RESO Web API
Server Testing Rules
1.0.2.0

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RESO Web API Server Testing Rules v1.0.2

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1.0 Introduction

This document contains the RESO Web API Testing Rules for Servers and Clients.

This document should be read by any organization who wants:

- To create a RESO Web API compliant server or client.
- To gain an understanding of the certification process.

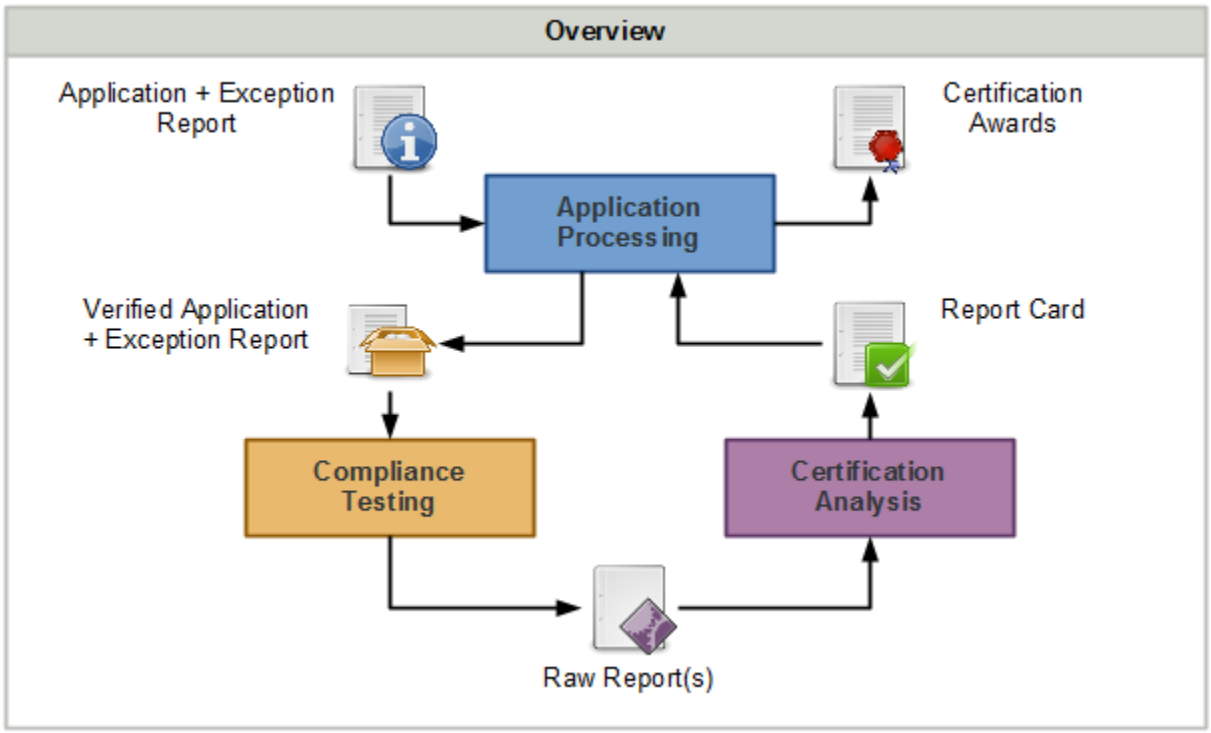
Any organization that wants their implementation certified against the RESO Web API standard follow a multi-step certification process that begins with an application submitted through http://reso.org/certification. There are two paths to certification: client or server. Certification as a server shows that the server can deliver structured information. Certification as a client shows that and the client can consume structured information. Client and server certification are separate. Organizations that have both a client and a server implementation must complete two certification processes, one for each type.

This document describes the steps and compliance rules that must be satisfied to become certified against the RESO Web API v1.0.2 standard.

1.1 Glossary

A glossary for common terms for RESO Web API processes is here <Document TBD>.

1.2 RESO Certification Flow (Summary)



RESO Group	Action	Output
Application Processing (Pre-Certification)	Accept and Verify Applicant's ***'Certification Application'*** via reso.org/certification	Prepare for Compliance Testing. Pass application and any information provided by applicant to Compliance Department.

Compliance Testing	Test applicant's implementation against well-defined Compliance Rules as set forth by the Transport and Compliance Workgroups.	Testing results formatted in ***'Raw Report'*** package. Pass ***'Raw Report'*** to Certification Department.
Certification Analysis	Analyze ***'Raw Report'*** to determine if applicant qualifies for a certificate. Create a ***'Report Card'*** with findings.	Pass analysis results and ***'Report Card'*** back to Application Processing.
Application Processing (Post-Certification)	Act on Certification Department recommendation ("Certify" or "Request Changes")	Notify applicant of Certificate Pass/Fail. Send notification and ***'Report Card'*** back to Applicant.

Application Processing (Pre-Certification)

2.0 RESO Web API Compliance Rules

This section contains the rules that RESO will use in the Compliance testing. The specific set of rules that need must be passed for a "Certification" are discussed in Section 3.

This version of the RESO Web API Testing Rules will only contain those applying to Web API Servers. The Web API Client Testing Rules will be recorded in a separate document and merged when both are finalized and approved.

2.1 RESO Web API Server Compliance Testing Rules

2.1.1 Non-RESO Technology Standards included in RESO Web API Compliance Testing Rules

The RESO Web API standard incorporates external standards from the W3C, OASIS, and the OpenID Foundation.

The RESO Web API is a more restrictive implementation of the external standards without extending into new functionality. The compliance requirements take selected portions of an external standard and make those portions a "MUST" requirement where they were previously a "MAY". Other portions were changed to "MUST NOT" where required. Where RESO has not changed the public standard, the certification uses a sub-set of well-defined external test systems.

2.1.1.1 OData 4.0 OASIS Standard

A server service end point MUST pass the OData 4.0 validation test for either AtomPub/XML or JSON with a Requirement Level of "MUST."

Once this test is completed, the test result is submitted to RESO as part of the certification process.

REQ-WA100-OASIS1: Satisfy OData 4.0 Standards for read-only transactions.

> **NOTE:** The focus here is on passing the basic validation checks for OData 4.0 using the OASIS validation tool here - http://services.odata.org/validation/validation.htm
>
> Any server service must first pass these validation checks. Testing is at a read-only, or "minimal" conformance level and metadata.
>
> The exact tests are provided by the OData standard "List of Rules" table for all "MUST" RequirementLevels: http://services.odata.org/validation/roadmap.htm#rules

OData Overview[2]

The Open Data Protocol (OData) is an application-level protocol for interacting with data via RESTful web services. The protocol supports the description of data models and the editing and querying of data according to those models. It provides facilities for:

- Metadata: a machine-readable description of the data model exposed by a particular data provider.
- Data: sets of data entities and the relationships between them.

- Querying: requesting that the service perform a set of filtering and other transformations to its data, then return the results.
- Editing: creating, updating, and deleting data.
- Operations: invoking custom logic.
- Vocabularies: attaching custom semantics.

The OData Protocol provides a uniform way to describe both the data and the data model. This improves semantic interoperability between systems and allows an ecosystem to emerge.

Further details pertaining to OData may be found here: OData Version 4.0

[2] Source: © Copyright OASIS Open 2013.

2.1.1.2 OpenID Connect Standard

OpenID Connect is an implementation of OAuth2. OpenID Connect must be used to secure a RESO Web API public implementation. Details pertaining to the expected server implementation are found here: 1.2 - OpenID Connect RETS Server Provider (Documentation available via http://members.reso.org/)

A server service end point MUST pass the OpenID Connect Provider conformance test available here: https://op.certification.openid.net:60000/.

Once this test is completed, the test result is submitted to RESO as part of the certification process.

REQ-WA100-OASIS1: Satisfy OpenID Connect Standards.

2.1.2 URLs & Endpoint Support

The RESO OData Transport defines a few standardized URL formatting requirements for ease of use and application interoperability. These requirements are designed to permit standards-compliant applications and servers to interoperate in a pluggable manner requiring minimal configuration. All service URL's must match OData V4 Part 2 Section 2 URL Components in addition to the additional recommendations detailed in the RESO specification here: 2.3 URL Formatting.

The goal is to offer RESO client developers a common structure that is well-understood and highly portable across all server vendors.

Requirement ID	Description	Web API Reference	Compliance Level	Test Results
REQ-WA100-URL1	Support Version in the URL Structures	2.2.1	Core	Compliant / Error
REQ-WA100-URL2	Support Hostname in URL Structures	2.3.1	Core	Compliant / Error
REQ-WA100-URL3	Support URI Stem in URL Structures	2.3.2	Core	Compliant / Error
REQ-WA100-END1	Support Service Endpoint	-----	Core	Compliant / Error
REQ-WA100-END2	Support DataSystem Endpoint	2.3.3	Core	Compliant / Error
REQ-WA100-END3	Support Metadata Endpoint	2.3.5	Core	Compliant / Error
REQ-WA100-END4	Support Resource Endpoint	2.3.4	Core	Compliant / Error

2.1.3 Query Support

OData offers an extensive query language that enables application developers to create from simple to complex user experiences. The RESO Web API search options are described here: 2.4 Search.

Requirement ID	Description	Web API Reference	Compliance Level	Test Results
REQ-WA100-Q1	Field names are case sensitive when used in the $select, $filter, and $orderby parameters. Case sensitivity is tested against the values defined in the resource metadata. Case sensitivity **MUST** be supported.	-----	Core	Compliant / Error
REQ-WA100-Q2	Servers **MAY** reject queries that are too complex to accept/handle. Servers **MUST** generate an appropriate error response and gracefully deny the request.	-----	Core	Compliant / Error
REQ-WA100-QR1	Required Search Parameters: Search by UniqueID	2.4.1	Core	Compliant / Error
REQ-WA100-QR2	Required Search Parameters: Search by <<Identify specific list of MUST queries>>	-----	Bronze	Compliant / Error
REQ-WA100-QR3	Required Query Support: $select	2.4.2	Core	Compliant / Error
REQ-WA100-QR4	Required Query Support: $top	2.4.2	Core	Compliant / Error

REQ-WA100-QR5	Required Query Support: $skip	2.4.2	Core	Compliant / Error
REQ-WA100-QO1	Optional Query Support: $filter	2.4.4	Core	Compliant / Error
REQ-WA100-QO2	Optional Query Support: $filter - Comparison: eq (equal)	2.4.4	Core	Compliant / Error
REQ-WA100-QO3	Optional Query Support: $filter - Comparison: ne (not equal)	2.4.4	Core	Compliant / Error
REQ-WA100-QO4	Optional Query Support: $filter - Comparison: gt (greater than)	2.4.4	Core	Compliant / Error
REQ-WA100-QO5	Optional Query Support: $filter - Comparison: ge (greater or equal)	2.4.4	Core	Compliant / Error
REQ-WA100-QO6	Optional Query Support: $filter - Comparison: lt (less than)	2.4.4	Core	Compliant / Error
REQ-WA100-QO7	Optional Query Support: $filter - Comparison: le (less or equal)	2.4.4	Core	Compliant / Error
REQ-WA100-QO8	Optional Query Support: $filter - Comparison: has	2.4.4	Bronze	Compliant / Error
REQ-WA100-QO9	Optional Query Support: $filter - Logical: and	2.4.4	Core	Compliant / Error
REQ-WA100-QO10	Optional Query Support: $filter - Logical: or	2.4.4	Core	Compliant / Error
REQ-WA100-QO11	Optional Query Support: $filter - Logical: not	2.4.4	Core	Compliant / Error
REQ-WA100-QO12	Optional Query Support: $filter - Grouping: ()	2.4.4	Platinum	Compliant / Error
REQ-WA100-QO13	Optional Query Support: $filter - String: contains	2.4.4	Platinum	Compliant / Error
REQ-WA100-QO14	Optional Query Support: $filter - String: endswith	2.4.4	Platinum	Compliant / Error
REQ-WA100-QO15	Optional Query Support: $filter - String: startswith	2.4.4	Platinum	Compliant / Error
REQ-WA100-QO16	Optional Query Support: $filter - String: tolower	2.4.4	Platinum	Compliant / Error
REQ-WA100-QO17	Optional Query Support: $filter - String: toupper	2.4.4	Platinum	Compliant / Error
REQ-WA100-QO18	Optional Query Support: $filter: Date: year	2.4.4	Gold	Compliant / Error
REQ-WA100-QO19	Optional Query Support: $filter: Date: month	2.4.4	Gold	Compliant / Error
REQ-WA100-QO20	Optional Query Support: $filter: Date: day	2.4.4	Gold	Compliant / Error
REQ-WA100-QO21	Optional Query Support: $filter: Date: hour	2.4.4	Gold	Compliant / Error
REQ-WA100-QO22	Optional Query Support: $filter: Date: minute	2.4.4	Gold	Compliant / Error
REQ-WA100-QO23	Optional Query Support: $filter: Date: second	2.4.4	Gold	Compliant / Error
REQ-WA100-QO24	Optional Query Support: $filter: Date: fractionalseconds	2.4.4	Gold	Compliant / Error
REQ-WA100-QO25	Optional Query Support: $filter: Date: Date	2.4.4	Core	Compliant / Error
REQ-WA100-QO26	Optional Query Support: $filter: Date: Time	2.4.4	Core	Compliant / Error
REQ-WA100-QO27	Optional Query Support: $filter: Date: Now	2.4.4	Core	Compliant / Error

REQ-WA100-QO28	Optional Query Support: $orderby	2.4.4	Bronze	Compliant / Error
REQ-WA100-QO29	Optional Query Support: $expand	2.4.4	Platinum	Compliant / Error
REQ-WA100-QM1	Support Only Correct Data Types <<Need additional information to determine if this is the right location for this rule.>>	2.4.3	Platinum	Compliant / Error
REQ-WA100-QM2	Support Lambda Operators	2.4.5	Platinum	Compliant / Error
REQ-WA100-QM3	Support Literals: $it	2.4.6	Platinum	Compliant / Error
REQ-WA100-QM4	Support Literals: $root	2.4.6	Platinum	Compliant / Error
REQ-WA100-QM5	Support Geospatial Search Implementation	2.4.7	Platinum	Compliant / Error
REQ-WA100-QM6	Support Annotations	2.4.8	Bronze	Compliant / Error
REQ-WA100-QM7	Support Single Value Lookups	2.4.9	Bronze	Compliant / Error
REQ-WA100-QM8	Support Multi Value Lookups	2.4.10	Bronze	Compliant / Error

2.1.4 RESO Data Dictionary Support

There is no requirement for the RESO Data Dictionary to be implemented within the RESO Web API Standard for applicants to receive RETS Web API Certification.

The RESO Data Dictionary may be represented using the RESO Web API Standard. However, the Data Dictionary Certification is awarded separately.

2.1.5 Response Code Support

Server vendors MUST use standard HTTP response codes to communicate successful transactions and all server errors. This conforms with OData and is accepted as a generally desired practice across all RESO transport standards.

REQ-WA100-RC1: A compatible server implementation **MUST** return a valid HTTP status **code** for each request indicating the status of the request when ATOM-XML is requested.

REQ-WA100-RC2: If the response was not successful, the server **MAY** include an error **message** in the body of the HTTP response. There is a defined response body for JSON but there is no explicit requirement in the OData standard.

The following table includes additional requirements about the specific response codes.

Requirement ID	Description	Web API Reference	Compliance Level	Test Results
REQ-WA100-RC3	Support Response Code: 200 (OK)	2.5.2	Core	Compliant / Error
REQ-WA100-RC4	Support Response Code: 202 (Accepted)	2.5.2	Core	Compliant / Error
REQ-WA100-RC5	Support Response Code: 400 (Bad Request)	2.5.2	Core	Compliant / Error
REQ-WA100-RC6	Support Response Code: 403 (Forbidden)	2.5.2	Core	Compliant / Error
REQ-WA100-RC7	Support Response Code: 404 (Not Found)	2.5.2	Core	Compliant / Error
REQ-WA100-RC8	Support Response Code: 413 (Retry Entity Too Large)	2.5.2	Core	Compliant / Error
REQ-WA100-RC9	Support Response Code: 415 (Unsupported Media)	2.5.2	Core	Compliant / Error
REQ-WA100-RC9	Support Response Code: 429 (Too Many Requests)	2.5.2	Core	Compliant / Error
REQ-WA100-RC10	Support Response Code: 500 (Internal Serversl ,	2.5.2	Core	Compliant / Error
REQ-WA100-RC11	Support Response Code: 501 (Not Implemented)	2.5.2	Core	Compliant / Error

2.1.6 Property Facet Support

OData Property Facets allow a model to provide additional constraints or data about the value of structural properties. Facets are expressed as attributes on the property element. Facets apply to the type referenced in the element where the facet attribute is declared. If the type is a collection, the facets apply to the type of elements in the collection. The RESO Web API requires implementation of specific OData V4 Part 3 Section 6.2 Property Facets.

Requirement ID	Description	OData Reference	Compliance Level	Test Results
REQ-WA100-L1	Required Property Facet Support: Attribute MaxLength	6.2.2	Core	Compliant / Error
REQ-WA100-P1	Required Property Facet Support: Attribute Precision	6.2.3	Core	Compliant / Error
REQ-WA100-S1	Required Property Facet Support: Attribute Scale	6.2.4	Core	Compliant / Error

3.0 RESO Web API Certification Rules

This section contains all of the rules that RESO will use in awarding RESO Web API Certificates. The specific set of rules that must be passed for "Compliance" are discussed in Section 2.

Certification is awarded when all requirements detailed in this testing rules document has been satisfied for any given certification level.

3.1 Compliance Levels Definition Summary

The RESO Web API Certification has many different levels. This is an effort to provide additional recognition to those who implement more than the minimum requirements. These level descriptions are for both Server and Client Certificates.[1] Each server and client compliance level has specific requirements detailed in sections later in this document.

Level Name	Objective	Target Year[2]	Description Summary
Core	Minimum	2016-2017	All Core Level functionality is implemented. This is the minimum functionality for a RESO Web API Server to function. Compliance Warnings and Notices MAY be allowed.
Bronze	Parity	2018	All Bronze Level functionality is implemented. This includes functionality similar to RETS 1.x Servers. Compliance Warnings and Notices MAY be allowed.
Silver	Advanced	2019	All Silver Level functionality is implemented. This includes advanced business cases previously not addressed by the RETS 1.x Specification. Compliance Warnings and Notices MAY be allowed.
Gold	Complete	2020	All RESO Web API functionality is implemented. Compliance Notices MAY be allowed. Compliance Warnings are NOT allowed. Compliance Notices MAY be allows
Platinum	Maximum	2021	All RESO Web API functionality is implemented. Compliance Warnings and Notices NOT allowed.

Every functionality within the RESO Web API specification has been assigned to one of these different levels. All functionality at that level **MUST** be implemented **AND** compliant to be certified at that level. Additionally, all aspects of a lower compliance level **MUST** be satisfied before receiving a higher compliance level. For example, “Core” is a requirement for “Bronze”, “Bronze” for “Silver”, “Silver” for “Gold”, and “Gold“ for “Platinum.” Generally speaking, failing at a level will result in receiving certification at the next level below.

> **Note 1:** "Functionality Implemented" may differ for between Servers and Clients. Generally, a functionality is implemented on a server if it can provide that feature or implemented on a client if it can request or accept that feature from the server. More specific details may be found in Section 2 - Compliance Rules of this document.
>
> **Note 2:** The Compliance Level Target Year is the year where this Compliance Level will become required. For example, beginning January 1, 2018, the Bronze (Parity) level of compliance is REQUIRED for certification. Beginning January 1, 2021, the Platinum (Perfection) compliance level is REQUIRED for certification.

3.2 RESO Web API Server Certification Level Testing Rules

3.2.1 RESO Web API Server Core Certification (Minimum)

3.2.2 RESO Web API Server Bronze Certification (Parity)

3.2.3 RESO Web API Server Silver Certification (Advanced)

3.2.4 RESO Web API Server Gold Certification (Complete)

3.2.5 RESO Web API Server Platinum Certification (Maximum)

3.2.1 RESO Web API Server Core Certification (Minimum)

RESO Web API Server Core Certification (Minimum) is the first of the compliance levels. Any description of a RESO Web API Certification without distinction will refer to this minimum level.

These are the minimum requirements that MUST be satisfied to receive certification. Any non-compliant core functionality will prevent receiving this certification.

REQ-WS100-WSC-1: Satisfies all requirements for RESO Web API Server Core certification.

> **NOTE:** The "Core Compliance" requirements will roll up into the Bronze requirements at the end of 2017.

3.2.2 RESO Web API Server Bronze Certification (Parity)

RESO Web API Server Bronze Certification (Parity) is the first of the certification levels beyond the minimum "Core" certification. Any non-compliant Bronze (Parity) functionality will prevent receiving this certification.

> **NOTE 1:** The term "Parity" implies those obtaining this certification means that the RESO Web API Server is able to perform the same functionality as a RETS 1.x Server. (Exact parity functionality MAY vary as determined by the RESO Transport Workgroup.)

REQ-WS100-WSB-1: All RESO Web API Server Bronze (Parity) functionality **MUST** be found compliant. Bronze (Parity) functionality found within the applicant's server implementation that is **NOT** found to be compliant will not be awarded Bronze certification but may be eligible for lower levels.

REQ-WS100-WSB-2: Satisfies **ALL** requirements for RESO Web API Server Core (Minimum) certification.

> **NOTE:** The "Bronze Compliance" requirements will roll up into the Silver requirements at the end of 2018.

3.2.3 RESO Web API Server Silver Certification (Advanced)

RESO Web API Server Silver Certification (Advanced) is the first level where the presence of cautionary warnings impacts certification results. Any non-compliant Silver (Advanced) functionality will prevent receiving certification.

> **NOTE:** The term "Advanced" implies obtaining this certification means that the RESO Web API Server is able to perform the more functionality than a RETS 1.x Server. This MAY include functionality exclusively available to the RESO Web API. (Exact advanced functionality MAY vary as determined by the RESO Transport Workgroup.)

REQ-WS100-WSS-1: All RESO Web API Server Silver (Advanced) functionality **MUST** be found compliant. Silver (Advanced) functionality found within the applicant's server implementation that is **NOT** found to be compliant will not be awarded Silver certification but may be eligible for lower levels.

REQ-WS100-WSS-2: Satisfied all requirements for RESO Web API Server Bronze (Parity) certification.

> **NOTE:** The "Silver Compliance" requirements will roll up into the Gold requirements at the end of 2019.

3.2.4 RESO Web API Server Gold Certification (Complete)

RESO Web API Server Gold Certification (Complete) is the certification level where ALL of the RESO Web API functionality has been implemented. Any non-compliant Gold (Complete) functionality will prevent receiving this certification.

REQ-WS100-WSG-1: All RESO Web API Server Gold (Complete) functionality **MUST** be found compliant. Gold (Complete) functionality found within the applicant's server implementation that is **NOT** found to be compliant will not be awarded Gold certification but may be eligible for lower levels.

REQ-WS100-WSG-2: No Compliance Warnings of any type are allowed. Compliance Notices are allowed, if applicable.

REQ-WS100-WSG-3: Satisfied **ALL** requirements for RESO Web API Silver (Advanced) certification.

> **NOTE:** The "Gold Compliance" requirements will roll up into the Platinum requirements at the end of 2020. The Platinum Certification will become the only level for Data Dictionary certification in 2021.

3.2.5 RESO Web API Server Platinum Certification (Maximum)

RESO Web API Server Platinum Certification (Maximum) is the certification level where ALL of the RESO Web API functionality has been implemented without warning or notice. Any non-compliant Platinum (Maximum) functionality will prevent receiving this certification. Platinum is the highest level of certification. This is the 100% compliance level.

REQ-WS100-WSP-1: All RESO Web API Server Platinum (Maximum) functionality **MUST** be found compliant. Platinum (Maximum) functionality found within the applicant's server implementation that is **NOT** found to be compliant will not be awarded Platinum certification but may be eligible for lower levels.

REQ-WS100-WSP-2: No Cautionary Warnings or Notices of any type are allowed.

REQ-WS100-WSP-3: Satisfies **ALL** requirements for RETS Web API Gold (Complete) certification.

> **NOTE:** The Platinum Compliance will become the only level for RESO Web API Certification in 2021.

4.0 RESO Web API Report Card and Specifications

The RESO Web API Report Card is used to report to the applicant the certification findings. This will include a list of the testing results from testing.

The exact format will be determined by the RESO Compliance Staff with input from the RESO Transport Workgoup.

Change Log

Web API Testing Rules Change Log

Version 0.0 (Draft)

This documentation is based on an existing Data Dictionary Certification Testing Rules. Due to large number of changes required to convert this for the Web API Standard, specific changes will not be recorded until after this document has been reviewed by the RESO Transport Workgroup.