# Predator Free 2050

# Interoperability & Remote Comms

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**Contributors**


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## Context

This report highlights the significant challenges facing the Predator Free 2050 movement in terms of the technical aspects of the execution environment. It identifies issues such as disconnected solutions, duplicated efforts by projects and developers, and a lack of standardisation and interoperability in equipment and data management. To address these problems, the report outlines several priority initiatives.

## State Of Play

- Projects are not provided with proven solutions to carry out the work they are being requested to execute
- Money spent on innovation is delivering a suite of disconnected solutions with no clear view of how those solutions come together to enable an end-to-end system that can operate efficiently to help projects solve the problems at hand
- There have been no concrete examples of how the collective of projects and developers has come together to identify repeatable solutions.
- Developers have thus far not been incentivised to collaborate on solutions.
- No standards have been defined to allow developers to deliver equipment that can integrate and/or communicate with other developers' equipment
- No common protocols have been defined to allow developers to deliver equipment that can integrate and/or communicate with communication solutions in the field
- Operational projects have thus far not been incentivised to collaborate on solutions or to deliver proven, repeatable solutions
- Projects have ended up duplicating effort on delivering technical solutions.
- Projects have had to come up with their own data analysis solutions to gain a view of status across their efforts. This has led to projects developing their own dashboarding and analysis solutions as well as duplicating the infrastructure (both technical and human) to support those.

### Why Has This Happened?

The above are signs of an immature industry. Mature industries:

- invest in carefully targeted ways to deliver parts of the overall outcomes
- have well understood, tried-and-tested solutions
- have well defined methods of allowing interoperability, integration, and collaboration
- understand the total costs of solutions, projects, and operations

- ensure funds are spent efficiently – always delivering against well-defined metrics
- manage out the complexity by providing proven solutions
- enable and encourage continuous improvement through rigorous trials with well-defined outcomes

The Predator Free movement does not (yet) exhibit many of these characteristics, which leads to sub-optimal delivery of programmes.

To succeed, the Predator Free movement needs to organise itself around the characteristics of a mature industry. A collective of well-intentioned projects will not deliver the efficient, seamless engine required to execute a programme of this size and achieve outcomes of this complexity.

The complexity of this challenge is increasing as additional tools and potential solutions are brought into this space without sufficient methods to make best use of them.

**What Are Projects Doing?**

Across the existing projects, effort has been duplicated at multiple layers, each project spending precious funds to:

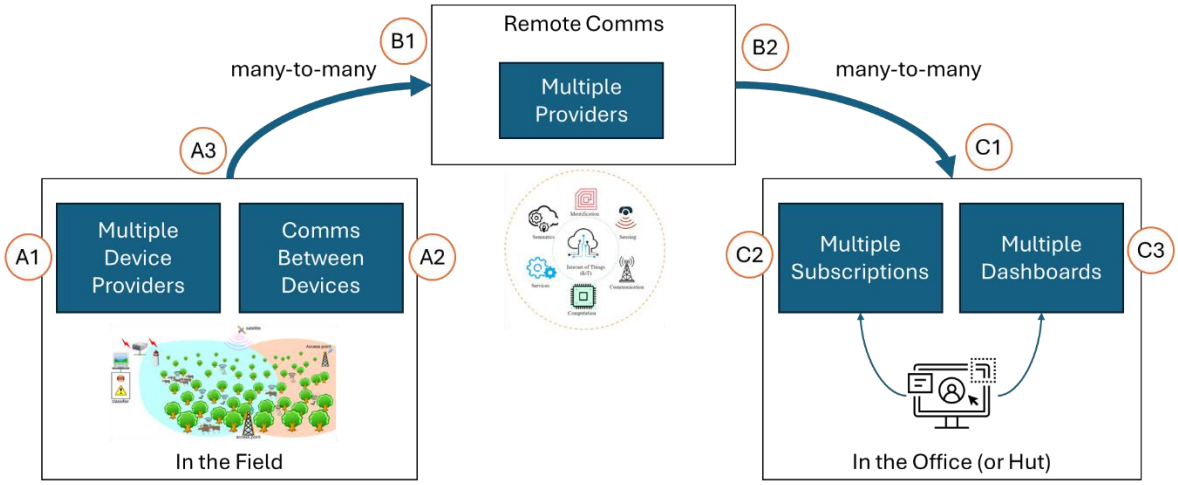
- Understand the features and capabilities of available tools (by engaging with the tool developer directly)
- Identify solutions that can deliver the stated goals of each phase

**What Are Developers Doing?**

The existing developers of field equipment have:

- Received little direction on design constraints for their products
- Received little direction on any standards their products should utilise and/or align to
- Received no direction on how their equipment could or should or must inter-operate with any other equipment
- Received no direction on what communications solutions their equipment should be able to integrate with in the field, sometimes forcing a developer to work on bespoke comms solutions

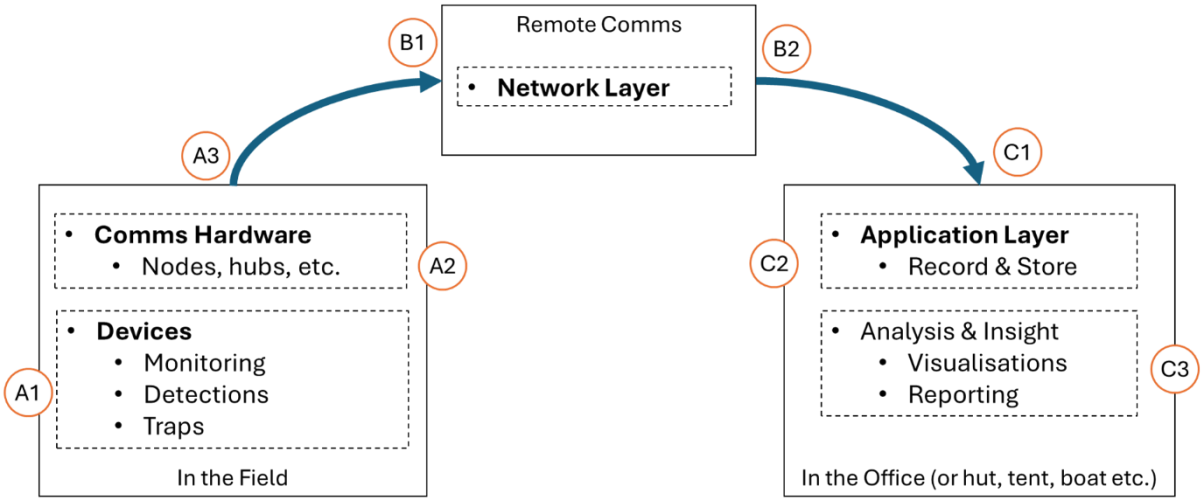
As a result of the above, developers have built their own custom solutions for most required elements. This has led to duplication of effort and has delivered an unconnected set of solutions.




*The current environment – fragmented with every project using its own solutions and zero interoperability between field equipment*

## What Needs to Happen?

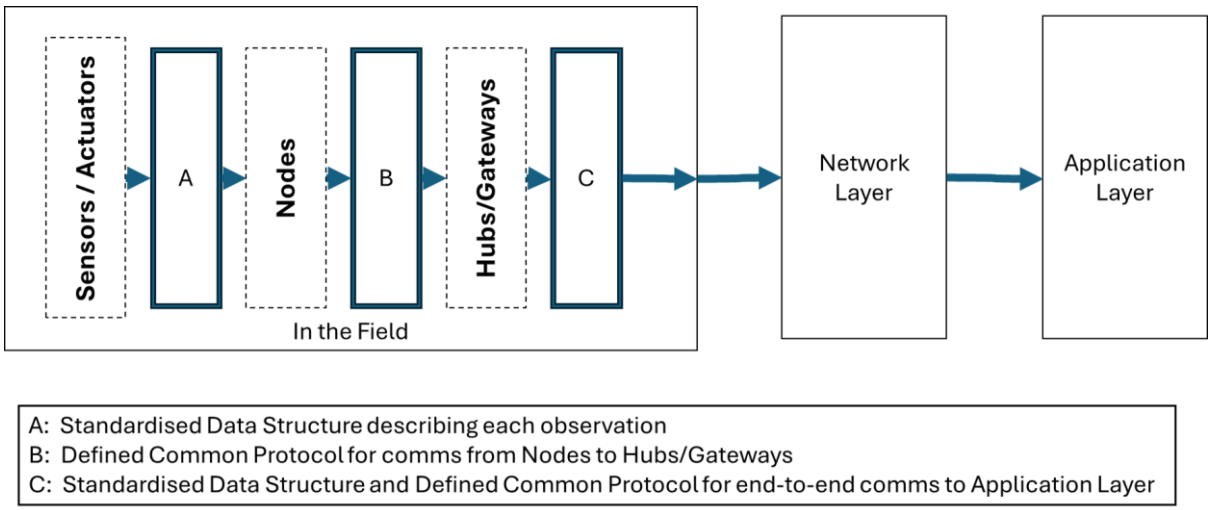
- All solutions must be designed and developed to play a known role in the overall solution space
- All solutions must comply with all standards and constraints defined
- All solutions must interoperate in the collective solution space
- All funded initiatives must contribute in a known way to the capabilities of the ecosystem and guarantee to enable interoperability within it
- All operational data reported must align to defined standards
- All communications across the execution environment must comply to well-defined protocols (to provide as much future-proofing as feasible)
- All solutions Deployment protocols must be provided
- E2E operation of the solutions must be proven
- The Total Cost of Ownership of each solution must be calculated, documented, and maintained




*The elements of the future environment*

| Region | ID | Description | Target State |
|---|---|---|---|
| Field | A1 | Multiple device providers | Standardised data structures describing all observations |
| Field | A2 | Field comms between devices | Defined protocol for communication between sensor and comms node/hub |
| Field | A3 | Connection to Remote Comms | Defined protocol to enable configurable plug-and-play integration with remote comms network |
| Comms | B1 | Connectivity / coverage | Graceful failure mode – handle unavailability of remote comms, report errors so they can be handled back at source |
| Comms | B2 | Data Reporting Endpoint(s) | Failure tolerant transmission – handle unavailability of endpoint, report errors so they can be handled back at source |
| Office | C1 | Application / Dashboard Endpoint | Standardised, centralised API |
| Office | C2 | Single Application Subscription | Single central subscription for all data management |
| Office | C3 | Single Dashboard | Single platform with rich visualisations and integrations |

*Targets for the future environment – a well-defined environment with defined data and interoperability methods*



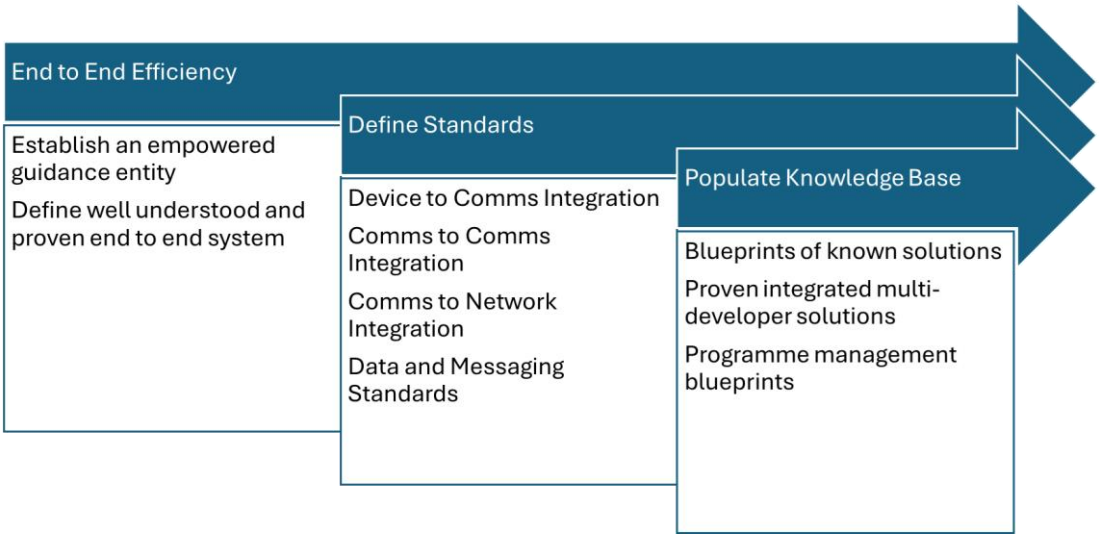

*Defined data and interoperability methods*

**How do we get there?**

To achieve this, some or all of the following need to be addressed:

1. End to End Efficiency
    a. A well understood and proven end to end system should be realised
    b. This will follow naturally if all of the above is put in place but it must be maintained as a clear goal
    c. To achieve that, an empowered guidance entity is required
2. Innovate for Outcomes
    a. Standards must be defined for interoperability at multiple levels:
        i. Device to Comms Integration
        ii. Comms to Comms Integration
        iii. Comms to Network Integration
        iv. Data and Messaging Standards
    b. A Knowledge Base must be maintained to cover:
        i. Blueprints of known solutions (that can then be localised)
        ii. Proven integrated multi-developer solutions (that can then be localised)
        iii. Programme management blueprints (that can then be localised)

A series of well-defined initiatives should be brought together into a programme of work that delivers each of the building blocks in a logical manner. There will need to be multiple instances of some initiatives (such as embedded field trials that prove solutions), not all of which can be defined up front.




*Establishing a roadmap*

A process must be put in place to regularly (perhaps quarterly) review new and innovative solutions and identify when the right time is to shape a trial to prove those initiatives.

***Note**: The following proposals are based around achieving that future state. It is **critical** that the efficiency of that future state is not constrained or limited by any of the existing status. The important thing is to build an efficient execution engine for 2030 and beyond.*

**Summary of High Priority Proposals**

The appendices of this report include lists of problem statements and proposals identified at this stage. This section covers a subset of those proposals.

In the short term, a number of building blocks are missing from the end to end environment so initiatives to deliver them are required.

| ID | Name | Short Description |
|---|---|---|
| Technical Initiatives | | |
| PR1.1 | Define the End-to-End System | Define the architecture for an end-to-end data management process |
| PR1.2 | Central Data Platform | Stand up a centralised data platform and make it ready and available to all projects and developers |
| PR1.3 | Knowledge Base | Stand up and populate a central Knowledge Base (KB) to host and share assets defining best practice solutions |
| PR1.4 | Feature Matrix | Produce a product feature matrix across all devices (add to knowledge base) |
| PR1.5 | Future Feature Matrix | Produce a matrix with opportunities highlighted for desirable features to enable future solutions. |
| Trial / Solution Proving Initiatives | | |
| PR3.1 | Identify / Initiate Proof of Solution Initiatives | Identify or Initiate project(s) to deliver Proven Solution Blueprints. |
| PR3.2 | Pilot E2E Integration Initiative(s) | Shape a Pilot project to prove the end-to-end system(s) |

**PR1.1: Define the End-to-End System**

Define the architecture for an end-to-end data management process providing a proposed solution for each of the elements in the flow.

The architecture in question has at least three elements:

- Technical solutions including integration and remote communications
- Data Management solution including hosting, storage, access management, analysis, reporting and more
- Organisational / People-centred: flows and processes – how humans get what they need out of the systems

Capabilities Required:

| Role | Scope | Initial Capacity | Future Capacity |
|---|---|---|---|
| Enterprise Architect | Define systems, data flows, and non-functionals | 0.5 | - |
| Solution Architect (Technical) | Define technical solutions including integration points | 0.5 | - |

*Timescales: Initial = 1.5 months*

**PR1.2: Productionise A National Data Platform**

The current state of play has led to data from projects being stored on a variety of dedicated, customised platforms. This makes it particularly difficult and time consuming to bring together a national view of status and progress towards the goal.

It is proposed that a central platform is created and made available to all projects and developers. This platform needs to be looked after by an independent, unbiased entity.

The architecture and development of that platform needs to be guided by the needs of the users – i.e. the developers, the operational projects, and those advising strategic delivery of the overall programme. A central, independent, unbiased entity should be charged with guiding the evolution of that platform.

 **Reference:** For further detail on the data platform, please refer to the supporting "Predator Free 2050: Delivering A Central Data Platform" provided alongside this report.

 ***Note**: Centralised projects of this type carry the risk of being hampered by complex requirements leading to long timelines. To reduce this risk, it is proposed that iterative, incremental processes are utilised to deliver working versions of the solution regularly and allow regular decision points along the way, removing the need for a big up-front architecture and design phase.*

**PR1.3: Stand up a Knowledge Base Hub**

A central Knowledge Base Hub (KBH) needs to be architected and stood up ready to receive and share assets such as solution blueprints, proven use cases, good practice guides, data insight capabilities etc.

A number of steps are required to deliver this:

1. Define architecture of platform, including hosting solutions, access endpoints, and management processes
2. Define data flows and curation processes (how does something make it onto the Knowledge Hub?)
3. Gather, analyse and publish content
4. Maintain and evolve the KB and its content in perpetuity

 ***Note**: Centralised projects of this type carry the risk of being hampered by complex requirements leading to long timelines. To reduce this risk, it is proposed that iterative, incremental processes are utilised to deliver working versions of the solution*

*regularly and allow regular decision points along the way, removing the need for a big up-front architecture and design phase.*

Capabilities Required:

| Role | Scope | Initial Capacity | Future Capacity |
|---|---|---|---|
| Solution Architect (Technical) | Define technical solution | 0.2 | - |
| Business Analyst | Define requirements | 0.2 | - |
| Development | If required, build out of platform | TBC | - |

*Timescales: Initial = 1 month*

**PR1.3: Stand up a Knowledge Base Hub**

A central Knowledge Base Hub (KBH) needs to be architected and stood up ready to receive and share assets such as solution blueprints, proven use cases, good practice guides, data insight capabilities etc.

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Capabilities Required:

| Role | Scope | Initial Capacity | Future Capacity |
|---|---|---|---|
| Solution Architect (Technical) | Define technical solution | 0.2 | - |
| Business Analyst | Define requirements | 0.2 | - |
| Development | If required, build out of platform | TBC | - |

*Timescales: Initial = 1 month*

**PR1.4. Feature Matrix (Current State)**

Populate the matrix of features supported across all currently available devices. A first version of this matrix has been completed. Beyond June 2025, this should be maintained by the CCET.

**Reference:** The current version of the matrix is provided alongside this report – see the FeatureMatrix.pdf file.

**PR1.5. Future Feature Matrix (Future State)**

Where features are identified as missing but desirable (using the Feature Matrix above), populate a matrix with opportunities to add features, integrate devices, make devices interoperable, or otherwise enable future solutions.

Capabilities Required:

| Role | Scope | Initial Capacity | Future Capacity |
|---|---|---|---|
| Technical consultant | Define matrix, outline potential solutions | 0.2 | - |

*Timescales: Initial = 2 months, Future = hand over to CCET for evolution*

**PR3.1: Initiate / Identify Proof of Solution Initiatives**

The Solution Blueprints proposed herein need to be brought together with input from developers and operational projects. The Blueprints need to be enhanced with proven use cases that show how the solutions work in practice.

To achieve this, one or more Proof of Solution projects need to be identified, tracked, and reported on.

Each Initiative needs to have defined:

1. A specified end-to-end technical solution supported by every developer / provider that has a role in the solution
2. A fully costed delivery plan, including total cost of ownership of all the elements of the solution
3. A defined set of measurable operational outcomes

**Reference:** A list of potential interoperability initiatives is provided alongside this report – see the Remote Comms Initiatives.xlsx file

***Note**: It seems likely that a number of these initiatives may already be in progress (e.g. one or more of the embedded R&D efforts). It may be very cost-effective to select such projects, but each must be reviewed to ensure the items above are defined, understood, and achievable.*

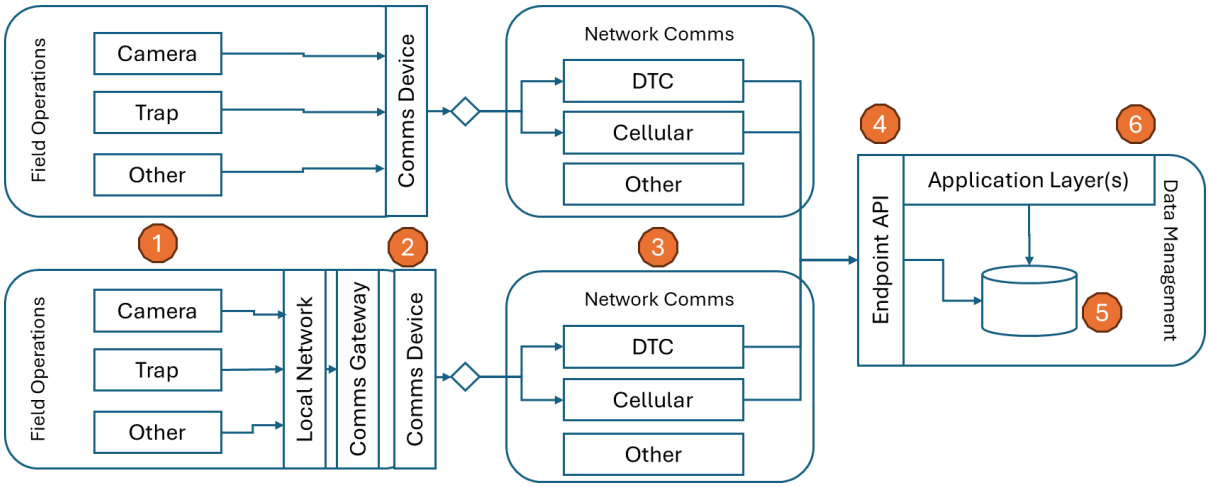
**PR 3.2: Identify a Pilot End to End Integration Initiative**

It is proposed a specific pilot initiative is identified and shaped to deliver accelerated proof of at least one solution to prove operation of the end to end system, including showcasing a level of technical interoperability and utilising unproven remote comms.

The following example is purely for illustrative purposes and relates to the OneNZ direct to cell initiatives.

This initiative should include as a minimum:

1. In field sensor/actuator devices from at least one product developer (e.g. NZAutoTraps, Critter Solutions, 2040, etc.)
2. In field comms from at least one comms product developer (e.g. Celium, LoraWAN, FlexiComms etc.)
3. A remote communications provider (e.g. OneNZ/SpaceX, Spark satellite-to-mobile etc.)
4. One or more defined data endpoints
5. At least one data reporting / analysis tool
6. An operational project with the capacity to oversee the in-field devices



The Critical Success Factors of these projects include:

| Factor | Rationale | Target / Measure |
|---|---|---|
| Data standardisation | Data contributes to national data set.<br>Seamless integration with pre-defined APIs.<br>Seamless usage of data for visualisations and insights.<br>Assists with E2E automation. | All messages comply to defined data standards |
| Protocol Uniformity | Enables plug-and-play communications between compliant devices.<br>Allows control of scalability (volume tolerance) and flexibility (usage tolerance).<br>Pre-defined error and noise behaviour. | All comms uses pre-defined protocol(s) |
| Future Proofing | Tolerance to change the overall environment. | All integration points defined in software / firmware |

Capabilities Required:

| Role | Scope | Initial Capacity | Future Capacity |
|---|---|---|---|
| Technical Project Manager | Oversee delivery of all deliverables | 0.4 | 0.2 |
| Solution Architect (Technical) | Define solutions, define technical responsibilities | 0.4 | 0.2 |
| Data Analyst | Shape visualisations, manage analytics and reporting | 0 | 0.2 |

*Timescales: Initial = 3 months, Future = 6-12 months (TBC)*

## Conclusions

The top priority for the next phase must be to ensure that a well understood, well defined technical environment is put in place.

The next developer to come into this space must not be left to make up their own answers to everything again – that doesn't help the collective build a cohesive solution. In the process of compiling this report we have engaged across multiple developers and have noted a willingness and desire to find ways to solve the problems identified herein. It seems feasible that, with some additional guidance and encouragement, developers would indeed be willing to influence their development roadmaps to deliver a much more collaborative execution environment.

The next operational project to start must be able to rely on well defined, proven, costed, and deliverable solutions with well-defined and supported operational processes to enable them.  Every project we have engaged with through this process has expressed a desire to have access to such a set of knowledge.

In an environment where funding remains a challenge, it is critical we ensure every dollar is spent as efficiently as possible.

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# Appendices

## Proposal Summary

| ID | Category | Proposal | Description |
|---|---|---|---|
| PR1.1 | E2E | Define the End-to-End System | Define the architecture for an end-to-end data management process providing a proposed solution for each of the elements in the flow. |
| PR1.2 | Application | Stand Up A National Data Platform | It is proposed that a central platform is created and made available to all projects and developers |
| PR1.3 | Knowledge | Build the Knowledge Base | The central Knowledge Base (KB) needs to be architected and stood up ready to receive and share assets such as solution blueprints, proven use cases, good practice guides, data insight capabilities etc. |
| PR1.4 | Knowledge | Product Overview Matrices | At-a-glance overview of products, which features they provide, and what other products they can operate with |
| PR2.1 | Organisation | Centralise the common elements | To remove duplication of effort (and spend), it is proposed that a Central Enablement & Capabilities Team (for brevity, referred to as CECT from here on) is put in place to support end to end operations. To support projects (and developers) in delivering solutions. Also to own centralised data management, reporting, and insights |
| PR2.2 | Operational | Costing Model | Define Total Cost of Ownership model for e2e solutions - purchase, implementation, integration, maintenance, data |
| PR3.1 | Pilot | Initiate / Identify Proof of Solution Initiatives | The Solution Blueprints proposed herein need to be brought together with input from developers and operational projects. The Blueprints need to be enhanced with proven use cases that show how the solutions work in practice. |
| PR3.2 | Pilot | Identify a Pilot E2E Integration Initiative | It is proposed a specific initiative is defined to prove at least one solution to prove technical interoperability and remote comms. |
| PR2.3 | Organisation | Developer Forum | To create and maintain a view of the technical ecosystem and promote interoperability |
| PR2.4 | Organisation | AI Forum | To provide a clear way forward for the use of AI across the collective |
| PR4 | Knowledge | Product Sheets | Produce a sheet per product in scope to capture product overview, capabilities, and features |
| PR5 | Knowledge | Knowledge Base | A base for all information and insight relevant to PF2050 - invited content but curated by central team |
| PR6 | Knowledge | Centre of Knowledge Team | Team to gather, analyse, collate, publish and manage all knowledge |

| ID | Category | Proposal | Description |
|---|---|---|---|
| PR7 | E2E | Solution Blueprints | End to end solutions, bringing together products from multiple developers - solutions to known problems |
| PR8 | E2E | Use Cases: Proofs of Solution | Documented test cases for solution blueprints - capturing benefits and gaps |
| PR9 | Comms | Interoperability Opportunities | List of prioritised interoperability opportunities that will bring value to developers and programmes |
| PR10 | Comms | Comms Protocol Standards | Standards for how comms solutions can interoperate (talk to each other in the field) |
| PR11 | Data | Data Standards | Defined minimum set of data all devices should report |
| PR12 | Application | Application Layer Interoperability | Approach for data sharing across application layers |
| PR13 | Application | Application Layer Centralisation | Central data storage, management, and application layer to collate data |
| PR14 | Application | Application Layer Visualisations | Centralised service for providing insight |
| PR15 | Comms | API Endpoint(s) | Centralisation and/or standardisation of API endpoints |
| PR16 | Organisation | Pilot projects to establish Proofs of Solutions | One or more projects to prove out solutions |
| PR17 | E2E | Automation of data process | Blueprint for Field > Remote Comms > Application Layer > Visualisation > Insights |

### Problem Statement Summary

| ID | Problem Statement | Description | Priority |
|---|---|---|---|
| PS1 | Lack of Knowledge about product capabilities | Projects have to engage with developers directly to spend time to understand the capabilities of the product | P2 |
| PS2 | Difficult to gauge suitability of product | Projects have to gauge the suitability of a product, often without the [technical] skillsets to do so | P2 |
| PS3 | Difficult to compare devices to each other | Projects have to work out the differences between product offerings | P2 |
| PS4 | No Central Repository for Products | No central place for projects to gather product information | P2 |
| PS5 | Lack of documented E2E Solutions | No documented e2e, multi-product solutions | P2 |
| PS6 | Lack of documented proven solutions | No documented examples of proven e2e, multi-product solutions | P2 |
| PS7 | Lack of interoperation in the field | No solutions for devices to inter-operate in the field | P1 |
| PS8 | Lack of interoperation standards | No documented or agreed standards for interoperation protocols | P1 |

| ID | Problem Statement | Description | Priority |
|---|---|---|---|
| PS9 | Lack of data standards | No defined standard for data reported from devices in the field | P2 |
| PS10 | Only manual Application Layer Interoperability | Only Manual approaches for data sharing across application layers (ETL) | P2 |
| PS11 | No Common Application Layer | Lack of Central data storage, management, and application layer to collate data | P2 |
| PS12 | No Common Application Layer Visualisations | No definition or provision of common visualisations to provide insight required by projects | P3 |
| PS13 | Very few Common API Endpoint(s) | Each provider is using their own, custom-developed API endpoint to report data from the field | P2 |
| PS14 | Learnings from projects not captured | Learnings from project deployments and/or equipment tests are not captured and documented centrally | P3 |
| PS15 | No automated E2E reporting of data | No real-time feedback loop from Field > Remote Comms > Application Layer > Visualisation > Insights | P2 |
| PS16 | No central technical skills capability | Each project has to learn (or recruit) skills to manage devices, application, data insights and more | P3 |