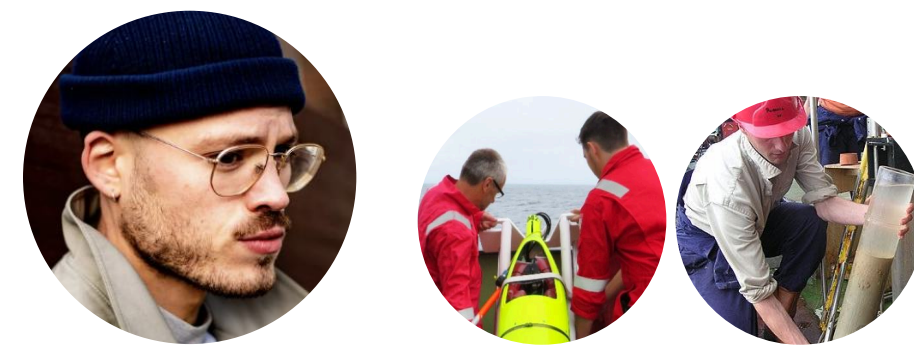


User Journey 1 - Expedition / Vessels

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Profile



Ruan Ship Science Systems Team Lead

On expedition along with:
Charles, & Georgios Research Scientists -
utilising glider (autonomy) and core-
sampling tools during the expedition
to measure & collect data and samples.

"Our responsibility ends pretty much
after the glider data is sent to the Data
Centre. Everything up to that point falls
with us, and it's our responsibility to get
it working..."

Jobs to be done

Ensure all systems are operating smoothly
during expedition. Team is responsible for
operating, maintaining, and developing the
onboard scientific and IT systems.

Work with Programme team, to identify cruise
requirements for each programme.

Review post-cruise assessments, to identify
and optimise (what we do well, what we could
improve?).

Annual management of maintenance for our
systems. Goes into annual refit tasks.
Maintenance upgrades.

Ensure Research which has been planned in
can be undertaken. Take direction from
Scientific community to spend time / money to
introduce new scientific capabilities.

Step

Step 1

→ Pre-season cruise planning

Actions

Research trip is planned (years to months in
advance)

Using the Marine Facilities Planning software (MFP),
Ruan plans the research trip.

Backing quote from research

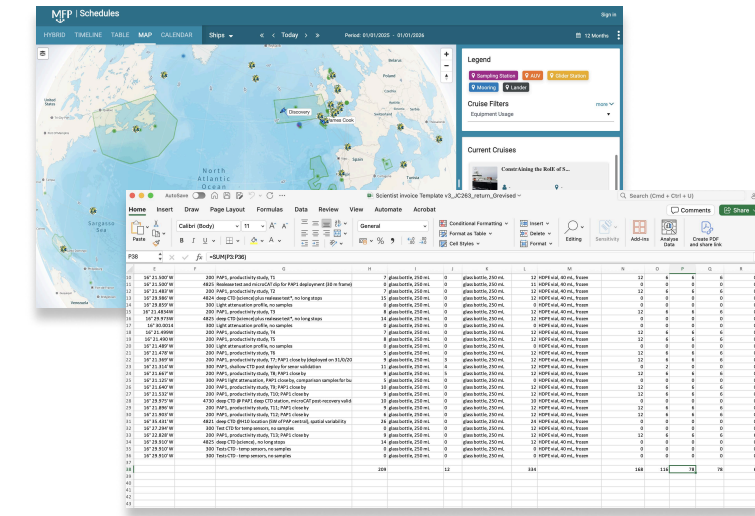
"You can make as good an attempt as you possible can,
ahead of time, to be able to plan and sort out **some of
the stuff**..."

"Unfortunately there are a few excel spreadsheets....
leave them separate, ...its' easier to leave them
separate"

Touchpoints

Marine Facilities Planning software

Various Spreadsheets (Excel etc)



Pain points

What's in the way of me achieving my goal?

Disconnected systems and info sources

Inability to predict weather, and factors
which may influence the expedition which
are not yet known.

HMW examples

1 2

Step 2

→ Prepare ship for expedition

The ship is physically loaded with relevant
tools and measurement devices, as well as
supplies etc. Manual processes carried out
on ship to ensure digital tools function.

"We need to physically get in there to run new cables
through. We have to do this every week, ... everywhere
there is a sensor - we need to do this. Not only
Science sensors, but the bridge and ship system,

Eg: installing new SatCom system last year, this year
GPS system needs to be replaced..."

"At the moment all of our risks are recorded in Excel
spreadsheets - I feel like there must be a better way of
doing this..."

Goal

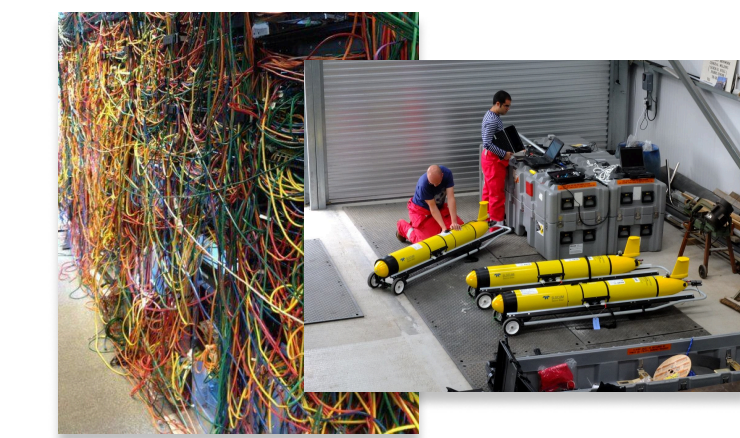
What is the aim / goal or purpose?

Effectively plan the expedition, ensuring
everything runs smoothly and within scope,
during the expedition

Cable transits inside ship (Physical)

Sensors (Physical)

Various Spreadsheets (Excel etc)



Pain point

What's in the way of me achieving my goal?

Design of vessel not always optimised
for efficient digital infrastructure utility.
Ship ergonomics do not consider increasing
needs of digital connectivity infrastructure
(eg: getting to cable transits between
decks and bulkheads, via fireproofing and
waterproofing, behind cable trays
to update sensor tech).

Risk & compliance processes are all
manual (excel)

68 14

Step 3

→ Contextualising metadata to gliders

Inconsistent metadata & issue logging to sensors.

"In the moment- you are trying to fix the problem. You
need a system that can take complex outcomes of
the problem and put it into something that 10 years
down the line, can be looking at the data, and see
something that doesn't seem right, and be able to
match that anomaly, with what actually occurred
during those few hours the problem was arising."

"No equivalent to MERMAN for Sensor Data"

"They may not necessarily be accurate. We're moving to
a paradigm, where we will have a continuous logging
database. Which then increases the importance of the
protocol around metadata management. You'd need to
make sure everyone knows - looking afterwards - that
metadata has changed at some point."

"Ships have (issue tracking tool) one but it's very poor -
not good enough for what is required... useful tool to
have - both on Marine IT side, and Science side."

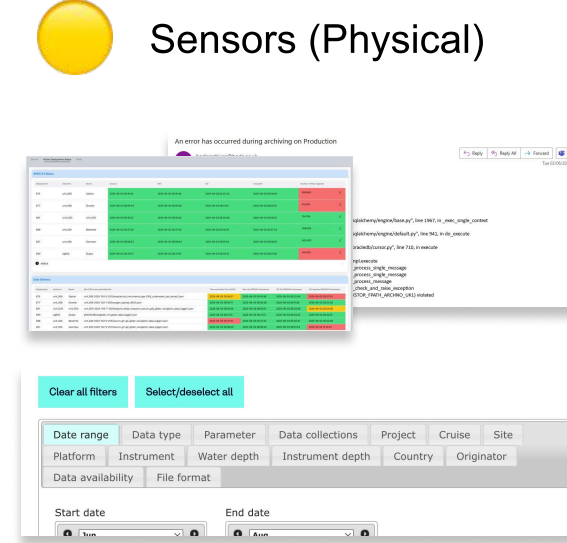
Goal

What is the aim / goal or purpose?

Ability to check any issues with data
collection retrospectively, and connect them
directly to the device / sensor used and the
reasons for any issues.

Data Centre systems/software (eg: BODC)

Various Spreadsheets (Excel etc)



Pain points

What's in the way of me achieving my goal?

No 'contextual' or 'issue' tracking metadata
is captured automatically (from sensors
linking to metadata collected). Has to be
collated manually across multiple
spreadsheets, systems and notes.

Lack of digital tooling / systems to
support this: "We don't have the tool
to do that at this point."

48 16 4

Step 4

→ Cruise requirement form submission(s)

All forms filled out on systems to ensure relevant
research can be carried out at sea, including
Diplomatic Clearance sent to FCDO as a Word
Document via email. This is signed off in their
Exclusive Economic Zone.

"Lots of different people involved in these things - putting
the same information into multiple forms. Doing some sort
of environmental impact in, and I'm putting the same
information into the Diplomatic clearance forms..."

"Dip Clear is out of our control - applied for in time,
sometimes granted last minute (eg: day before)"

Goal

What is the aim / goal or purpose?

Get all the cruise planning documentation
(including clearances) submitted.

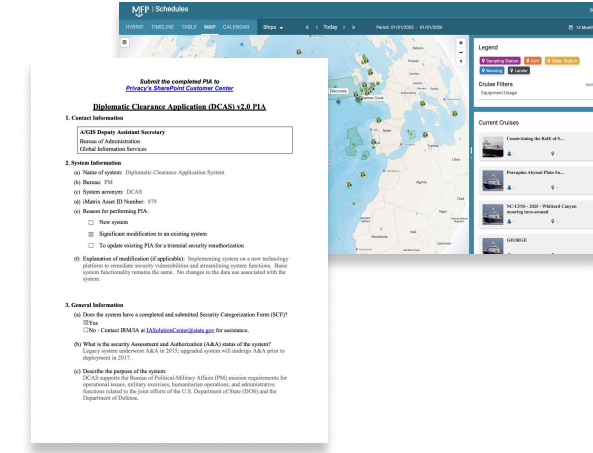
Effective management of all scientific
measurement tools / assets on board in
relation to the Cruise / Expedition.

Environmental impact forms

Dip. Clear Forms / System

Data Management Plan Documents

MFP Data / Documentation (Marine
Facilities Planning & Inventory)



Pain points

What's in the way of me achieving my goal?

Forms in different systems - relies on team
to maintain order and progress applications

Disconnect between various systems (not
automatically connected - especially across
Continents / Globally - eg: Diplomatic
Clearance processes differ depending
on EEZ).

1 25 27 28

Step 5

→ Expedition begins

Different types of Scientific research will be undertaken
on each cruise.

Simultaneous use of different systems can introduce
acoustic interference. This can reduce the opportunity for
other types of Science to be carried out.

Note: On RRS DA - synch hardware Kongsberg K Sync
reduces conflict, but priority also affects collection...
"bathymetry ping rates were often <5% of what could have
been achieved if operating stand alone..."

"There are always trade offs... if you want to do a certain type
of science, it would mean you can't do a different type of
science - the way the ship is set up..."

Goal

What is the aim / goal or purpose?

Optimise the scientific output of a cruise,
based on the parameters and constraints
of the cruise. Reduce friction between
competing priorities (For eg: route
planning efficiency, carbon use reduction
and maximising scientific output).

Ensure additional aims and objectives
to support collaborative work with other
institutes and research groups are met.

Negotiations (People / Governance)

Sensors (Physical)

NOTE:
New technology is being developed (eg: BAS) which is
factoring this in as a HMW/Use Case.

Please see Page 31 in the Research Report for more
information about this Application (which has a primary
objective of reducing carbon use during cruises, but
has secondary features to optimise Scientific research
during a cruise).

Pain points

What's in the way of me achieving my goal?

Negotiations, with Scientists, Captain
and the Cruise Team. Compromises
made (based on decisions depending on
negotiation / constraints of what is
possible during cruise). No support tools
for this. All manual / discussion based /
email etc.

Usability of MFP is not optimised for self
serve - eg: equipment use: greying out one
piece of equipment if another is selected.
Relies heavily on expert system user
knowledge.

3 18 54 55 59 15 16 48

Step 6

→ Research underway

Underway and other ship data collected. During the cruise,
the Scientist will capture all the research manually (in
whichever way works best for them). Post-cruise, a BODC
document is used to capture all this once it's been
standardised. Sometimes, metadata is not captured
because of all the other tasks having to happen.

When sensors are changes
When the glider sensor is changed, this will affect the
metadata (if metadata changes, continuous logging will be
affected).

Goal

What is the aim / goal or purpose?

To maintain the integrity, traceability, and
usability of the collected data for future
(eg: AI use). Allows users and analysts to
understand the exact conditions under
which data was collected.

Prevent gaps or inconsistencies in data due
to hardware changes. Ensures that datasets
from different time periods or sensor
configurations can be compared or merged
meaningfully. Supports quality control and
post-collection adjustments (critical for
audits, certifications, and scientific
validation).

Sensors (Physical)

Manual processes / non standardised

Various Spreadsheets (Excel etc)

Pain points

What's in the way of me achieving my goal?

Still awaiting Diplomatic Clearance!

Continuous logging of metadata - protocol
around metadata isn't as well ironed out /
considered on vessel when sensors are
switched / changed out. Those we spoke to
do not have an automated procedure for
this (eg: NOC, BAS, Fugro)

Manual capture of data by Scientists means
that often standards are not maintained,
consistency is lacking - until it's passed
onto the Data Centre which applies these
standards (MEDIN). Often Metadata is left
out completely (left to last or de-prioritised).

3 18 54 55 59 15 16 48

Step 7

→ Dip clear received

"We're not sure from our side how the Diplomatic Clearance
are being requested - because they don't align with the
equipment we've got on the ship - and sometimes the wrong
Dip Clear get submitted - that don't cover equipment that's
actually requested on the Diplomatic Request form - it's not
under my remit. Where we get stuck with - my team operate
the equipment and we have to check if we have diplomatic
clearance to be able to use it - and we come to the point
where the Scientist wants something on, but the Captain says
no (as no Diplomatic Clearance is available)."

NOTE:
When speaking to the RRS James Cook PM's, they
have mentioned this is a known issue (currently being
addressed), and is something that can be accommodated
by the MFP software platform (a 3rd party - "they are very
flexible to our needs").

This involves digital development resource & allocation
of funds, time & digital development resource. In terms of
the MFP, each funding application will keep the MFP
running (a portion of each expedition/cruise funding is
dedicated to this).

Goal

What is the aim / goal or purpose?

Connected flow of administrative and
management information to allow scientific
research to happen on board vessels more
efficiently and effectively.

Negotiations (People / Governance)

Sensors (Physical)

Marine Facilities Planning software

Pain points

What's in the way of me achieving my goal?

3rd Party system (MFP) - feature updates
and interconnectivity need to be scheduled
in and costs accounted for.

Interconnectivity only applies to those
Vessels which use the MFP system
(not extensive to wider ecosystem of
vessels).

4

Step 8

→ Ship to shore data collection and transfer

Currently, until the Scientists come back to shore, the larger
dataset - the more difficulty there is to transfer it. Ship to
shore file transfer and management solutions varies
depending on Organisation. Private companies like Fugro
have their own proprietary solution for this use case but it is
internal only (patents pending so we were not able to get
more information at this time). At NOC, this relies on the data
being transferred (either through satellite / internet stream, or
physically being delivered on a drive to the Data Centre -
depending on size and time this will take to transfer). This is
not 'future-proof'.

NOTE:
There are other 'off the shelf' solutions available for external
file transfers - but these solutions are primarily for file transfer
via HTTPS or FTP. They may not have metadata level
automation.

"The only time this isn't the case has been where data
volume has been so large that it was faster and more robust
to simply post a HDD to a partner (one recent example was
6Tb of data that they could only access at ~ 1.5 Mb/s over
ftp).

"It's what Researchers do, but again on their own computers -
there's no easy way to see the data..."

"No defined process to archive this" (Satellite/Radar data)

Goal

What is the aim / goal or purpose?

Prevent data loss risk (if the data exists
only on one drive, any loss is potentially
irrecoverable, especially for unique,
time-sensitive observations.

Email

Hard Drives / USB Sticks (manual)

Satellite transfer (ship to shore low width
orbit satellite links - utilised for large
data vol streaming - WIP)

Pain points

What's in the way of me achieving my goal?

Bottleneck in collaboration and analysis:
other scientists or technicians may not have
access to the data if it is isolated on one
person's drive, slowing collaborative
workflows, allowing real-time analysis or
quality assurance (or building tools to enable
real-time data management to occur).

Loss of data (risk)

MFP (or other Vessel planning software if
outside of NOC/BAS) and Data Centres
servers / databases are not linked (data
transfer happens through manual intervention
- except for Autonomy - See UJ 2).

20 29 57

Step 9

→ Onshore: Data Centre

Data centres then have the task to standardise the data
received from the Cruise. However there are also issues with
it - in terms of the volume of historic data which has not
yet been standardised, and the data which is not currently
linked to cruise data (eg: samples). Currently, there is no
unified software platform facilitating seamless
communication, data transfer, or interoperability
between the three key entities involved in marine
scientific expeditions:

(1) Scientists conducting research and collecting data on
expeditions using autonomous vehicles and onboard tools
(2) the Programme Team acting as the operational interface
between the scientists and the National Marine Facilities
(NMF) or chartering organisations
(3) Data Management Centres & Standard Bodies (e.g.,
BODC, Copernicus, MEDIN), which are responsible for
reviewing, processing, validating, and archiving collected
data.

SAMPLES

"There's no link with the data we hold back to the Cruise
data...it doesn't link to the other data that's being created as
part of the expedition..."

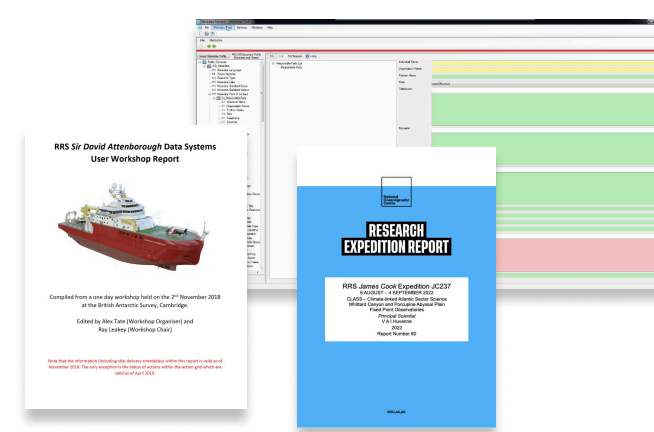
Currently data is not collected/organised and linked by
location or expedition."

3rd PARTY DATA - eg: Wind farms
"The PI contacted the Developers, they sent this data
to the PI... then to me..."

Goal

What is the aim / goal or purpose?

A unified view of the data throughout the
expedition lifecycle.



Pain points

What's in the way of me achieving my goal?

Lack of historical digitisation of sample data,
and no link between samples collected and
relevant cruise.

Fragmented data flow: Data collected in the
field is often transferred through manual or
ad hoc methods, increasing the risk of data
loss, duplication, or errors.

Delayed Insights: The time lag between
data collection and processing/analysis
slows down scientific output and operational
decision-making.

Disconnect between data coming in from
any other external sources.

45 46 52

Step 10

→ 2 years later - data required for further use

The cruise happened approx. 2 years ago. The
Researcher who carried out the work has since left the
Organisation. All the visualisation tools which were used
on the cruise are separate and there is no overall context
of an issue which occurred during data collection which
means the current AI & Data Modelling team will need to
spend considerable time trying to figure it out.

"Historical data is NOT AI ready, not machine readable... it's
the going forwards..."

"In the moment - you are trying to fix the problem. We need a
system that can take complex outcomes of the problem and
put it into something that 10 years down the line, can see
something that doesn't seem right, and be able to match that
anomaly, with what actually occurred during those few hours
the problem was arising."

"We start a new database every cruise - so that makes
metadata management relatively easier. However we're
moving to a paradigm, where we will have a continuous
logging database. Which then increases the importance of the
protocol around metadata management. You'd need to make
sure everyone knows - looking afterwards - that metadata has
changed at some point. We don't have the tool to do that at
this point." [See Step 6]

Existing data visualisation tools on vessels currently:

• Electronic chart display and information systems (ECDIS)
• Variable and flexible display configurations
(configurable software)
• Real time event log info
• Interactive maps with spatial information
• Different user permissions
• Security (bridge data vs. other data)
• Separate spreadsheets - especially with Admin processes

Goal

What is the aim / goal or purpose?

Contextual understanding of data post-
collection and analysis for re-use.

Communication (phone / conversation)

Various Spreadsheets (Excel etc)

Email

Pain points

What's in the way of me achieving my goal?

Currently no issue tracking system cross-org
blocks data-driven decision making.

Ability to provide data onwards for visualisation /
direct data access is not as efficient as it could
be (signposting, access etc).

Loss of contextual understanding over time.

Data silos - no clear visibility of what is available
'cross-Org' without investing time into search

47 48 66