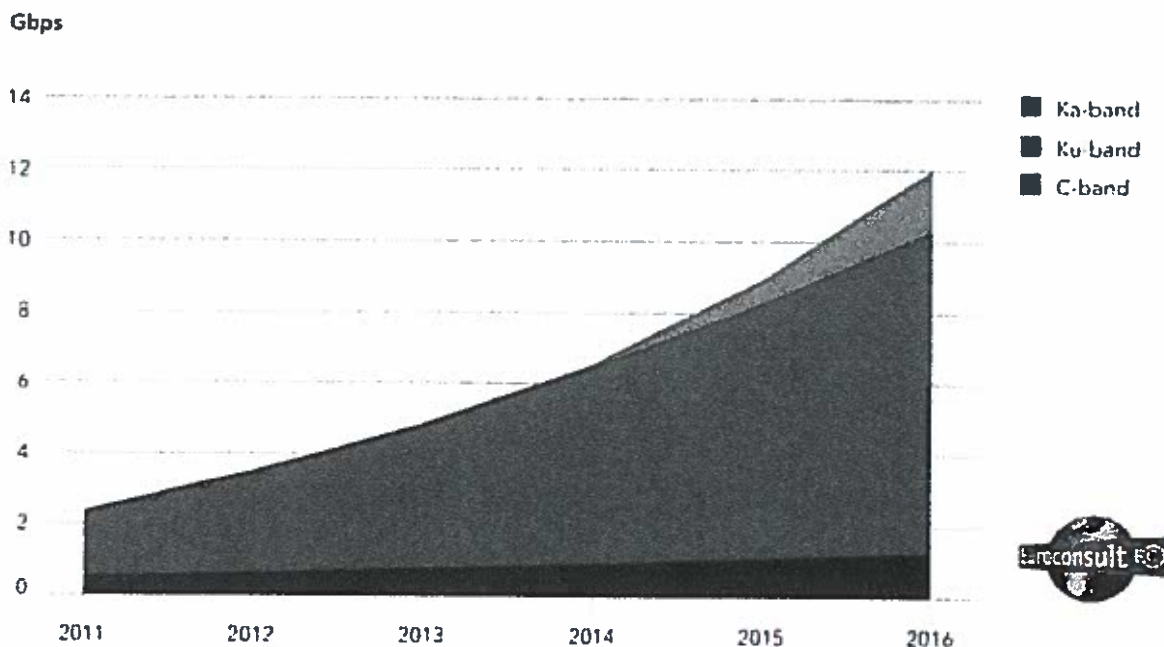
## Satellite VSAT

VSAT satellites operate on C-, Ku and Ka bands which have a broader spectrum. As a result, data rates are typically much higher and costs much lower than L-band systems like Inmarsat and Iridium. Because of the way a ship typically moves, a VSAT antenna must be extremely stable and accurate so that it constantly points toward the satellite.

Typical VSAT plans offer data speeds up to 6 Mbits per second capped at a certain amount of consumption. Overages are charged for additional usage, typically in the \$1 or less per MB range.

The VSAT market is more competitive than the L-band satellite market, and as a result, there are more innovations happening there. Low antenna gains make it an excellent choice for deep-sea operators.

## Bandwidth Comparisons



Source: Euroconsult, *Maritime Telecom, Solutions by Satellite, 2014*



## Cybersecurity

No conversation on ship connectivity would be complete without also factoring in the risks associated with cybersecurity. As ships become more connected, automated, and with autonomous vessels a reality, the marine transportation industry is placing greater focus on cybersecurity.

It is strongly recommended that operators develop a cybersecurity policy that resides and is maintained within the SMS or TSMS.



## Current Challenges in the Marine Industry

While there are common cybersecurity issues across industries, the marine industry has unique challenges.

One challenge derives from the ad-hoc nature of the various systems onboard a vessel. Often these systems are a cobbled together from a variety of OEM providers during the original construction, and further fragmented over the lifespan of a vessel, such as during a repowering event or a change in wheelhouse electronic equipment. This leads to the lack of a top-down, comprehensive cybersecurity plan that contemplates all of the systems onboard, as a single securable asset.

Another common challenge stems from a misunderstanding between the OEM provider and the operator. OEM providers often think that the operator is ultimately responsible for cybersecurity, while the operator assumes that the responsibility lies with the OEM provider. Operators often falsely assume that OEM equipment, usually installed by third parties, is innately secure, and that the providers have contemplated cybersecurity on their behalf. This is usually not the case and leads to a false sense of security.

To overcome these challenges, OEM providers should focus on:

- Product assurance statements that the operator can rely on
- Third party cybersecurity validation of equipment
- Certification and training of third party integrators

Operators should:

- Ask for assurance statements from the OEM provider, and/or the integrator
- Understand the limitations and vulnerabilities of systems as detailed by the provider
- Request and validate the segregation of onboard networks, such as engine, cooling, steering, AIS, GMDSS, Wi-Fi, back office, etc.

## Types of Attacks

Cyber-attacks come in multiple and unsuspecting forms including, but not limited to the following practices:

- **Social engineering**  
An attack vector that relies heavily on human interaction and often involves tricking people into breaking normal security procedures.
- **Phishing**



An email that will typically direct the user to visit a website where they are asked to update personal information, such as a password, credit card, social security, or bank account numbers, that the legitimate organization already has.

- **Waterholing**

A watering hole attack is a security exploit in which the attacker seeks to compromise a specific group of end users by infecting websites that members of the group are known to visit. The goal is to infect a targeted user's computer and gain access to the vessels network.

- **Ransomware**

A type of malicious software designed to block access to a computer system until a sum of money is paid.

- **Scanning**

An attacker launches a port scan to see what ports are open, with a listening service, on your machine. A port scan attack, therefore, occurs when an attacker sends packets to your machine, varying the destination port.

- **Spear-phishing**

Spear phishing is an email that appears to be from an individual or business that you know, but in reality, is not. Instead it is from a hacker looking for vital information from your system, such as the vessels current location, the cargo it is carrying, and to which port and at what time it will arrive.

- **Deploying botnets**

A network of private computers infected with malicious software and controlled as a group without the owners' knowledge, e.g., to send spam messages.

- **Subverting the supply chain**

A supply chain attack is a cyber-attack that seeks to damage an organization by targeting less-secure elements in the supply network. Cybercriminals typically tamper with the manufacturing process of a product by installing a rootkit or hardware-based spying components.

## Vulnerable Onboard Systems

Vulnerable onboard systems can include, but are not limited to:

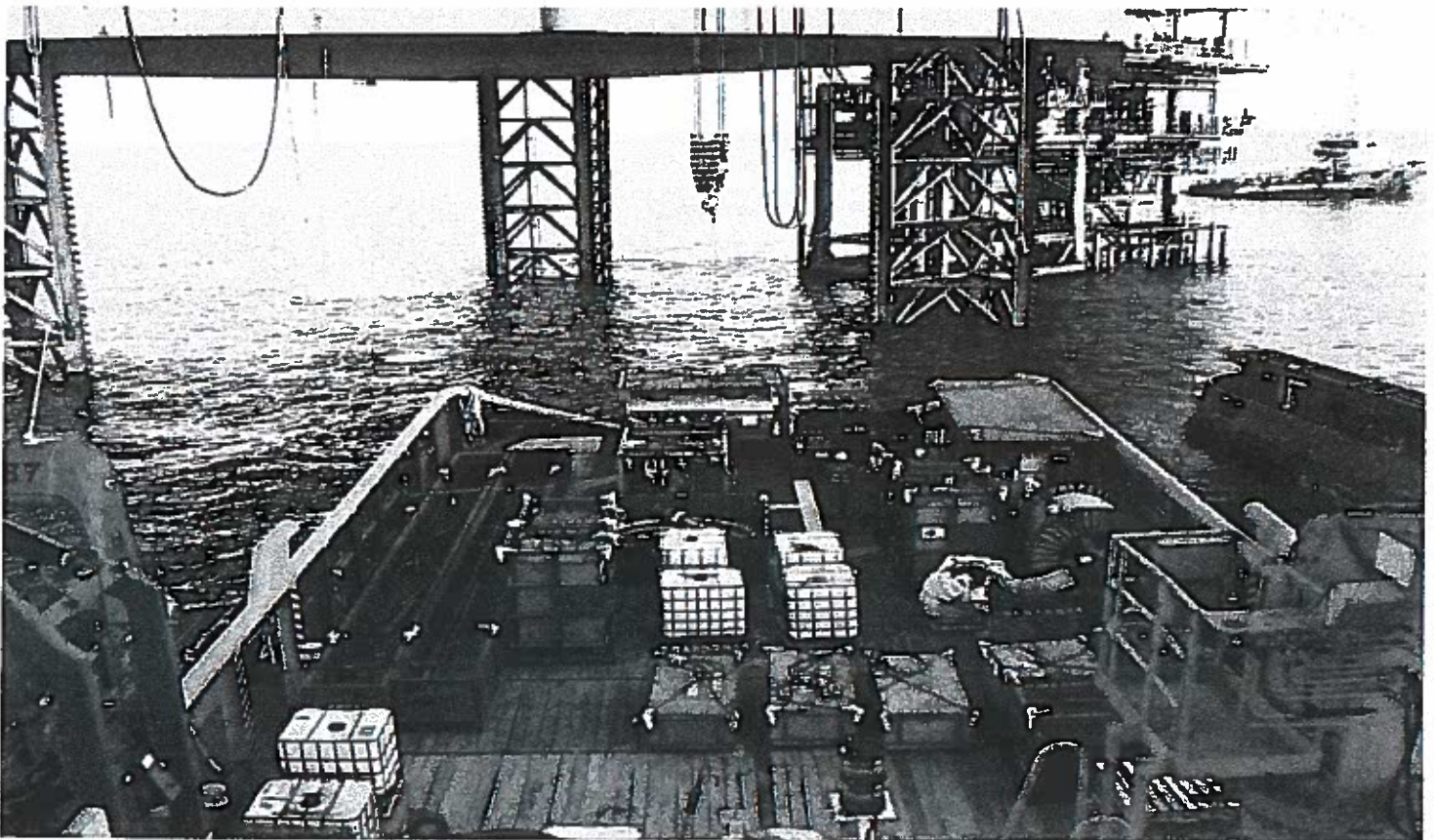
- Cargo management systems.
- Bridge systems.
- Propulsion and machinery management and power control systems.
- Access control systems.
- Passenger servicing and management systems.
- Passenger facing public networks.
- Administrative and crew welfare systems.
- Communications systems.
- Edge and distributed computing devices that support an IoT enabled ship

## Mitigation Strategies

s.15, s.17

s. 15, s. 17

s.15, s.17



## Selecting the Appropriate Communication Solution

With the wide variety of vessel types, waterways of operation, communication technologies, and operational needs, operators may find it difficult to make decisions that best fit their needs. This section will discuss the variables to consider when making those decisions.

## Vessel Types and Machinery

The type of vessel and the machinery it contains should be considered when deciding on a communication infrastructure and provider. Factors include:

- The number and type of operational applications the vessel uses to operate, such as the ones described earlier in this document
- The number of sensors the vessel contains that are remitting data
- The maintenance plans associated with the onboard equipment
- The typical crew size of the vessel, and the amount of data consumption each individual may consume if Wi-Fi is provided
- Voice strategy
- Data strategy
- The importance of timely e-Navigation updates (eATON's, for example)

## Job Functions

Other considerations include the type of work the vessel typically performs. Factors may include:

- Digital interactions with ports, locks, bridges, tunnels, and other facilities
- Customer driven requirements, such as the need to notify them immediately when cargo has been picked up or dropped, or a VGP report
- The benefits to the company for automating billing. Activities performed by the vessel can be sent shore-side immediately to create just-in-time billing scenarios
- Automation of dispatching, change orders, turnarounds, etc.
- Maintenance of vessel status in real-time, such as lives on board, cargo in transit, or barges in tow
- Distribution of digital documents to physical reside on vessel, such as COI's, strapping tables, SMS policies, etc.

## Operational Waterways

Another major factor involves the waterways that a vessel typically operates within.

Inland, or "brown water" operators can often benefit from terrestrial systems, such as mobile cellular, for their data strategy. Many inland waterways are substantially covered by cellular, 5G, or similar networks. Operators can use air cards, hot spots, or similar devices to provide bandwidth to the vessel in a fixed-costs manner, with data speeds that can support the bi-directional transmission of application data, video feeds, sensor data, or Wi-Fi. Additionally, relatively inexpensive antenna boosters can be installed

to increase range coverage. While there are still "dark spots" without cellular coverage in the rural areas of some waterways, those spots are quickly going away, and applications that are built with connectivity-resilience can often deal with intermittent data outages.

Many deep-water operators, or vessels that primarily operate in blue water, are typically limited to satellite based systems. Some work continental shelves where terrestrial technologies are available part of the time, and at other times will not be within range. Those that can switch between available networks often use a least-cost-routing concept. In that model, the vessel will use a primary, often more cost effective connection when it is available. When the system detects the primary connection is no longer available, it will automatically switch over to a defined secondary connection, usually more expensive, to maintain communications. There can also be additional connections defined with an order of precedence. The switching between defined connections can be performed by hardware systems that range in price from \$2500-\$6000.

A viable alternative to least-cost routing hardware is to allow an operating system, such as Microsoft Windows, to recognize and manage all available connections. In this model, the OS handles the switching between the networks by monitoring the health of each, and always using the highest priority network where possible.

## Costs

Terrestrial networks often offer more consistent billing rates and affordable data plans. Data plans can run from \$60-150 per month for unlimited data, and typically cover the vast majority of inland and coastal waterway systems. Additionally, hot spots can be used to make the vessel Wi-Fi enabled, allowing crew the ability to connect their personal devices for business or personal reasons.

Satellite systems are typically more expensive but offer a larger geographical coverage area, which typically includes the vast majority of the world's navigable waterways. Data plans often contain fixed pricing for a certain amount of data, and then so much per data unit (i.e. MB) thereafter.

## Business Continuity

Many operators are concerned with the potential for terrestrial systems, such as cellular, to go down for extended periods of time. For example, in the South-Eastern portion of the United States, hurricanes have been known to disrupt cellular service for days at a time. If your vessel has only one form of communication, then this is often not acceptable. Whether by radio or other proprietary systems, it is important for the shore to stay in touch with the vessel for operational and safety reasons. This often



## The Securely Connected Vessel



leads operators down a path of considering multiple, redundant systems, often incorporating a least-cost-routing concept.

Many of the onboard software applications are built with communication resiliency in mind, meaning, that intermittent data outages will not affect the functionality of the system. With that in mind, some operators can simply use terrestrial technologies, and perhaps keep a prepaid satellite phone on board in the rare cases where it goes down for extended periods of time.

For those operators that cannot use terrestrial technologies because they are typically at sea, satellite is often the most viable option. Compared to other technologies, satellite systems are typically more reliable from an always-on perspective, but typically cost more to maintain.

# Vessel365 BY MARINECFO

## Vessel365 and Related Applications

MarineCFO offers an integrated shore-to-vessel solution called Vessel365.

Shore-side personnel login to a cloud based portal to perform the following tasks:

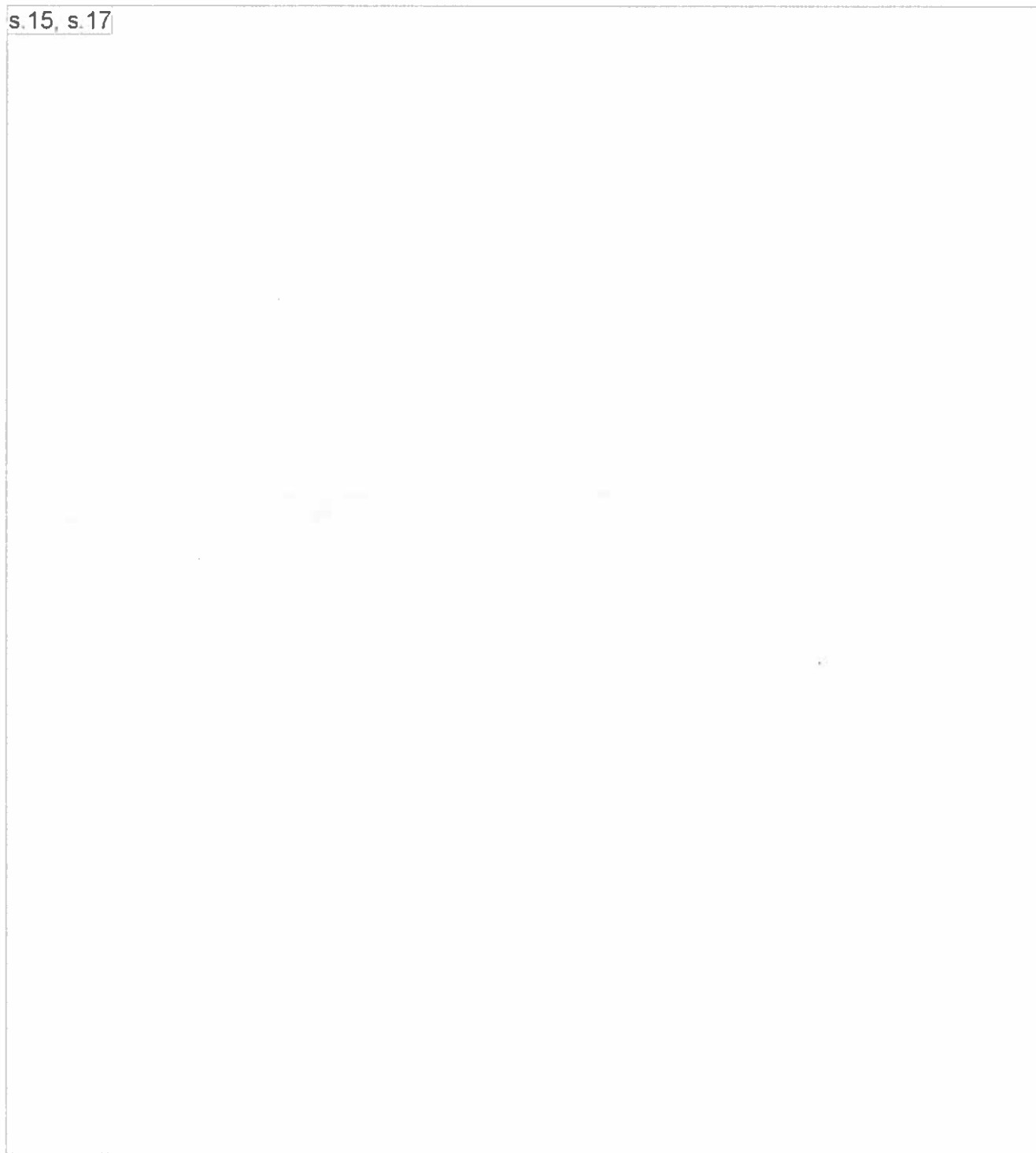
- Disseminate job tasks and notifications to vessels
- Configure checklists that must be completed on a recurring interval and disseminate them to the appropriate vessels
- Distribute physical documents, such as COI's and an SMS plan, that must by regulation physically exist on the vessel
- Manage the complete lifecycle of deficiencies and nonconformities
- Monitor all inbound fleet activities, such as the status of schedule items, maintenance plans, or logging
- Monitor crew activities and track their physical presence onboard

Each vessel contains an application used on one or more PC's, tablet's, or laptop's, that remits data to and from the shore cloud component and offers the following:

- Event logging
- Alerts and notifications
- Document management
- Compliance and e-records
- Checklists
- Planned Maintenance
- Remittance of sensor data to the shore
- More

## Architecture

s.15, s.17



s.15, s.17

## Calculating Costs and Data sizes

The amount of data being sent to or from the vessel varies through the configuration of the system.

Primary factors include:

- The number of scheduled items to be completed by the vessel, and how often the shore decides to receive these completed items
- The verbosity of daily logging
- The number of notifications sent to or from the vessel
- The number of sensors connected, and the verbosity of the data configured to be sent shore-side
- The number and size of physical documents sent from the shore to the vessel
- The number of and size of documents completed by the vessel and sent to the shore

The following table shows approximations as to the amount of data transmitted by certain features of Vessel365:

Functional Area	Data Size
<b>Checklist Sent to Vessel</b>	Around 145 bytes per item in checklist
<b>Documents/Folders Sent to Vessel</b>	Around 220 bytes per document/folder (plus actual document download)
<b>Waterways Sent to Vessel</b>	342 bytes per
<b>Mob Location Sent to Vessel</b>	350 bytes per
<b>Vessel Activities Sent to Vessel</b>	255 bytes per
<b>Notifications Sent from Vessel</b>	Around 921 bytes per notification
<b>Completed Checklist Sent from Vessel</b>	Around 2600 bytes per checklist item
<b>Completed Documents Sent from Vessel</b>	Around 840 bytes per document (plus actual document upload)

*Example: If you complete 2 documents a day, 5 checklists of 10 lines each, and send/receive 20 notifications your daily bandwidth usage would be estimated around 149 kb a day.*

## Sensor Integration

s. 17, s. 21



## APPENDIX A: References

- USCG, NCOE, Maritime Communications
- ABS, Guidance Notes on The Application of Cybersecurity Principles to Marine and Offshore Operations
- Lloyd's Register, Cyber-enabled ships, First Edition, February 2016
- IMO Standard Marine Communication Phrases, April 2000
- DNV, Ship Connectivity, April 2015
- MarineInsight.com, Communication Systems Used in the Maritime Industry
- ASTM, Best Standard Practice/Guide for Cyber Security, for Cyber Attack Mitigation for Marine and Mariner Use (2017 Proposed)
- ENISA, Methodologies for the identification of Critical Information Infrastructure assets and services, December 2014
- United States Coast Guard, Cyber Strategy, June 2015
- DHS, Automated Indicator Sharing Initiative
- USCG, Cyber Risks in the Marine Transportation System
- DNV, Integrated Software Dependent Systems (ISDS)
- IMO, Interim Guidelines on Maritime Cyber Risk Management
- ESC Global Security, Maritime Cyber Security White Paper
- Recommended Practice: Improving Industrial Control Systems Cybersecurity with Defense-In-Depth Strategies, DHS, October 2009

To sign-up to receive future whitepapers, please visit: <http://www.marinecfo.com/securely-connected-vessel>

25 pages withheld.  
ss 15, 17, 21

Page 1 of 1

# Product Requirements Document for BC FERRIES TCCS PROJECT

---

## Employee Management Configuration

This document is intended for confidential use between VerticalLive and BC FERRIES. Distribution outside these two companies is prohibited without approval from one of the document authors.

Each Product Requirements Document (PRD) will feature a list of desired functionality. The estimated effort that follows those details features three components:

- **Project Management:** The time it will take to develop the full specification for the required functionality. Additionally, this portion of the quotation allows for weekly progress reviews with the BC Ferries project sponsors during the Development/Configuration phase. Lastly, this portion includes time for development of training plans for the VerticalLive internal QA team's testing, as well as for the BC Ferries team using the features configured herein.
- **Development / Configuration:** The time it will take to configure the requested functionality using the VerticalLive Business Framework.
- **QA and Testing:** Time allocated for the VerticalLive QA Team to assess the configuration, test the features and insure those features meet the criteria of the PRD and work with Development when and if revisions are necessary. This portion of the quotation also features time to push configuration changes from Development environments, to Staging, to BETA and finally to Production, when internal and BC Ferries approvals are received.



## DOCUMENT HISTORY

Document Version: 1

Date: 07/31/2018

### Revision History

Version	Date	Changes	Reason
1	07/31/2018	Initial document	

### Approval History

Milestones	Version	Review Dates	Action Taken
Internal VerticalLive approval	1	07/31/2018	Laura Martin, Jared Crosby
BC FERRIES approval			

## Table of Contents

<b>DOCUMENT HISTORY</b> .....	<b>1</b>
<b>REQUESTED FUNCTIONALITY</b> .....	<b>3</b>
<b>MAINTENANCE AND SUPPORT</b> .....	<b>6</b>
<b>DOCUMENT SCOPE AND AUTHORITY</b> .....	<b>6</b>
<b>PRODUCT DESCRIPTION</b> .....	<b>6</b>
<b>CONDITIONS</b> .....	<b>6</b>
<b>GENERAL PRODUCT OPERATIONS/ROLL OUT</b> .....	<b>6</b>
<b>DOCUMENTATION REQUIREMENTS</b> .....	<b>6</b>

**REQUESTED FUNCTIONALITY:**

BC Ferries has released an RFI to procure a new Time Collection and Crew Scheduling Solution (TCCS). This document details functionality to be added to MarineCFO Endurance to meet the workflow demands detailed in the RFI.

This document details functionality required for management of Employee profiles.

The specific RFI items addressed via this configuration specification are:

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Planning Schedules	Must Have
		Planning Schedules	Must Have

**Estimated Effort**

Project Management	s.17, s.21
Development / Configuration	
QA and Testing	
Total Hours:	
Hourly Rate:	
TOTAL INVESTMENT:	

## **DOCUMENT SCOPE AND AUTHORITY**

This document describes the features required for the successful completion of the BC Ferries Production project, as it relates to only the functionality detailed in this document. As the project progresses, other specific functional requirements will be detailed, scoped and quoted separately.

### **Product Description**

The release of the product will be a feature release to the core MarineCFO product line.

s.17, s.21

## **DOCUMENTATION REQUIREMENTS**

All product features will be documented in VL's Support Knowledgebase system. BC Ferries employees will have web access to this system.

# **Product Requirements Document for BC FERRIES TCCS PROJECT**

---

## **Employee Portal / Mobile Application Configuration**

This document is intended for confidential use between Verticalive and BC FERRIES. Distribution outside these two companies is prohibited without approval from one of the document authors.

Each Product Requirements Document (PRD) will feature a list of desired functionality. The estimated effort that follows those details features three components:

- **Project Management:** The time it will take to develop the full specification for the required functionality. Additionally, this portion of the quotation allows for weekly progress reviews with the BC Ferries project sponsors during the Development/Configuration phase. Lastly, this portion includes time for development of training plans for the Verticalive internal QA team's testing, as well as for the BC Ferries team using the features configured herein.
- **Development / Configuration:** The time it will take to configure the requested functionality using the Verticalive Business Framework.
- **QA and Testing:** Time allocated for the Verticalive QA Team to assess the configuration, test the features and insure those features meet the criteria of the PRD and work with Development when and if revisions are necessary. This portion of the quotation also features time to push configuration changes from Development environments, to Staging, to BETA and finally to Production, when internal and BC Ferries approvals are received.

## DOCUMENT HISTORY

Document Version: 1

Date: 07/31/2018

### Revision History

Version	Date	Changes	Reason
1	07/31/2018	Initial document	

### Approval History

Milestones	Version	Review Dates	Action Taken
Internal Vertical approval	1	07/31/2018	Laura Martin, Jared Crosby
BC FERRIES approval			

## Table of Contents

<b>DOCUMENT HISTORY</b> .....	<b>1</b>
<b>REQUESTED FUNCTIONALITY</b> .....	<b>3</b>
<b>MAINTENANCE AND SUPPORT</b> .....	<b>6</b>
<b>DOCUMENT SCOPE AND AUTHORITY</b> .....	<b>6</b>
<b>PRODUCT DESCRIPTION</b> .....	<b>6</b>
<b>CONDITIONS</b> .....	<b>6</b>
<b>GENERAL PRODUCT OPERATIONS/ROLL OUT</b> .....	<b>6</b>
<b>DOCUMENTATION REQUIREMENTS</b> .....	<b>6</b>

**REQUESTED FUNCTIONALITY:**

BC Ferries has released an RFI to procure a new Time Collection and Crew Scheduling Solution (TCCS). This document details functionality to be added to MarineCFO (MCFO) Endurance to meet the workflow demands detailed in the BC Ferries TCCS RFI.

This document details functionality suggested for an Employee Portal and/or Mobile Application used to enter manual leave requests, publish schedules, and communicate with employees, in general. The existing MarineCFO Approve module will be utilized to consume leave requests entered directly into the Oracle Employee Self Service portal and to issue approvals and denials on various requests and documents defined in this workflow.

The specific RFI items addressed via this configuration specification are:

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Maintain Schedules	Should Have
		Planning Schedules	Must Have
		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Planning Schedules	Should Have
		Maintain Schedules	Must Have
		Notifications	Should Have
		Notifications	Must Have
		Notifications	Must Have



REQUIREMENT	MCFO Category	Category	Priority
s. 17, s. 21		Notifications	Must Have
		Notifications	Must Have
		Notifications	Must Have
		Notifications	Must Have
		Notifications	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Planning Schedules	Should Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Maintain Schedules	Won't Have
		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Planning Schedules	Should Have
		Planning Schedules	Should Have
		Reporting	Must Have

**Estimated Effort**

Project Management	s.17, s.21
Development / Configuration	
QA and Testing	
<b>Total Hours:</b>	
<b>Hourly Rate:</b>	
<b>TOTAL INVESTMENT:</b>	

## **DOCUMENT SCOPE AND AUTHORITY**

This document describes the features required for the successful completion of the BC FERRIES Production project, as it relates to only the functionality detailed in this document. As the project progresses, other specific functional requirements will be detailed, scoped and quoted separately.

### **Product Description**

The release of the product will be a feature release to the core MarineCFO product line.

s.17, s.21

## **DOCUMENTATION REQUIREMENTS**

All product features will be documented in VL's Support Knowledgebase system. BC FERRIES employees will have web access to this system.

# Product Requirements Document for BC FERRIES TCCS PROJECT

---

## Oracle Integration

This document is intended for confidential use between VerticalLive and BC FERRIES. Distribution outside these two companies is prohibited without approval from one of the document authors.

Each Product Requirements Document (PRD) will feature a list of desired functionality. The estimated effort that follows those details features three components:

- **Project Management:** The time it will take to develop the full specification for the required functionality. Additionally, this portion of the quotation allows for weekly progress reviews with the BC Ferries project sponsors during the Development/Configuration phase. Lastly, this portion includes time for development of training plans for the VerticalLive internal QA team's testing, as well as for the BC Ferries team using the features configured herein.
- **Development / Configuration:** The time it will take to configure the requested functionality using the VerticalLive Business Framework.
- **QA and Testing:** Time allocated for the VerticalLive QA Team to assess the configuration, test the features and insure those features meet the criteria of the PRD and work with Development when and if revisions are necessary. This portion of the quotation also features time to push configuration changes from Development environments, to Staging, to BETA and finally to Production, when internal and BC Ferries approvals are received.

## DOCUMENT HISTORY

Document Version: 1

Date: 07/31/2018

### Revision History

Version	Date	Changes	Reason
1	07/31/2018	Initial document	

### Approval History

Milestones	Version	Review Dates	Action Taken
Internal VerticalLive approval	1	07/31/2018	Laura Martin, Jared Crosby
BC FERRIES approval			

**Table of Contents**

**DOCUMENT HISTORY** ..... 1

**REQUESTED FUNCTIONALITY** ..... 3

**MAINTENANCE AND SUPPORT** ..... 6

**DOCUMENT SCOPE AND AUTHORITY**..... 6

**PRODUCT DESCRIPTION**..... 6

**CONDITIONS** ..... 6

**GENERAL PRODUCT OPERATIONS/ROLLOUT** ..... 6

**DOCUMENTATION REQUIREMENTS**..... 6

**REQUESTED FUNCTIONALITY:**

BC Ferries has released an RFI to procure a new Time Collection and Crew Scheduling Solution (TCCS). This document details functionality to be added to MarineCFO Endurance to meet the workflow demands detailed in the RFI.

This document details an integration with Oracle. BC Ferries TCCS RFI details the following integration points:

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Time Collection & Compatibility	Must Have
		Planning Schedules	Should Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have
		Time Collection	Should Have

REQUIREMENT	MCFO Category	Category	Priority
s. 17. s. 21		Compatibility	Must Have
		Compatibility	Must Have
		Compatibility	Must Have
		Compatibility	Must Have
		Compatibility	Must Have
		Compatibility	Must Have
		Compatibility	Must Have
		Compatibility	Must Have



REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Compatibility	Must Have
		Compatibility	Must Have
		Maintainability	Must Have

**Estimated Effort**

Project Management	s.17, s.21
Development / Configuration	
QA and Testing	
<b>Total Hours:</b>	
<b>Hourly Rate:</b>	
<b>TOTAL INVESTMENT:</b>	

## **DOCUMENT SCOPE AND AUTHORITY**

This document describes the features required for the successful completion of the BC FERRIES Production project, as it relates to only the functionality detailed in this document. As the project progresses, other specific functional requirements will be detailed, scoped and quoted separately.

### **Product Description**

The release of the product will be a feature release to the core MarineCFO product line.

s.17, s.21



## **DOCUMENTATION REQUIREMENTS**

All product features will be documented in VL's Support Knowledgebase system. BC FERRIES employees will have web access to this system.

# Product Requirements Document for BC FERRIES TCCS PROJECT

---

## Schedule Management & Rules Configuration

This document is intended for confidential use between Verticalive and BC FERRIES. Distribution outside these two companies is prohibited without approval from one of the document authors.

Each Product Requirements Document (PRD) will feature a list of desired functionality. The estimated effort that follows those details features three components:

- **Project Management:** The time it will take to develop the full specification for the required functionality. Additionally, this portion of the quotation allows for weekly progress reviews with the BC Ferries project sponsors during the Development/Configuration phase. Lastly, this portion includes time for development of training plans for the Verticalive internal QA team's testing, as well as for the BC Ferries team using the features configured herein.
- **Development / Configuration:** The time it will take to configure the requested functionality using the Verticalive Business Framework.
- **QA and Testing:** Time allocated for the Verticalive QA Team to assess the configuration, test the features and insure those features meet the criteria of the PRD and work with Development when and if revisions are necessary. This portion of the quotation also features time to push configuration changes from Development environments, to Staging, to BETA and finally to Production, when internal and BC Ferries approvals are received.

## DOCUMENT HISTORY

Document Version: 1

Date: 07/31/2018

### Revision History

Version	Date	Changes	Reason
1	07/31/2018	Initial document	

### Approval History

Milestones	Version	Review Dates	Action Taken
Internal Vertical approval	1	07/31/2018	Laura Martin, Jared Crosby
BC FERRIES approval			

## Table of Contents

<b>DOCUMENT HISTORY .....</b>	<b>1</b>
<b>REQUESTED FUNCTIONALITY .....</b>	<b>3</b>
<b>MAINTENANCE AND SUPPORT .....</b>	<b>6</b>
<b>DOCUMENT SCOPE AND AUTHORITY.....</b>	<b>6</b>
<b>PRODUCT DESCRIPTION .....</b>	<b>6</b>
<b>CONDITIONS .....</b>	<b>6</b>
<b>GENERAL PRODUCT OPERATIONS/ROLLOUT .....</b>	<b>6</b>
<b>DOCUMENTATION REQUIREMENTS.....</b>	<b>6</b>

**REQUESTED FUNCTIONALITY:**

BC Ferries has released an RFI to procure a new Time Collection and Crew Scheduling Solution (TCCS). This document details functionality to be added to MarineCFO Endurance to meet the workflow demands detailed in the RFI.

This document details functionality required for Schedule Management, views and alerts within Schedule Management, rules applied to schedules from the Collective Bargaining Agreement and various reports needed.

The specific RFI items addressed via this configuration specification are:

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Planning Schedules	Must Have
		Maintain Schedules	Should Have

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have
		Maintain Schedules	Should Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have
		Maintain Schedules	Must Have
		Maintain Schedules	Should Have
		Maintain Schedules	Must Have
		Maintain Schedules	Should Have
		Maintain Schedules	Should Have
		Reporting	Must Have

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Reporting	Must Have
		Reporting	Must Have

**Estimated Effort**

Project Management	s.17, s.21
Development / Configuration	
QA and Testing	
<b>Total Hours:</b>	
<b>Hourly Rate:</b>	
<b>TOTAL INVESTMENT:</b>	



## **DOCUMENT SCOPE AND AUTHORITY**

This document describes the features required for the successful completion of the BC FERRIES Production project, as it relates to only the functionality detailed in this document. As the project progresses, other specific functional requirements will be detailed, scoped and quoted separately.

### **Product Description**

The release of the product will be a feature release to the core MarineCFO product line.

s.17, s.21

## **DOCUMENTATION REQUIREMENTS**

All product features will be documented in VL's Support Knowledgebase system. BC FERRIES employees will have web access to this system.

# Product Requirements Document for BC FERRIES TCCS PROJECT

---

## Timesheet & Time Collection Rules Configuration

This document is intended for confidential use between VerticalLive and BC FERRIES. Distribution outside these two companies is prohibited without approval from one of the document authors.

Each Product Requirements Document (PRD) will feature a list of desired functionality. The estimated effort that follows those details features three components:

- **Project Management:** The time it will take to develop the full specification for the required functionality. Additionally, this portion of the quotation allows for weekly progress reviews with the BC Ferries project sponsors during the Development/Configuration phase. Lastly, this portion includes time for development of training plans for the VerticalLive internal QA team's testing, as well as for the BC Ferries team using the features configured herein.
- **Development / Configuration:** The time it will take to configure the requested functionality using the VerticalLive Business Framework.
- **QA and Testing:** Time allocated for the VerticalLive QA Team to assess the configuration, test the features and insure those features meet the criteria of the PRD and work with Development when and if revisions are necessary. This portion of the quotation also features time to push configuration changes from Development environments, to Staging, to BETA and finally to Production, when internal and BC Ferries approvals are received.

## DOCUMENT HISTORY

Document Version: 1

Date: 07/31/2018

### Revision History

Version	Date	Changes	Reason
1	07/31/2018	Initial document	

### Approval History

Milestones	Version	Review Dates	Action Taken
Internal VerticalLive approval	1	07/31/2018	Laura Martin, Jared Crosby
BC FERRIES approval			

## Table of Contents

<b>DOCUMENT HISTORY .....</b>	<b>1</b>
<b>REQUESTED FUNCTIONALITY .....</b>	<b>3</b>
<b>MAINTENANCE AND SUPPORT .....</b>	<b>6</b>
<b>DOCUMENT SCOPE AND AUTHORITY.....</b>	<b>6</b>
<b>PRODUCT DESCRIPTION .....</b>	<b>6</b>
<b>CONDITIONS .....</b>	<b>6</b>
<b>GENERAL PRODUCT OPERATIONS/ROLL OUT .....</b>	<b>6</b>
<b>DOCUMENTATION REQUIREMENTS.....</b>	<b>6</b>

**REQUESTED FUNCTIONALITY:**

BC Ferries has released an RFI to procure a new Time Collection and Crew Scheduling Solution (TCCS). This document details functionality to be added to MarineCFO Endurance to meet the workflow demands detailed in the RFI.

This document details functionality required for timesheet management, CBA rules and workflow around the timekeeping process.

The specific RFI items addressed via this configuration specification are:

REQUIREMENT	MCFO Category	Category	Priority
s. 17, s. 21		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Should Have
		Time Collection	Should Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Should Have
		Time Collection	Must Have

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Should Have
		Time Collection	Should Have
		Time Collection	Should Have
		Time Collection	Must Have
		Time Collection	Should Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have
		Time Collection	Must Have

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Time Collection	Must Have
		Reporting	Should Have

**Estimated Effort**

Project Management	s.17, s.21
Development / Configuration	
QA and Testing	
<b>Total Hours:</b>	
<b>Hourly Rate:</b>	
<b>TOTAL INVESTMENT:</b>	

## **DOCUMENT SCOPE AND AUTHORITY**

This document describes the features required for the successful completion of the BC FERRIES Production project, as it relates to only the functionality detailed in this document. As the project progresses, other specific functional requirements will be detailed, scoped and quoted separately.

### **Product Description**

The release of the product will be a feature release to the core MarineCFO product line.

s.17, s.21

## **DOCUMENTATION REQUIREMENTS**

All product features will be documented in VL's Support Knowledgebase system. BC FERRIES employees will have web access to this system.



# Product Requirements Document for BC FERRIES TCCS PROJECT

---

## Configuration

s. 15, s. 17, s. 21

This document is intended for confidential use between VerticalLive and BC FERRIES. Distribution outside these two companies is prohibited without approval from one of the document authors.

Each Product Requirements Document (PRD) will feature a list of desired functionality. The estimated effort that follows those details features three components:

- **Project Management:** The time it will take to develop the full specification for the required functionality. Additionally, this portion of the quotation allows for weekly progress reviews with the BC Ferries project sponsors during the Development/Configuration phase. Lastly, this portion includes time for development of training plans for the VerticalLive internal QA team's testing, as well as for the BC Ferries team using the features configured herein.
- **Development / Configuration:** The time it will take to configure the requested functionality using the VerticalLive Business Framework.
- **QA and Testing:** Time allocated for the VerticalLive QA Team to assess the configuration, test the features and insure those features meet the criteria of the PRD and work with Development when and if revisions are necessary. This portion of the quotation also features time to push configuration changes from Development environments, to Staging, to BETA and finally to Production, when internal and BC Ferries approvals are received.

## DOCUMENT HISTORY

Document Version: 1

Date: 07/31/2018

### Revision History

Version	Date	Changes	Reason
1	07/31/2018	Initial document	

### Approval History

Milestones	Version	Review Dates	Action Taken
Internal Vertical approval	1	07/31/2018	Laura Martin, Jared Crosby
BC FERRIES approval			

## Table of Contents

<b>DOCUMENT HISTORY</b> .....	<b>1</b>
<b>REQUESTED FUNCTIONALITY</b> .....	<b>3</b>
<b>MAINTENANCE AND SUPPORT</b> .....	<b>6</b>
<b>DOCUMENT SCOPE AND AUTHORITY</b> .....	<b>6</b>
<b>PRODUCT DESCRIPTION</b> .....	<b>6</b>
<b>CONDITIONS</b> .....	<b>6</b>
<b>GENERAL PRODUCT OPERATIONS/ROLL OUT</b> .....	<b>6</b>
<b>DOCUMENTATION REQUIREMENTS</b> .....	<b>6</b>

**REQUESTED FUNCTIONALITY:**

BC Ferries has released an RFI to procure a new Time Collection and Crew Scheduling Solution (TCCS). This document details functionality to be added to MarineCFO Endurance to meet the workflow demands detailed in the RFI.

s. 15, s. 17, s. 21

s.15, s.17, s.21

The specific RFI items addressed via this configuration specification are:

REQUIREMENT	MCFO Category	Category	Priority
s.17, s.21		Support Non-Crewing Users	Should Have
		Support Non-Crewing Users	Should Have
		Support Non-Crewing Users	Should Have

**Estimated Effort**

Project Management	s.17, s.21	
Development / Configuration		
QA and Testing		
<b>Total Hours:</b>		
<b>Hourly Rate:</b>		
<b>TOTAL INVESTMENT:</b>		

## **DOCUMENT SCOPE AND AUTHORITY**

This document describes the features required for the successful completion of the BC Ferries Production project, as it relates to only the functionality detailed in this document. As the project progresses, other specific functional requirements will be detailed, scoped and quoted separately.

### **Product Description**

The release of the product will be a feature release to the core MarineCFO product line.

s.17, s.21

## **DOCUMENTATION REQUIREMENTS**

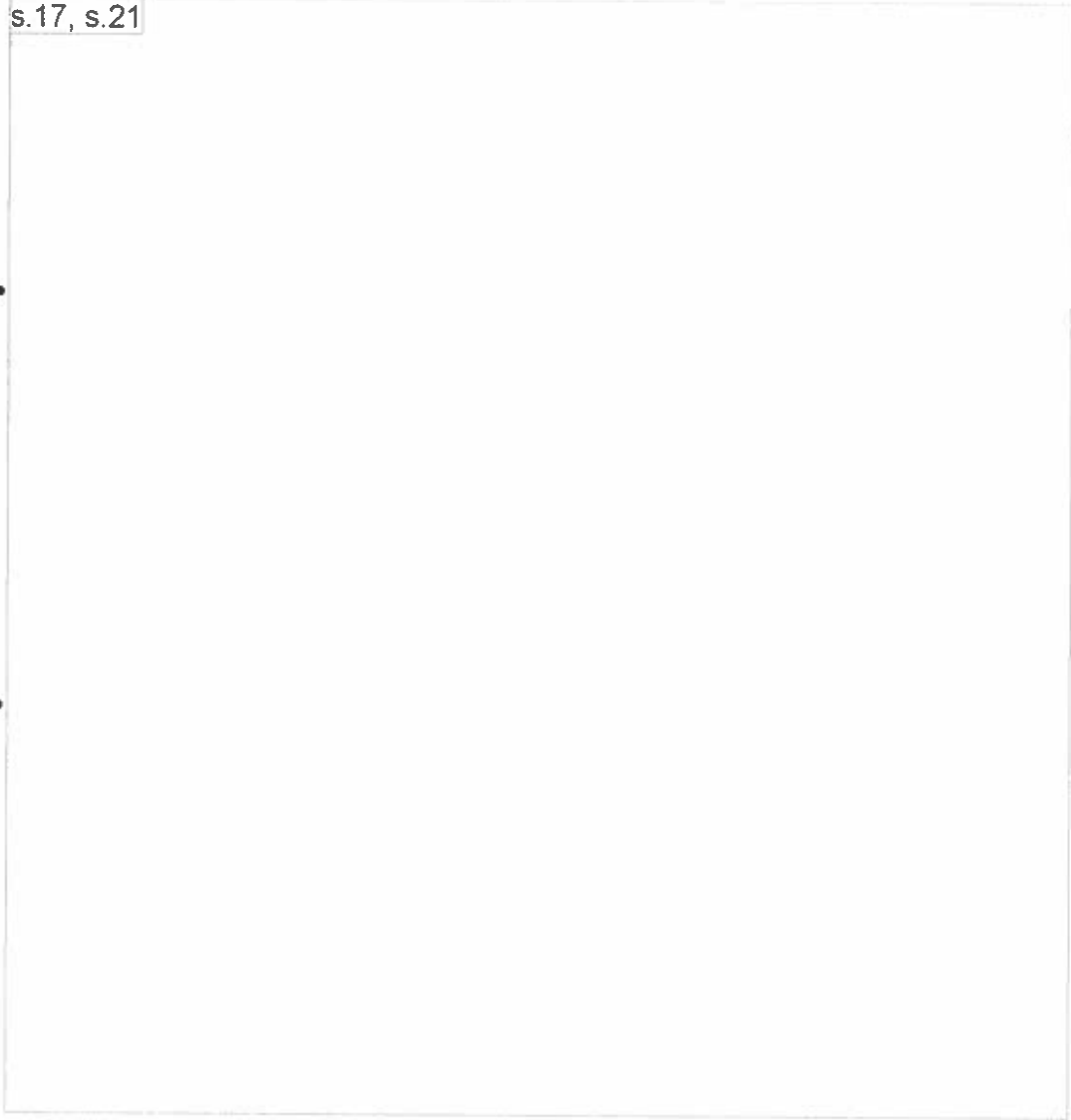
All product features will be documented in VL's Support Knowledgebase system. BC Ferries employees will have web access to this system.

s.17, s.21

h

3

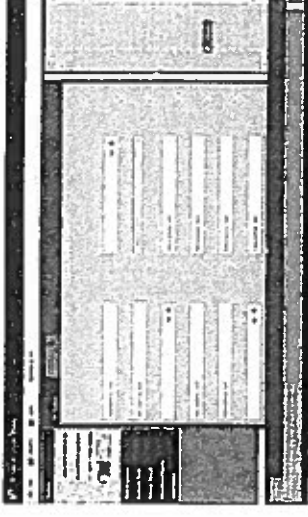
s.17, s.21



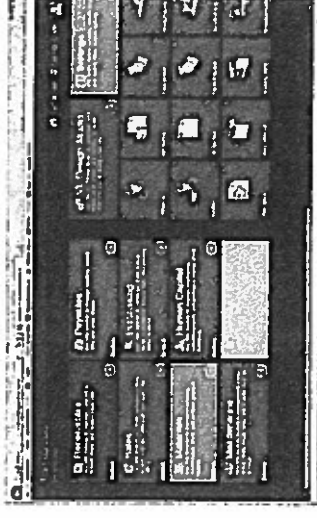


# MarineCFO Business Framework

- MarineCFO is built by and customized with our own sophisticated toolset
  - Logical model memorialized in MCFO Design Studio
  - Publish converts logical model to physical model
  - DevOps processing built-in (staging, beta, production, etc.)
  - Customer modifications do not jeopardize future upgrades
  - Customer can modify the systems themselves, if desired
  - Future-proof for unknown needs to come
- Customizable areas
  - Objects/Entities
  - Fields
  - Workflows
  - Automations
  - Solution packages



Publish







## Vessel365 and Related Applications

MarineCFO offers an integrated shore-to-vessel solution called Vessel365.

Shore-side personnel login to a cloud based portal to perform the following tasks:

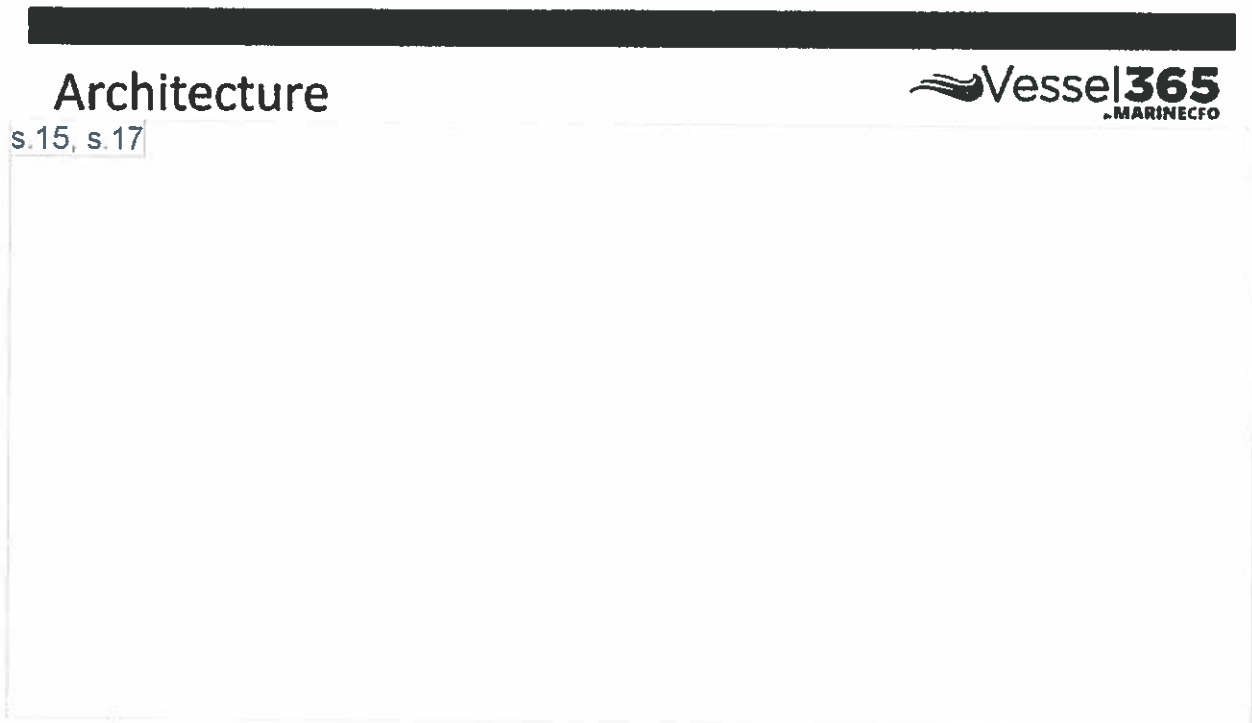
- Disseminate job tasks and notifications to vessels
- Configure checklists that must be completed on a recurring interval and disseminate them to the appropriate vessels
- Distribute physical documents, such as COI's and an SMS plan, that must by regulation physically exist on the vessel
- Manage the complete lifecycle of deficiencies and nonconformities
- Monitor all inbound fleet activities, such as the status of schedule items, maintenance plans, or logging
- Monitor crew activities and track their physical presence onboard

Each vessel contains an application used on one or more PC's, tablet's, or laptop's, that remits data to and from the shore cloud component and offers the following:

- Event logging
- Alerts and notifications
- Document management
- Compliance and e-records
- Checklists
- Planned Maintenance
- Remittance of sensor data to the shore
- More

## Architecture

The following diagram show the basic architecture of the system:



## Smart Client



## Encryption and Compression

s.15, s.17, s.21

## Calculating Costs and Data sizes

The amount of data being sent to or from the vessel varies through the configuration of the system. Primary factors include:

- The number of scheduled items to be completed by the vessel, and how often the shore decides to receive these completed items
- The verbosity of daily logging
- The number of notifications sent to or from the vessel
- The number of sensors connected, and the verbosity of the data configured to be sent shore-side
- The number and size of physical documents sent from the shore to the vessel
- The number of and size of documents completed by the vessel and sent to the shore

The following table shows approximations as to the amount of data transmitted by certain features of Vessel365:

Functional Area	Data Size
Checklist Sent to Vessel	Around 145 bytes per item in checklist
Documents/Folders Sent to Vessel	Around 220 bytes per document/folder (plus actual document download)
Waterways Sent to Vessel	342 bytes per
Mob Location Sent to Vessel	350 bytes per
Vessel Activities Sent to Vessel	255 bytes per
Notifications Sent from Vessel	Around 921 bytes per notification

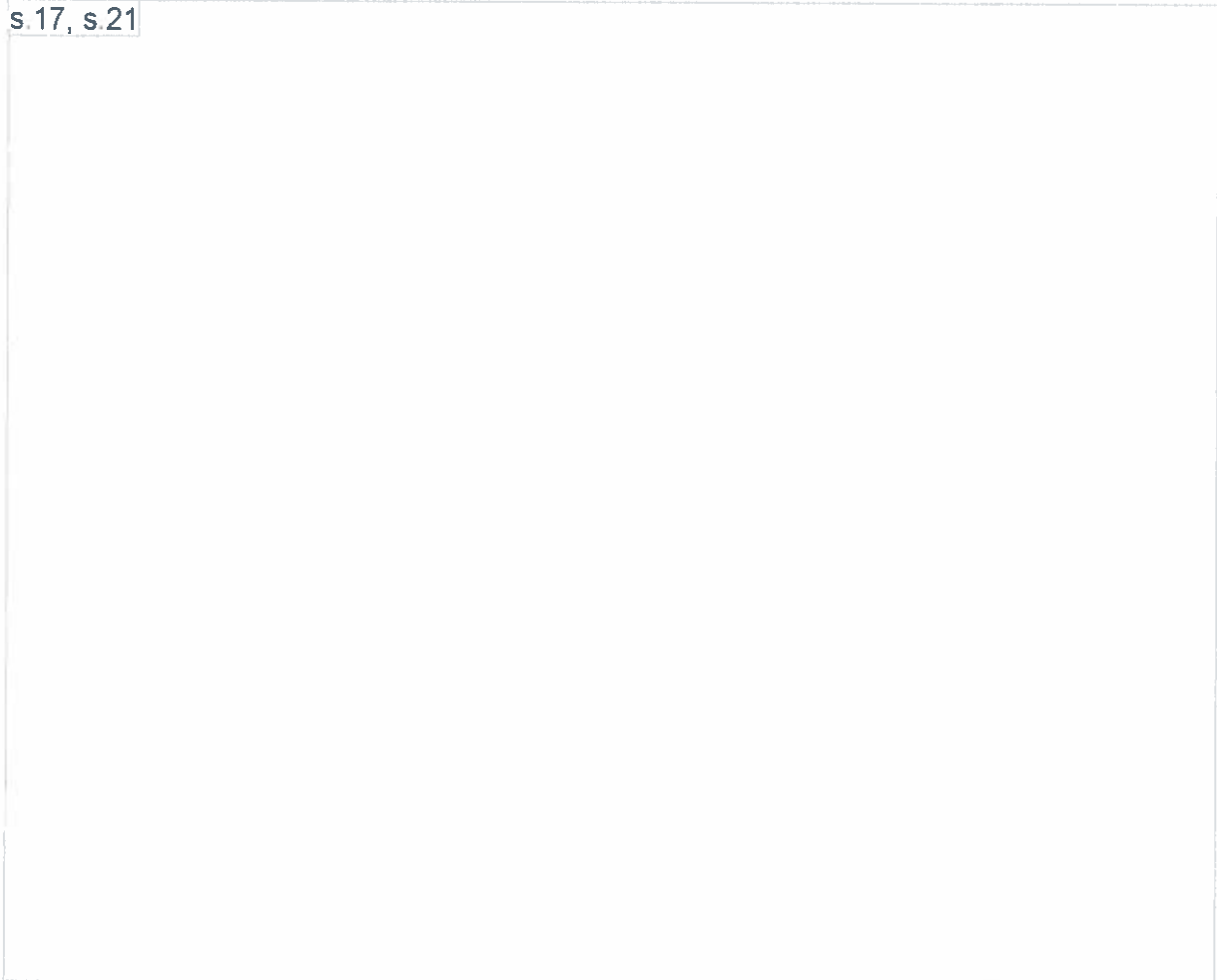
# Vessel 365 BY MARINECFO

Completed Checklist Sent from Vessel	Around 2600 bytes per checklist item
Completed Documents Sent from Vessel	Around 840 bytes per document (plus actual document upload)

*Example: If you complete 2 documents a day, 5 checklists of 10 lines each, and send/receive 20 notifications your daily bandwidth usage would be estimated around 149 kb a day.*

## Sensor Integration

s.17, s.21







## MarineCFO Endurance & Vessel 365 Local Server Requirements

s.15, s.17



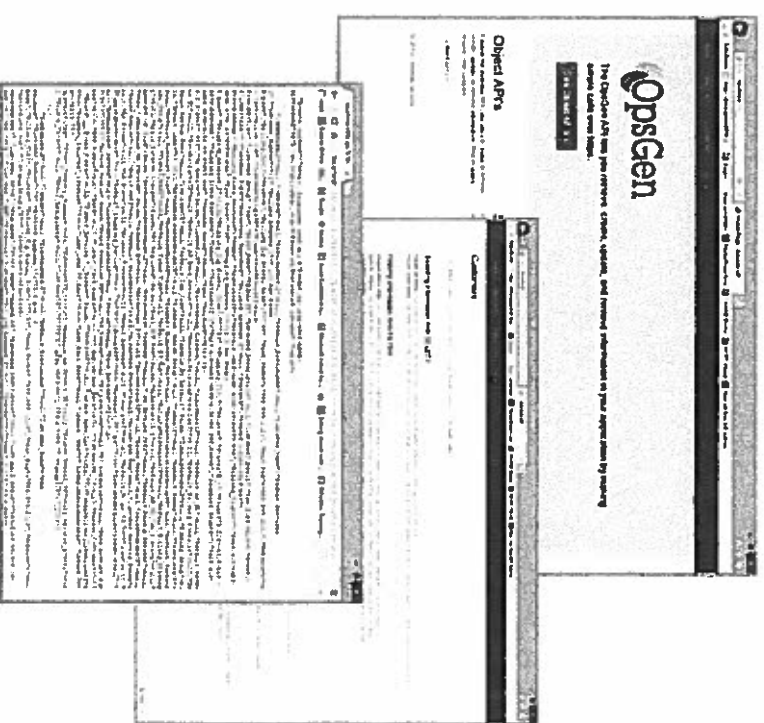
Redacted 4 pages  
ss. 17 + 21

Page Redacted



# MarineCFO Operations Generator (OpsGen)

- CASE tool that allows VerticalLive to create and memorialize customer specific data, workflow, and user interface experiences without custom coding
  - RESTful APIs generated automatically
  - Bearer token logic created
  - Backbone of MarineCFO Mobile and mobile extensions
- Share data with customers
- Ingest data from other sources
- Seamless and methodical approach to integrations with other systems, such as an ERP system
- Cloud design environment. Can be used by MarineCFO or client.
- Lift and shift data, such as spreadsheets and departmental Microsoft Access databases, into cloud



22 pages withheld  
SS. 15, 17, 21

Page redacted

Priority Values	
Must Have	Fundamental to project success
Should Have	Important, but the project success doesn't rely on this
Could Have	Can easily be left out without impact to the project
Won't Have	Not delivered this time around

Non-Functional Categories	
Compatibility	
Maintainability	
Performance Efficiency	
Portability	
Reliability	
Security	
Usability	
Commissioning	

Functional Categories	
Planning Schedules	
Maintain Schedules	
Notifications	
Rules evaluation for scheduling	
Time Collection	
Rules evaluation for time collection	
Support Non-Crewing Users	
Reporting	
Documentation	
Privacy and Security	
Privacy	
Security	

Training and Documentation	
Training	
Documentation	

Support	
In Project Support	
SLA / Post "go live" Support	
Warranty	
Monitoring	
Release Cycle	
Future Roadmap	
Versioning / End of Life Policies	

Proponent's Ability to Support	
Can be delivered "out-of-the-box" / without configuration.	Please specify in the Details column of how requirement is met and delivered.
Requires Proponent supported configuration. Details are provided.	Please specify in the Details column of how requirement is met and delivered.
Requires configuration which BC Ferries can perform. Details are provided.	Please specify in the Details column of how requirement is met and delivered.
Can be delivered but requires customizations to Proponent's source code. Details are provided.	Please specify in the Details column of how requirement is met and delivered.
Supported, but requires a BC Ferries process change or manual workaround. Details are provided.	Please specify in the Details column of how requirement is met and delivered.
Can be delivered by non-integrated module or third-party add-on. Name of add-on or module is specified in comments. Details are provided.	Please specify in the Details column of how requirement is met and delivered.
Supported in a future release. Expected delivery date in comments.	Please specify in the Details column of how requirement is met and delivered.
Not supported.	Please specify in the Details column of how requirement is met and delivered.
Reference Material	
Annex E – TCSS-91113_Collective-Bargaining-Unit-Rules	
N/A	
Companion Document slide 44 + 45	
Companion Document slide 14 + 15	
Companion Document slide 21	
Companion Document slide 26 + 27	
Companion Document slide 21 to 25	
Companion Document slide 28 + 29	
Companion Document slide 31 to 33	
Companion Document slide 37 + 51	
Companion Document slide 30, 35, 37 + 38	
Companion Document slide 34 + 35	
Companion Document slide 39 + 40	
Companion Document slide 42 + 43	
Companion Document slide 49 to 51	
Companion Document slide 45 + 46	
Companion Document slide 50	
Companion Document slide 51	
Companion Document slide 53 + 54	
Companion Document slide 61	
Companion Document slide 64	
Companion Document slide 67	
Companion Document slide 70	
Companion Document slide 78	
Companion Document slide 58 + 59	