RESILIENX

Part 108 and Part 146 White Paper

Statement of Capabilities: How ResilienX Products Support BVLOS Operations

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About RESILIEN X

ResilienX is *making future skies safer™* by protecting the next generation of aviation from autonomous error. Let us build trust and safety into your autonomous ecosystem.

As humans are increasingly removed from the loop, automated safety assurance is not only crucial, but is also being required during operations by regulators around the world, including the FAA and EASA. We provide automated, real-time monitoring, assessment, and mitigation of issues to autonomous ecosystems. We bring critical value to the ecosystem lifecycle, from the design phase and runtime products, to providing full digital infrastructure solutions.

We are at the forefront of state-of-the-art safety assurance solutions for autonomous ecosystems. By increasing the safety and reliability of these systems, we're pioneering their broader and safer integration into our world. Our team has deep industry experience and expertise that allows us to solve your challenging technical and safety issues using a scalable, supported, aviation-grade approach.

FRAIHMWORK™
In-Time Aviation Safety Management System (IASMS)

AAM OptiX™
AAM Operations Center

ResilienX FRAIHMWORK IASMS

UAS Traffic Management

ResilienX Data Exchange

UAS and Ground Control Stations

BVLOS Supporting Infrastructure

Introduction

RESILIEN**X**

Background

The FAA's proposed 14 CFR Part 108 rules (if accepted) establish a comprehensive framework for routine Beyond Visual Line of Sight (BVLOS) Unmanned Aircraft Systems (UAS) operations, covering everything from general requirements and operational rules to personnel, airworthiness, requirements for approval with the FAA, and requirements for maintenance of the UAS. The proposed 14 CFR Part 146 rules covers third-party services, known as Automated Data Service Providers (ADSPs), serving as a vital component of UAS for safe and scalable BVLOS operations.

This white paper maps each applicable section of the Part 108 and Part 146 draft rules to the capabilities of two ResilienX products:

- ResilienX **FRAIHMWORK** In-Time Aviation Safety Management System (IASMS)
- ResilienX **Data Exchange** as part of ResilienX **AAM OptiX**, henceforth, "OptiX".

By aligning ResilienX's product capabilities and requirements with the regulatory intent of the draft rules, we demonstrate how ResilienX can dramatically help drone operators and service providers **comply with the forthcoming BVLOS rules, expedite deployment, and improve performance.**
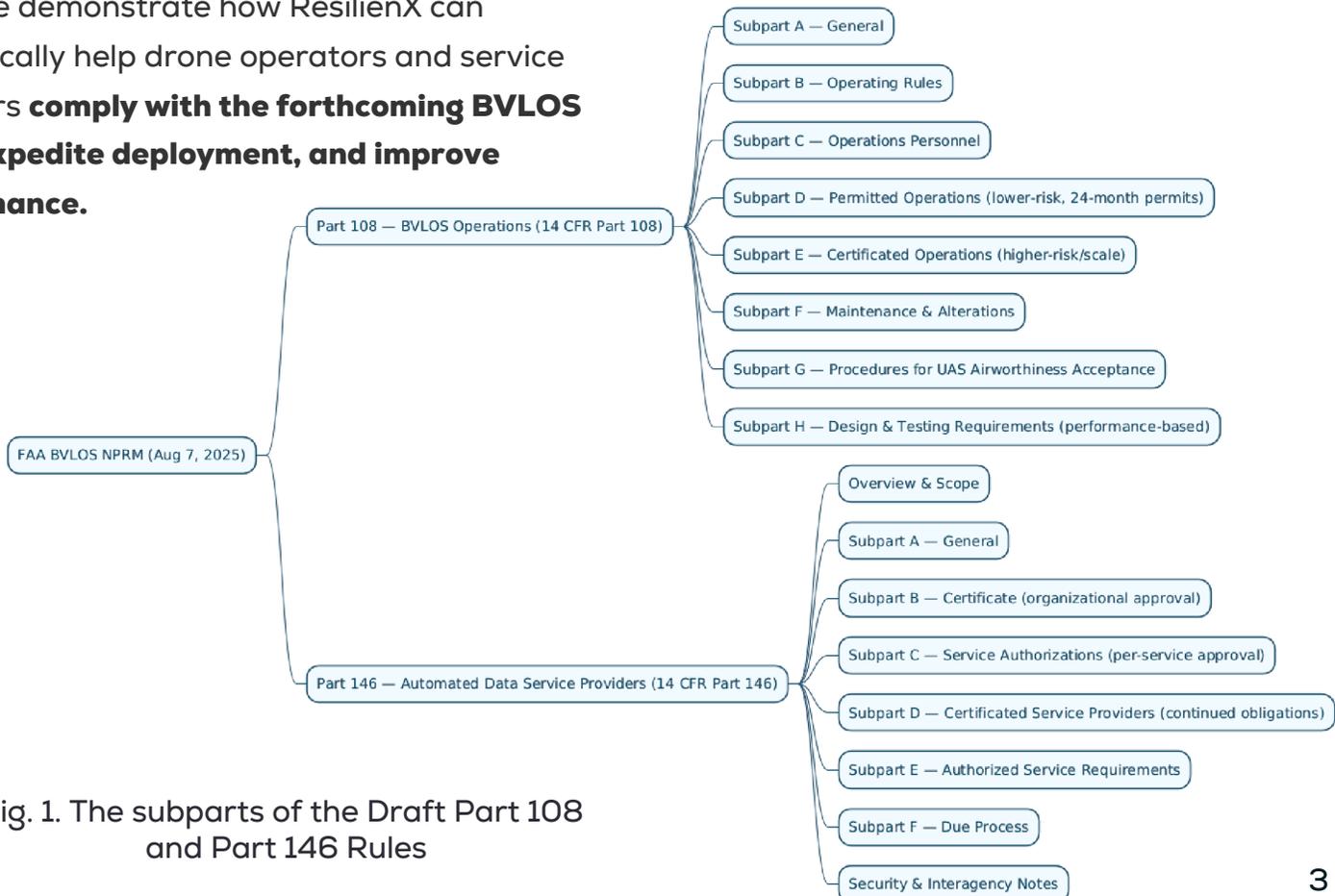

Fig. 1. The subparts of the Draft Part 108 and Part 146 Rules

Acronyms

Acronym	Definition
ADS-B	Automatic Dependent Surveillance - Broadcast
ADSP	Automated Data Service Provider
AE	Associated Elements
AIS	Assured Information Security
BAA	Broad Agency Announcement
BVLOS	Beyond Visual Line of Sight
CFR	Code of Federal Regulations
CMSA	Conformance Monitoring for Situational Awareness
FRAT	Flight Risk Assessment Tool
IASMS	In-Time Aviation Safety Management System
MBSE	Model-Based Systems Engineering
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
NPRM	Notice of Proposed Rule Making
OEM	Original Equipment Manufacturer
PNT	Position Navigation and Timing
RAS	Risk Assessment Service
SBIR	Small Business Innovation Research
SDSP	Supplemental Data Service Provider
SMS	Safety Management System
SSAS	Surveillance Sensor Assessment Service
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
USS	UAS Service Supplier
UTM	Unmanned Traffic Management

Results

Part 108 Requirements -

Requirement	Support	Explanation
108.40 Operator recordkeeping requirements	Supported	FRAIHMWORK can accumulate historical evidence and records for operations of the elements specified in the requirement. There are some limitations due to the ways we integrate FRAIHMWORK with UAs, however collecting data for Associated Elements (AE) is well demonstrated.
108.45 Operator reporting requirements	Partially supported	FRAIHMWORK provides support for the following sub-requirements (c) Interruption reports: unplanned or precautionary landing, change or diversion in planned route caused by a known or suspected mechanical difficulty or malfunction. (d) Service difficulty reports (for subpart E, certificated operations) (e) Security Occurrences
108.105 Unmanned aircraft	Supported	Re: (a) "must be in condition for safe operation": FRAIHMWORK, when integrated with UAs, demonstrates a comprehensive level of operational assurance through telemetry monitoring and assessment. It can bring conditions indicated in telemetry into mitigation workflows, as well as detecting issues that are not clearly identified in the implementation of UA self-test conditions, as demonstrated for the FAA, per our report _Key Challenges and Solutions for Scaling BVLOS Operations_.
108.135 Company operations manual	Partially supported	Reference documentation pertaining to components in FRAIHMWORK could be used to satisfy (b) and (e), and (f) in part, by being an operationally integrated component of an SMS. FRAIHMWORK provides this documentation hyperlinked from any applicable UAS component.
108.140 Aircraft performance	Supported	(a) FRAIHMWORK provides aircraft performance assessments by monitoring UA telemetry feeds and is configurable to assure the operational compliance to performance limits for ground speed with alerting.
108.145 Weather conditions	Supported	FRAIHMWORK and the ResilienX Data Exchange is configurable to retrieve weather conditions as part of an enhanced operational risk assessment for operational intent(s), and would alert a USS of elevated risk states due to weather conditions.

Part 108 Requirements -

Requirement	Support	Explanation
108.150 Operating location	Supported	FRAIHMWORK leverages state-of-the-art user and role-based access control for any data, assuming that data flows and access are included in the definition of the terms 'facilities' and 'controlled access areas' in the requirement. Additionally, event logging includes user-specific events for any changes to the system.
108.155 Unmanned aircraft tracking	Supported	FRAIHMWORK can monitor and assess telemetry and therefore meets this requirement.
108.160 ADS-B and transponder use	Supported	FRAIHMWORK can be configured to monitor for prohibited drone operations correlated with ADS-B surveillance tracks. This capability is planned for demonstration Q1 2026.
108.165 Area of operations	Partially supported	ResilienX Data Exchange provides contingency workflows and operational mitigations for operational compliance. This capability is planned for demonstration Q1 2026.
108.170 - Preflight requirements	Partially supported	FRAIHMWORK is capable of meeting c), e), g), h), and k) and has individually demonstrated these assessments. Other requirements in the subsection are not especially suited to automated/operational assessments, but Part 108-facing flight risk assessment tools (FRATs) for pre-flight information collection could easily be integrated with FRAIHMWORK via the ResilienX Data Exchange.

Part 108 Requirements -

Requirement	Support	Explanation
108.175 - Operating restrictions	Partially supported	FRAIHMWORK's risk assessment service (RAS) includes proximity to threat assessments that meet the intent of §(a)(2). RAS also could be configured to source information services for "steeply changing terrain" map classification. FRAIHMWORK performs telemetry monitoring for altitude compliance. Operational alerts are supported for all of these conditions.
108.180 - Operation in controlled airspace	Supported	FRAIHMWORK has been demonstrated to successfully provide compliance checks to airspace classes as part of enhanced strategic planning as well as conformance monitoring for situational awareness (CMSA) with a USS. For class B and C airspace BVLOS, FRAIHMWORK includes supportive functionality for operational assurance of non-cooperative surveillance sensors, aligned with ASTM F3623-23.

Fig. 2. FRAIHMWORK includes a state-of-the-art risk assessment capability that integrates with UTM's Strategic Deconfliction and Conformance Monitoring for Situational Awareness functions that are required for BVLOS, providing the most robust operational risk assessment capability in the industry.

Part 108 Requirements -

Requirement	Support	Explanation
108.185 - Operation over people	Partially supported	FRAIHMWORK has already been demonstrated to include ground risk assessments as part of an integration with a certified USS for enhanced strategic deconfliction. Certified static model-based data sets, such as Landscan, as well as dynamic data sources, such as live population counts from a mobile network operator can be routed through the ResilienX Data Exchange and integrated into FRAIHMWORK's Capability Performance Map (CPM). CPM is an enhanced operational risk assessment service that includes both pre-flight integration with USSs, as well as (in-flight) alerting, exceeding what is required in the rule requirements.
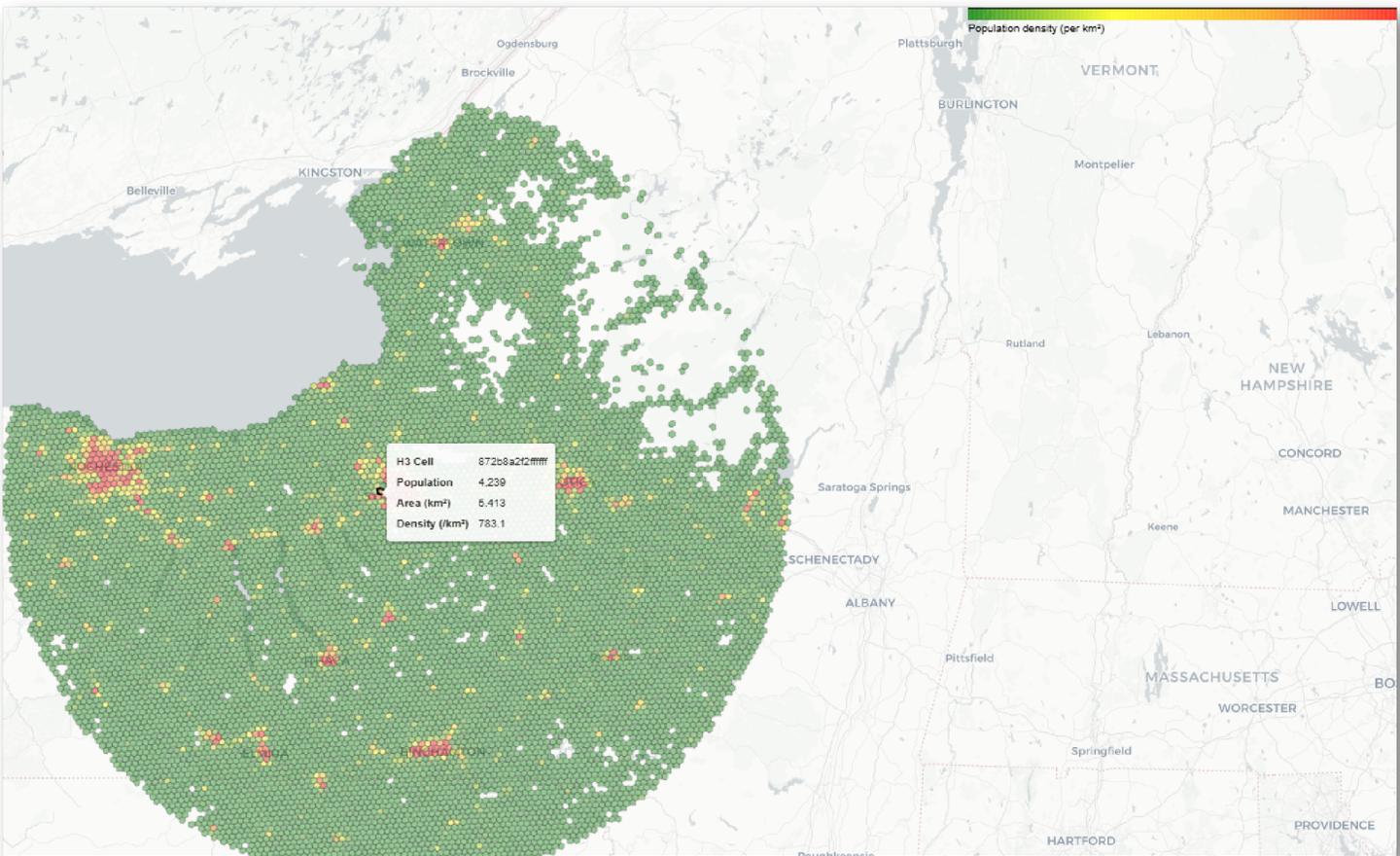
Fig. 3. By unifying static and dynamic data into a single operational view, FRAIHMWORK's Capability Performance Map sets a new standard for proactive risk assessment in BVLOS operations.

Part 108 Requirements -

Requirement	Support	Explanation
108.435 Cybersecurity (permitted operations)	Supported	FRAIHMWORK provides monitoring, assessment, and mitigation workflows that support a robust cybersecurity policy, satisfying (a) and (b). OptiX includes demonstrated capabilities (to the FAA) including extensive cybersecurity assessments and mitigations, enabled by integrating with Assured Information Security (AIS) Artemis software (built on the AIS Metasponse software). In this way, an integration with FRAIHMWORK provides robust support of this requirement, provided that the cybersecurity policy and processes includes active monitoring for cybersecurity hazards.
108.535 Cybersecurity (policies and process)	Supported	See 108.435, above.
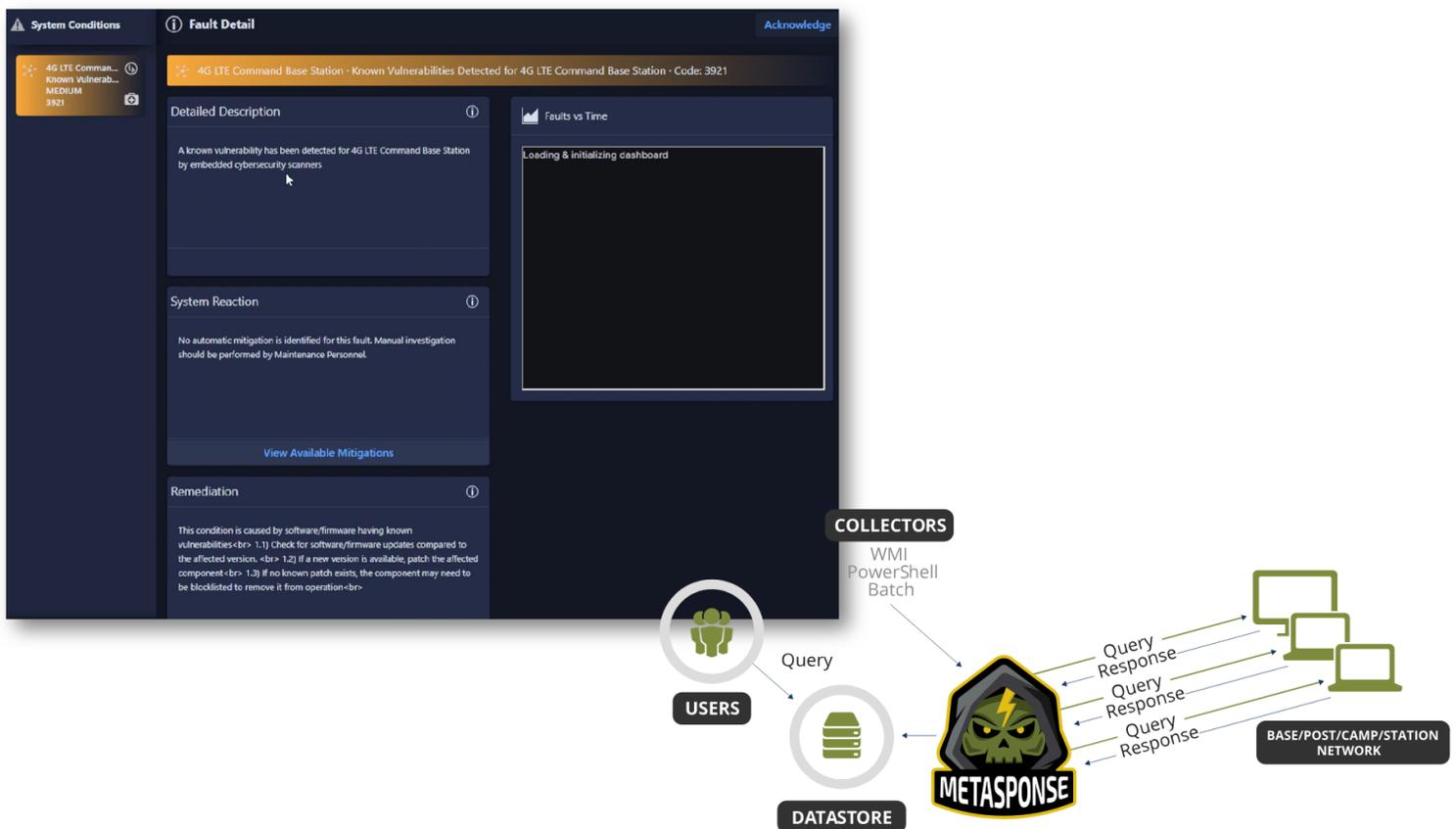
Fig. 4. FRAIHMWORK provides workflows for mitigating Cybersecurity risk

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Part 108 Requirements -

Requirement	Support	Explanation
108.555 Inoperative equipment	Supported	In general, FRAIHMWORK monitors all relevant UAS data feeds, and in the case of inoperative equipment, provides assessments, actionable evidence, and where applicable, mitigations. It provides a means to disposition loss scenarios due to inoperative equipment, such that a log containing operator decisions can be reviewed afterwards, and could be made part of operational procedures per 108.505(b)(14). Customers use FRAIHMWORK in this way, to maintain awareness of UAS availability, as part of their preflight activities, as well as during operations.

Fig. 5. The FRAIHMWORK Dashboard, with one high severity fault – FRAIHMWORK is the leading IASMS platform, delivering unmatched operational assurance for safe and scalable BVLOS operations.

Part 108 Requirements -

Requirement	Support	Explanation
108.600 General (maintenance and alterations)	Supported	This requirement pertains to maintenance or alterations of UAS, namely the UA, which the operator is under direct control of. FRAIHMWORK provides a means to identify at the telemetry interface, any adverse alteration, impacting the messaging (through data integrity assessment, and message schema validation) as well as self-reported monitoring of version numbers. Other modes for monitoring and assessment for maintenance and alteration scenarios are for associated elements, which are not covered in 108.600, and are covered elsewhere in part 146.

Fig. 6.
A sample of the FRAIHMWORK tiered maintenance display's version baseline monitoring — FRAIHMWORK monitors UAS component versions and alerts on any changes

Requirement	Support	Explanation
108.605 Persons performing maintenance and alterations	Supported	FRAIHMWORK provides a maintenance workflow where a maintenance supervisor could authorize maintenance to be performed by specific technicians, per (a), as part of its maintenance workflow, per (b). FRAIHMWORK's Maintenance Schedule provides workflows where a supervisor would approve maintenance actions, for both preventative actions, and mitigations for degradations and failures. Maintenance appointments provide the ability for maintainers to be specified in the scope of the work described in appointments.

Fig. 7.
A sample of the FRAIHMWORK tiered maintenance display's maintenance schedule — FRAIHMWORK provides scheduled maintenance workflows, calendars, lists, and notifications to ease the burden of maintenance, and track repairs

Part 108 Requirements -

| Requirement	Support	Explanation
108.615 Life-limited parts	Supported	FRAIHMWORK includes time-in-service counters for associated elements, as well as the UA. It tracks component states, determines availability, and calculates MTBF and MTTR.
108.630 Operation after maintenance or alterations	Partially supported	Per (a), FRAIHMWORK provides a maintenance workflow for repairs and alterations to be tracked and authorized by a maintenance supervisor.
108.725 Flight data	Supported	FRAIHMWORK can be used as part of a flight data collection system to provide UAS health and performance data, including health state information and associated fault, mitigation, and event history. Note, all events are timestamped and integrated with FRAIHMWORK's support of record/data retention, per 108.760.
108.750 Design changes	Partially supported	See response to 108.600
108.760 Record retention	Supported	FRAIHMWORK retains all event data pertaining to performance, including intermediate data, faults, and mitigations, pertaining to integrated UAS components, including AE, and has a configurable retention period.
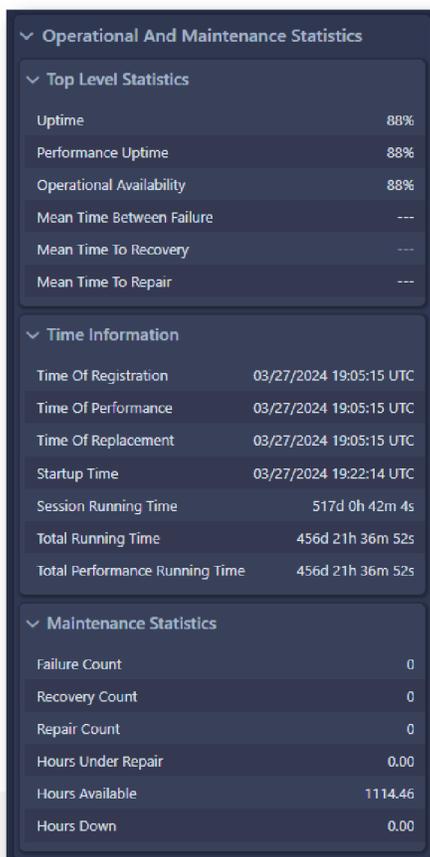
Fig. 8.
A sample of the FRAIHMWORK tiered maintenance display's statistics, found for each UAS component.

FRAIHMWORK tracks critical maintenance metrics—including mean time between failure, total failures (qty), and operational hours—to drive higher reliability and performance.

Part 108 Requirements -

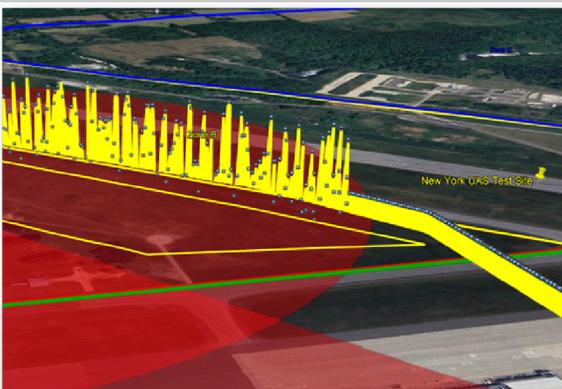| Requirement	Support	Explanation
108.810 Simplified user interaction	Partially supported	FRAIHMWORK is intended to provide a configurable means for an operator to identify loss scenarios (through preconfigured faults) and mitigations. This capability can provide the means to automatically or manually (human-approved) mitigate "via simplified user interaction design features", as specified in this requirement. …*the degradation or nonavailability of external services, systems, operator input, or signals.*
108.815 Signal monitoring and transmission	Supported	FRAIHMWORK provides the means to monitor, assess, and mitigate link outages and degradations. UA design may require self-assessment and mitigation of link degradation and outages, however FRAIHMWORK is a proven (if not critical) additional layer of operational assurance for this requirement.
108.820 Position, navigation, and timing	Supported	FRAIHMWORK provides the means to monitor, assess, and mitigate issues with telemetry data integrity. UAS design may require self-assessment and mitigation of PNT discontinuity or data anomalies, however FRAIHMWORK is a proven additional layer of operational assurance for this requirement regardless of UA capabilities or telemetry formats.
108.860 Software	Supported	FRAIHMWORK provides a means to actively monitor UAS software, to assure dependability. Additionally, version baseline monitoring and fault reporting for interface changes due to data integrity assessments all provide a means to satisfy this requirement.
108.865 Electronic hardware	Supported	Through the integration of software and communications functions, FRAIHMWORK can provide operational assurance for hardware (firmware, reconfigurable elements, etc).

Fig. 9.
A depiction of unreliable telemetry (altitude) data, prior to mitigation by FRAIHMWORK's data integrity assessment.

Part 108 Requirements -

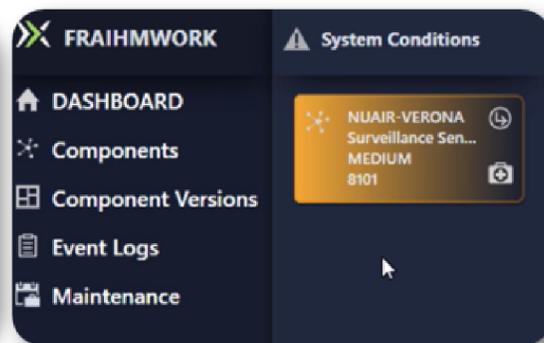| Requirement	Support	Explanation
108.870 Systems and equipment	Supported	Failures of installed systems and equipment, if integrated with FRAIHMWORK benefit from active monitoring, assessment, and mitigation functionality. Inherently, failures that are integrated in this way have some reduction in safety risk (which should be known to the operator), as mitigation actions are provided for each loss scenario.
108.875 Cybersecurity	Supported	Addressed in 108.535.
108.880 Associated elements design and performance requirements	Supported	The design and testing of associated elements, namely ADSPs set their own level of operational assurance, through self-monitoring, indication of their system element state, and in some cases, provide some level of fault/failure mode enumeration (assessment and fault related behavior). For example, FRAIHMWORK's surveillance sensor assessment service ("SSAS"), ingests this information (translating/homogenizing it as part of its data processing, and health assessment behavior), and can provide additional layers of assessment, both at the system element-level as well as at the capability level. Through this strategy, FRAIHMWORK can uniquely identify failure and malfunction modes that the ADSPs may not be able to. FRAIHMWORK is the only ADSP of its kind, and is designed for exceeding this requirement, 7 years before the NPRM issuance. Example exceeding this requirement: FRAIHMWORK ingests multimodal surveillance data from any number of sources (including cooperative and non-cooperative sensors as well as Surveillance Supplemental Data Service Providers). It ascertains individual sensor degradation relative to its expected nominal performance (see fig.).

Fig. 10.
Left: ADS-B Sensor with In-line tunable attenuator, an injected degradation not detectable to the sensor itself

Right: FRAIHMWORK Assessing the degradation within seconds

Part 108 Requirements -

Requirement	Support	Explanation
108.890 Operating environment conditions	Not supported, but will be soon	(b) calls for identification and avoidance of environmental conditions outside the UAS design envelope. FRAIHMWORK's risk assessment service can couple weather conditions and discrete elements of the operational environment. As demonstrated to NASA in a phase III SBIR, FRAIHMWORK was integrated with OneSky's USS, as a means to enhance its strategic deconfliction function. A future enhancement to the risk assessment service will integrate weather analysis into its ability to enhance USS strategic planning, as well as for airspace managers to receive general weather alerts relevant to flight operations.
108.895 Lightning protection	See 108.890 above	Lightning conditions will be integrated in weather-based risk assessments.
108.935 Function and reliability testing	Supported	FRAIHMWORK's health monitoring, operational availability metrics and event logging functionality all support the sub-requirement (b) for accumulating flight hours and associated loss scenario data.

Results

Part 146 Requirements -

Requirement	Support	Explanation
146.205 Authorization requirements (Service authorizations)	Supported	In order to comply with 146.205, FRAIHMWORK would need to be identified along with its minimum performance requirements, per (b), indicates that data, and documentation, in a form acceptable to the administrator is how this is done. It goes further, explaining this is comprised of: (1) an overview of the service and its intended use (2) a representation for any service users (a CONUSE) (3) technical specifications of the systems architecture and functionality We can provide that, today, for FRAIHMWORK and any ResilienX services, as ResilienX uses a form of MBSE throughout its systems architecture and software design. (c) Provides a declaration of compliance. This could include integration test results and configuration control evidence. This also conforms to ASTM F3201-24 (Software Dependability) for configuration management and release/verification documentation.
146.305 Cybersecurity	Supported	Operational Cybersecurity: FRAIHMWORK provides UAS a level of operational assurance for cybersecurity hazards, through its assessment functionality existing at the edge, enabled by AIS Artemis, as an adaptation of their Metasponse product. Artemis is capable of performing cybersecurity threat assessment, and is integrated with FRAIHMWORK for automatic mitigation of threat modes, preventing specific and evolving cybersecurity loss scenarios. Per (1), (2), (3), and (4) these sub-requirements are supported by FRAIHMWORK + AIS Artemis, and were recently demonstrated for effectiveness in the previously mentioned FAA BAA project. Sub-requirement (5) is supported by ResilienX's organizational cybersecurity posture, combined with FRAIHMWORK's IASMS functionality specific to mitigation of cybersecurity threats in UAS.

Part 146 Requirements -

Requirement	Support	Explanation
146.310 Quality management system	Supported	ResilienX FRAIHMWORK is built in accordance with sub-requirement (b), (c), (d), (e), and (f).
146.315 Change management	Supported	ResilienX is prepared to meet the sub-requirements in this requirement with its change management process, used in FRAIHMWORK development since its inception.
146.320 Training program	Supported	ResilienX is prepared to meet the sub-requirements in this requirement. The ResilienX engineering team maintains training for development, including coding standards, change management processes, and extensive product maintenance documentation.
146.325 Reportable occurrences	Supported	ResilienX FRAIHMWORK fully enables reportable occurrence support in an automated or retroactive fashion, for all monitored UAS components, even those that cannot do this on their own behalf. This aggregation of occurrences is contingent on the FAA providing a means to ingest it from FRAIHMWORK and the ResilienX Data Exchange. In the meantime, manual notification to the administrator would be manually provided in support of this requirement. Software defects are tracked, through ResilienX's customer reporting process.
146.330 Record retention	Partially supported	(a) Data and documentation would be maintained for at least a 24 month period beyond the period for application for certification. (b) Data and documentation, records of testing, service difficulty reports, are all maintained indefinitely, per the ResilienX software release process. (c) Additional information is TBD by FAA in certification. (d) Data exchanged through the FRAIHMWORK external system boundary is stored for at least 6 months. (e) Training records are recorded and retained to support certification. (f) Audits and inspection records would also be retained indefinitely, per ResilienX configuration control policy.

Part 146 Requirements -

Requirement	Support	Explanation
146.400 Authorized service data exchange requirements	Supported	(a) ResilienX Data Exchange provides secure, topic-based subscriptions for clients, including other ADSPs, users, and administration. (b) ResilienX Data Exchange is integrated with FRAIHMWORK, meeting this subrequirement. (c) The ResilienX Data Exchange uses OAuth2.0-compliant flows for authentication. (d) The ResilienX Data Exchange uses a data message schema that provides assurance of data sources, as well as schema validation and fault processing for off-nominal interface behavior. (e) The ResilienX Data Exchange does not discriminate, and is the best in the industry.

146.405 Software updates	Partially supported	ResilienX's engineering and release process meet all sub-requirements for this requirement.
		
		For (c) testing, ResilienX would include notifications and documentation for testing activities to an administrator, using the current level of verification and change management already in place.
		
		For (d) user notification and (e), ResilienX would use its change management process for notifying users and administration within the required period, and (f) would gate major and minor releases on administrative approval.
		
		(g) In normal circumstances, interface endpoints and software functionality are supported for the required period.

Conclusions

The FAA's proposed Part 108 and Part 146 rules represent a transformative step toward routine BVLOS operations. Through this white paper, ResilienX has demonstrated that its FRAIHMWORK In-Time Aviation Safety Management System (IASMS) and ResilienX Data Exchange already meet, and in many cases exceed, the intent of these draft requirements.

Our analysis shows that FRAIHMWORK delivers robust support across operator recordkeeping, reporting, maintenance, cybersecurity, preflight planning, operational assurance, and risk assessment. Where partial support exists today, pathways to full compliance have been identified and progressed through integration with ResilienX Data Exchange and AAM OptiX, partnerships with certified service providers, or ongoing product enhancements. This demonstrates a roadmap for achieving comprehensive compliance with the forthcoming regulation.

The ResilienX Data Exchange further strengthens compliance by enabling seamless integration with third-party ADSPs—Weather Information Providers, UTM Providers, and Surveillance SDSPs— within the ResilienX OptiX platform. This interoperability ensures that operators, OEMs, and service providers can rely on a trusted ecosystem of data to maintain safety, resilience, and scalability.

In summary, ResilienX is uniquely positioned to help the industry meet and exceed the FAA's BVLOS requirements. By providing a comprehensive operational assurance framework, proactive risk assessment, and seamless integration with USS and ADSPs, FRAIHMWORK and Data Exchange establish the foundation for safe, scalable, and commercially viable BVLOS operations.

As the FAA finalizes Part 108 and Part 146, ResilienX stands ready to support operators, OEMs, and service providers in achieving a competitive advantage and compliance, while advancing the broader vision of a safe and resilient national airspace.

References

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