

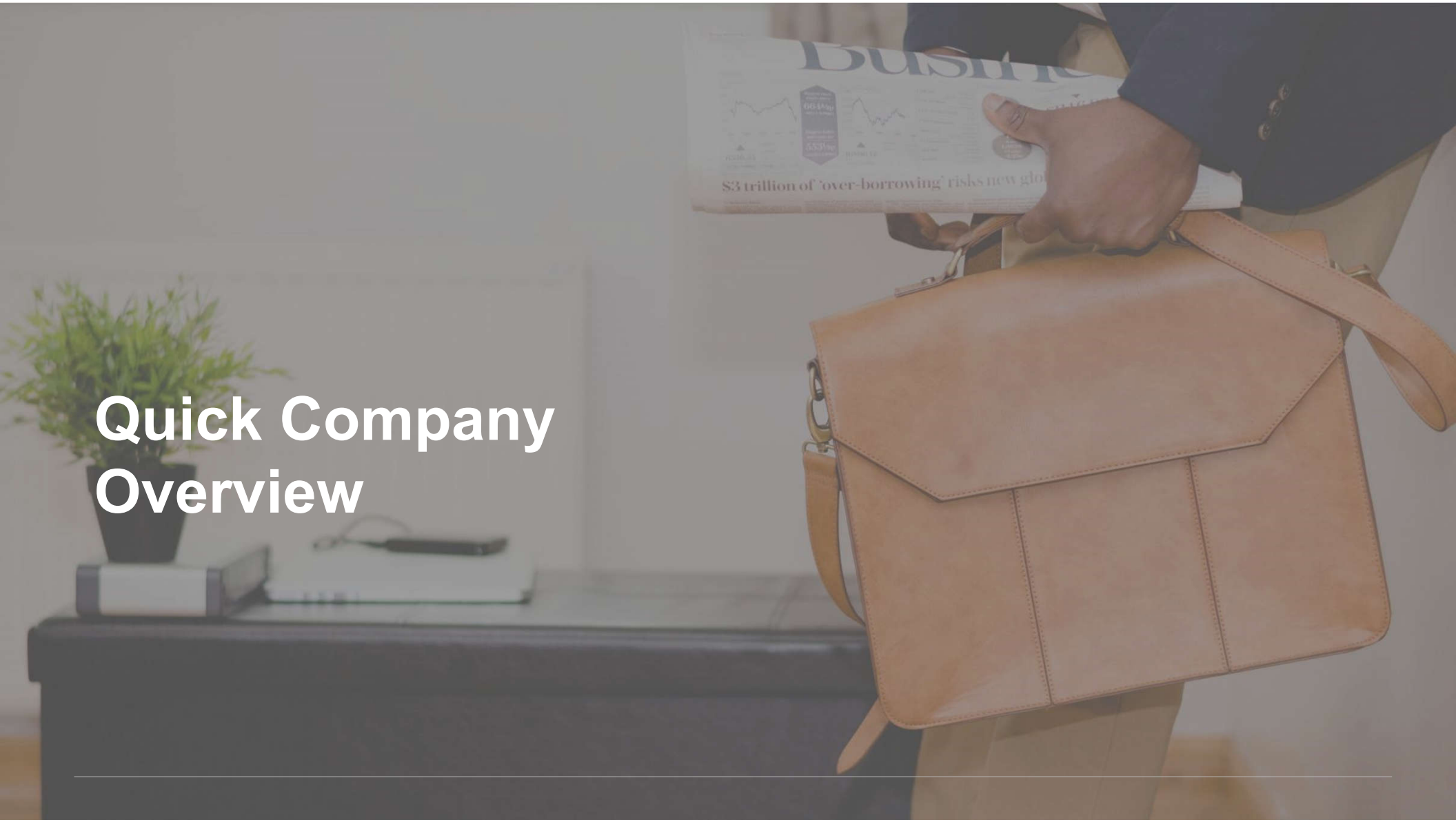
Synthesis Overview

IASS 2020



The material contained in this document is provided in confidence, for the sole purpose of the evaluation of an investment in Certification Center Canada through the Flight Test Centre of Excellence or part thereof by recipient. Distribution is restricted to individuals performing such an evaluation, and distribution to other personnel requires the express written consent from Certification Centre Canada.

Quick Company Overview



Marinvent Background



Privately-held Canadian Corp.

Organically funded business since 1983



Two distinct revenue streams serving two different sets of customers

Research and Development, IP generation and IP exploitation

Certification-related services of all kinds.



Stellar track record of success (Many awards)

+50 successful certification programs with TCCA and FAA

CGP and AS9100



Management Team



DR. JOHN MARIS

President & Owner



MR. PHIL COLE

Vice President Business
Development



MR. SAM GRAINGER

Vice President Operations

Awards

Canadian American Business Achievement Award

Awarded for leading a joint enterprise demonstrating strong business growth, remarkable innovation, noteworthy contributions to local communities and the capacity to provide their partners with a global advantage

Canadian Aeronautics & Space Institute: Trans Canada (McKee) Trophy

Canada's oldest and most prestigious aeronautical trophy awarded to Marinvent for the Canadian whose achievements were most outstanding in promoting aviation in Canada

Aviation Week & Space Technology Laureate

Awarded for "...helping to transition from paper in the cockpit to a digital flight deck."

Canadian Business Aviation Association Industry Award

Outstanding contribution to aviation

Aerospace Association of Quebec (AQA) Prix de l'Entreprise

Aerospace company of the year

Canadian Business Aviation Association Industry Award

Awarded for the safety gains achieved through human factors enhancements, systems engineering and flight test services.

Create the Future Award

APM product winner

New Zealand Ministry of Defense Award of Excellence to Industry

Marinvent singled out as one of the two most valuable contractors from a pool of more than 800 contractors for contributions to C-130 LEP and P-3K capital programs

AIAC James C Floyd Award

Aerospace company of the year

C2-MTL Annual Aerospace Award

Marinvent's work on unmanned aerial systems flight test and evaluation with its Piaggio Avanti project singled out as aerospace innovation of the year

NASA

Small Business Subcontractor of the Year (TASAR)

NASA

LaRC 2014 Group Achievement Award

Canadian Defense Executive of the Year

Dr. John Maris

Canadian Aviation Hall of Fame

Dr. Maris Inducted

Canadian Defense Review

Canadian Top 50 Defense Companies 2015 - 2020



Need for Synthesis[®] Tools Suite

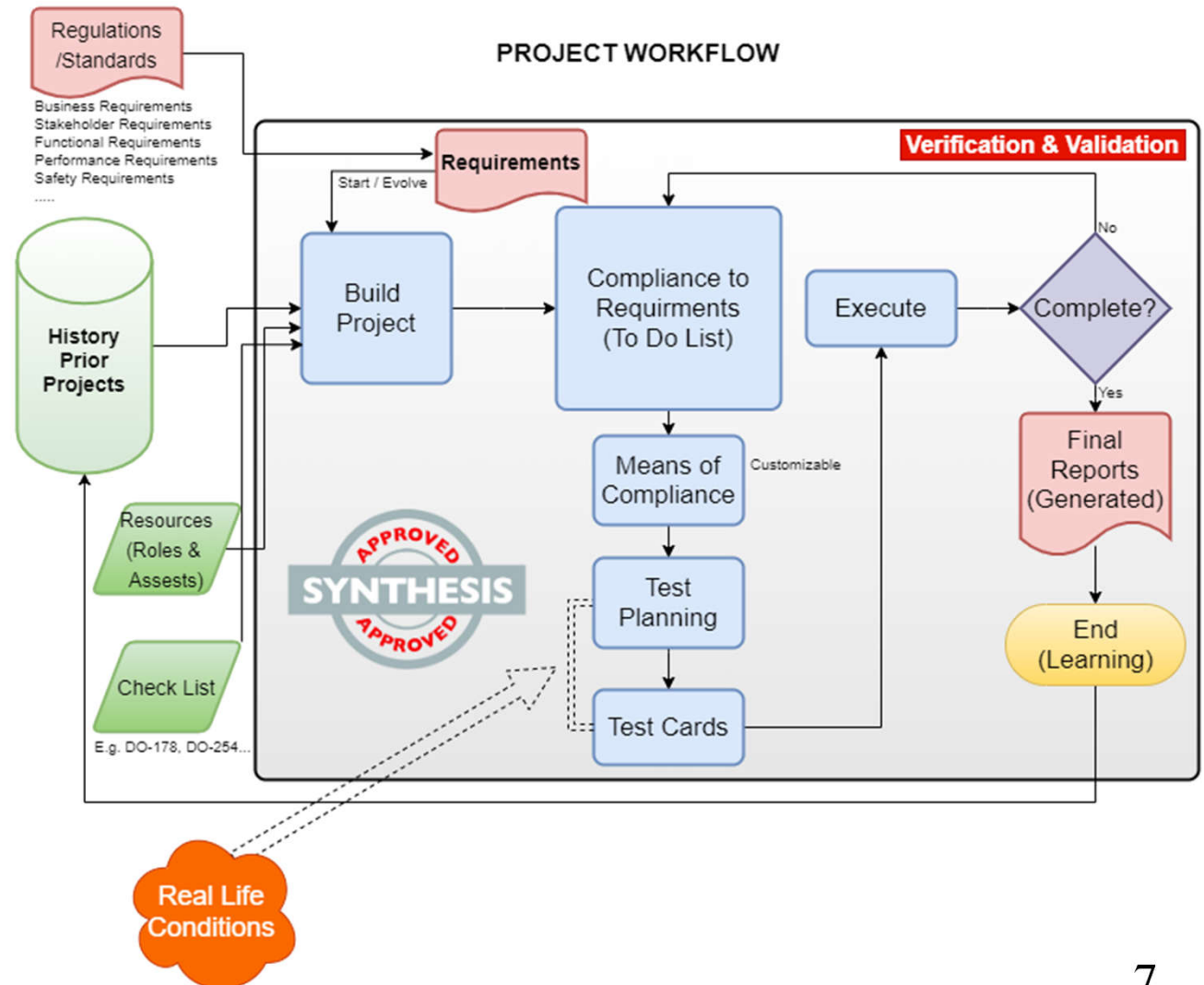


Ever increasing complexity of projects with external regulations / requirements / acceptance criteria -
COMPLIANCE

- Constantly changing
- Currently Ad-Hoc tools
- Not integrated
- Lots of paper
- Difficult to status, manage, predict, optimize
- Almost impossible to re-use data

Project lifecycle

- Value increases over time
- Link Teams / Information
- Unifies distributed teams (Supply chain)
- Built for working level
- Provides transparency to Management
- Optimizes execution
- Out-of-box functionality
- "What if" capability
- Standardization



Definitions

- Product – the end result of a project (a flight release, new release of PoH / aircraft operations with new gear, “certification” of hardware, software, etc.)
- Test environment / equipment, such as an aircraft, simulator, test rig / harness, test bench, etc.
- Users – who is involved on a project (stakeholders, QTP, FTE, FTA, etc.)
- Suppliers – groups of users from different units, companies, stakeholders, who need might need IP separation, of organization
- Test parameters – used to build simple and complex test plans and test cases

Building a Project – Starting Out (big picture)

- A project manager (or user with appropriate permissions) creates a new project when a contract is received and assigns users
- The project manager creates at least one product and test environment for the project
- The project starts with the creation of a requirements document, consisting of contract requirements, which is then reviewed and approved in Synthesis
- A second requirements document is then created which comprises the estimate (schedule cost, etc.), which is also reviewed and approved in Synthesis
- The object of the project is to demonstrate compliance with these two, and any other requirements documents

Products

- Versioned - minor & major changes tracked (automatic CM)
- Describes a goal / target in a project
- All project data attached to a product it belongs to
- Changes to a product can drive changes in documents
 - for example, a major change in a product can force related documents to be revised and re-approved.

Modify Product

Is this change minor or major?
[\(Help me decide\)](#)
A minor change won't have any effect on existing documentation or projects, but a major change will. Only certain fields are modifiable for a minor change, but all fields can be changed for a major change. Choose what type of modification you are making, and update the fields as desired.

☒ Minor - a change that will not impact associated documents or artifacts.
☐ Major - a change that will impact associated documents or artifacts.

Test Environment Data

Name
Test

Version: 1 last updated by An Author on 2016-08-04 08:36

Description
Test

Part number
001

☒ Active (a deactivated environment may not be selected in new or modified documents)

Documents currently using this product
Functional requirements NC-0.1 (Draft)
Test plan demo NC-0.1 (Draft)
Project regs NC-1.1 (Draft)
190 test - config items NC-0.1 (Draft)
Software tests - functional NC-2.0 (Release)

Modify Cancel

Test Environment

- Versioned - minor & major changes tracked (automatic CM)
- Describes a test environment, such as an aircraft, sim, bench, desktop PC (anywhere a test needs to take place)
- All project test plan data (tests) are attached to a target test environment testing will occur in (e.g.: target aircraft, system, etc.)
- Changes to a test environment can drive changes in documents
 - for example, a major change in an environment can force related documents to be revised and re-approved to ensure they are still applicable and correct for any changes made to the test environment.

Modify A Test Environment

Is this change minor or major?
([Help me decide](#))
A minor change won't have any effect on existing documentation or projects, but a major change will. Only certain fields are modifiable for a minor change, but all fields can be changed for a major change. Choose what type of modification you are making, and update the fields as desired.

☒ Minor - a change that will not impact associated documents or artifacts.
☐ Major - a change that will impact associated documents or artifacts.

Test Environment Data

Name
PAL B200 S/N BB1395

Version: 1 last updated by John Maris AP001 on 2019-10-24 20:45

Description

Type
Aircraft

Type of data parameters
N/A

☒ Active (a deactivated environment may not be selected in new or modified documents)

Projects currently using this test environment
PAL200 - PAL DFO King Air B200 Upgrade (3 documents)

ModifyCancel

Users / Suppliers

- Build-in basic roles – author, reviewer, approver, observer, project manager, etc.
- Includes approval for differing safety / risk levels in tests (no risk, low, medium, high, very high)
- Supports integration with LDAP, MS ActiveDirectory back-ends or database users



Test Parameter

- Describes an input or output for a test
- Configured for a project
- Ensures consistency across all tests and between test plan authors
- Can be any type of data with formatting and optional minimum and maximum limits
- Can define conditions for a test, and/or data to be collected / recorded when executing a test
- Configurable field from free-form entry, to restricted “pick” list

The image displays two screenshots of the 'Modify Test Parameter' dialog box, illustrating different configurations for test parameters.

Top Screenshot (Test_Condition Group):

- Group:** Test_Condition
- *Parameter:** KCAS
- Description:** Calibrated Airspeed (kts)
- Unit:** (kts)
- Value Type:** ☒ Numeric/String, ☐ Enumerated
- Default special format:** Default
- Limitations:** Min: 0, Max: 260
- Table:**

Add	Delete	Value
		New Value
		Opt
		V2
		Va (182 KCAS)
		Vc
		Vd
		Vef

Bottom Screenshot (Compliance_methods Group):

- Group:** Compliance_methods
- *Parameter:** Compliance_methods
- Description:** none
- Unit:** None
- Value Type:** ☐ Numeric/String, ☒ Enumerated
- Table:**

Add	Delete	Value
		Inspection
		N/A
		Opt
		S.O.C.
		Similarity
		Simulation
		Test-flight
		Test_ground

Building a Project – Next Steps

- All Synthesis projects are requirements driven
- Requirements can be anything that needs to be achieved, from contract requirements, functional, constraints, etc.
- Either the project manager can create documents and assign them to users, or individual users with author permissions can create documents
- Documents can also be general reports, memos, analysis documents and so on.

Documents

- Hierarchical, data-driven, documents (outlined numbering)
- Allows engineers to enter the data, and not worry about the layout
- Auto-generated indexes, headers, footers (including security markings, e.g.: built-in Top Secret, Secret, Protected, ITAR/Controlled Goods Restricted, Unclassified, and customizable)
- Automatic draft watermarks
- Revision history and automatic configuration manage and history
- PDF output
- Built-in dictionary (no data sent offsite)

1. Introduction

2. System overview

▼ 3. Requirements

3.1. Architecture

3.2. Constraints

3.3. Functional

3.4. Safety

3.5. Other regulatory

Confidential proprietary information, not for disclosure without prior written consent.

190-123, NC-1.0
Page 2 of 4

Test - System software requirements

1. Introduction

Requirements

[121126.1]
Software Guidelines - DO-178B
The software process shall meet DO-178B objectives.

[121179.1]
QMS AS9100
The software planning, design, development, and verification shall follow AS9100 processes and procedures as per quality manual QM-001.

2. System overview

The control software system in general is comprised of the following elements:

1. Control inputs
2. Expert systems processing
3. Control outputs

The following diagram shows the system in general terms.

```
graph LR; SP[Set Point] --> S1(( )); S1 --> DC[Digital Controller  
PIDz]; DC --> A[Amplifier  
PWM]; A --> S2(( )); S2 --> P[Plant  
PT2]; P --> PV[Process Variable]; PV --> S[Stiction]; S --> S1;
```

Documents

- Live change tracking, including outdated requirements and requirements with outdated parents
- Modification / differencing of all document data, such as section text, requirements, test points
- Search for any text in any data (requirement, CAR/FAR, sections, test points, etc.)

Document
Review and Approvals
Header
Procedures

- *Pitot-static boom structural clearance [L]
- *23.1323 Airspeed Indicating System (Flight) [L]
- *23.1323 Airspeed Indicating System (Ground) [L]
- *23.51 Takeoff [25.105, 25.105(d), CAR 3.84] [L]
- *FAR 135 App A 5(c). Accelerate-stop distance [L]
- *SFAR 41C: 25.111 Takeoff path [also 135 Appendix A]
- *SFAR 41C: 25.113(a) Takeoff distance and Takeoff run
- *Half-Flap OEI Takeoff Handling Evaluation [L]
- *23.65 Takeoff Climb (AEO)[CAR 3.85(a)] [L]
- *FAR 135 Appendix A (6)(b). Takeoff Climb: One-engine
- *SFAR 41C: 25.115 Takeoff flight path [135 Appendix A]
- *23.75 Landing [CAR 3.86] [L]
- *23.77 Balked landing [25.119, 135 Appendix A, CAR 3.84]
- *23.143 Control and Maneuverability general [L]
- *23.145 Longitudinal control [CAR 109(a)(c)], 110(a)(b)
- *23.147 Directional and lateral control [CAR 3.109(a)(c)
- *23.149 Minimum control speed [M]
- *23.161 Trim [135A, CAR 3.112] [L]
- *23.171 Stability general [L]
- *23.173 Static longitudinal stability [135 Appendix A, CAR 3.109(a)(c)]
- *23.175 Demonstration of static longitudinal stability [C]
- *23.175 Climb static longitudinal stability [135 Appendix A]
- *23.175 Cruise static longitudinal stability [135 Appendix A]
- *23.175 Approach and Landing static longitudinal stability
- *23.181 Dynamic longitudinal stability [L]
- *23.49 Stalling speed [CAR 3.82] [L]
- *23.201 Stall demonstration [L]
- *23.203 Stall characteristics [L]
- *23.205 One-engine-inoperative stalls [M]
- *23.207 Stall warning [135 Appendix A] [L]
- *SFAR 41C: 25.153(d) Operating limitations [L]
- Compliance: FAR 23.1 - Applicability [L]
- Compliance: FAR 23.3 - Airplane categories [L]
- Compliance: FAR 23.21 - Proof of compliance [L]
- Compliance: FAR 23.23 - Load distribution limits [L]
- Compliance: FAR 23.25 - Weight limits [L]
- Compliance: FAR 23.29 - Empty weight and corresponding
- Compliance: FAR 23.31 - Removable ballast [L]
- Compliance: FAR 23.33 - Propeller speed and pitch limits
- Compliance: FAR 23.45 - Performance general [L]
- Compliance: FAR 23.49 - Stalling speed [L]
- Compliance: FAR 23.51 - Takeoff [L]
- Compliance: FAR 23.65 - Climb: all engines operating
- Compliance: FAR 23.67 - Climb: one engine inoperative
- Compliance: FAR 23.75 - Landing [L]
- Compliance: FAR 23.77 - Balked landing [L]
- Compliance: FAR 23.141 - Flight characteristics general
- Compliance: FAR 23.143 - Control and Maneuverability
- Compliance: FAR 23.145 - Longitudinal control [L]
- Compliance: FAR 23.147 - Directional and lateral control
- Compliance: FAR 23.149 - Minimum control speed [L]
- Compliance: FAR 23.151 - Atmospheric maneuvers: N/A

Procedure Title

Test procedure 002: 23.1323 Airspeed Indicating System (Flight)

Test Procedure Definition

Test Blocks

The following procedure must be completed in calm conditions with a stable wind-field, as follows:

1. Establish and record the desired aircraft configuration;
2. Stabilize in steady level flight at the desired test speed; allow 10 seconds for GPS ground track and stabilize;
3. When all parameters are stabilized, concurrently record the IAS, pressure altitude (29.92 set), OAT, speed, and wind velocity;
4. Turn 120 degrees either direction;
5. Allow the GPS ground track and ground speed to stabilize and record the new ground track, ground speed, and wind velocity;
6. Turn 120 degrees to complete the triangle and record the third set of data;
7. Attain the next test condition;
8. Repeat Steps (1 – 9) until the test matrix has been completed;
9. Repeat with the gear down.

NOTE: According to the guidance in AC 23-8C, variations in altitude (up to 100 feet) are much preferred from the initial value. A one knot change in indicated airspeed will cause at least a one knot change in altitude only causes on the order of 1/2 of 1 percent change in the density ratio, σ .

Test #	Name	CIAS KIAS	Alt (ft)	Gear None	Flaps (%)	Test result (Click to see history)
001	PEC (Flight) - Gear UP	1.1 Vs1 - 175 KIAS	For smooth air	Up	1/2 (180 KIAS)	Not set
002	PEC (Flight) - Gear Down	1.1 Vs1 - 175 KIAS	For smooth air	DN	1/2 (180 KIAS)	Not set

Click to enter text...

Hazard Identification

Risk Reduction Method

Test Procedure Comments

AC 23-8C Appendix 9

3. GPS Method

a. Test Conditions.

- (1) Air Quality. The air should be as smooth as possible with a minimum of turbulence. The wind velocity for this method to give correct results.
- (2) Weight and C.G. Same as the speed course method.
- (3) Altitude. The altitude is not critical, but it should be chosen where the air is smooth and the winds are light.
- (4) Speed Range. Any speed at which the aircraft can be stabilized in level flight (see Figure A9.2).
- (5) Runs. Three runs per airspeed are required to calculate one true airspeed. The three runs must be at different headings. The headings should be 60 to 120 degrees apart.

Pass-Fail Criteria

Requirements

Search

Search Results **Changes Summary** 76

Procedure : Pitot-static boom structural clearance

Procedure Title Modified

Procedure : 23.1323 Airspeed Indicating System (Flight) New

Procedure : 23.1323 Airspeed Indicating System (Ground)

Procedure Title Modified

Test Point Title Modified

Test Point Values Modified

Test Point Input Parameters Modified

Test Point Title Modified

Test Point Values Modified

Test Point Input Parameters Modified

Procedure Test Block Pre-text Modified

Test Parameters Modified

Procedure : 23.51 Takeoff [25.105, 25.105(d), CAR 3.84] Moved

Procedure : FAR 135 App A 5(c). Accelerate-stop distance

Procedure Test Block Pre-text Modified

Procedure : SFAR 41C: 25.111 Takeoff path [also 135 Appendix A(5)(e)] Moved

Procedure : SFAR 41C: 25.113(a) Takeoff distance and Takeoff run

Procedure Test Block Pre-text Modified

Procedure : Half-Flap OEI Takeoff Handling Evaluation New

Procedure : 23.65 Takeoff Climb (AEO)[CAR 3.85(a)]

Procedure Title Modified

Requirements

- Hierarchical requirements with configurable levels (default levels in order are Contract, Regulatory, System, Subsystem, Design)
- Parent-child relationships between levels
- Support for CSV import
- CAR/FAR regulatory fields (fully searchable)
- Configuration managed and versioned
- Labeling (safety, functional, constraint, etc.)

The screenshot displays two overlapping windows from a requirements management application. The background window is titled 'Modify requirement' and shows details for requirement ID 121241.1, which is at the 'System' level, 'Functional' class, and 'None' type. Its parent is '[121123.1] TSO-C4c'. The foreground window is titled 'Select Parent Requirement' and shows a search interface with a table of results.

Modify requirement

ID: 121241.1 Last updated 2020-09-15 14:29 by An Author

Level: System

Class: Functional

Type: None

Parent: [121123.1] TSO-C4c [Change parent](#) [View parent](#)

Header: Navigational - waypoint

Content: [Rich text editor toolbar]

Select Parent Requirement

Header ☒ Content ☐ Car/Far ☐ ID

Enter Search Text [Search Icon]

Use Double Click to view requirement 1-2 of 2 requirements

Filter By Document

Documents

Level	Updated	Type	Class
Project regs (190-SYSREQ)			
System software requirements (190-123)			
121123.1	TSO-C4c	Regulatory	09.07.2020
121124.1	TSO-C2d	Regulatory	09.07.2020

Buttons: Set Parent, Remove Current Parent, Close

Document Life-Cycle

- All documents share the same life-cycle
- A document by the author, or an author is assigned (and can be re-assigned any time) by someone else
- Content is written (memo, analysis, requirements, tests, etc.)
- Users are assigned for review or approval
- Reviews can occur as many times as necessary (or not at all),
- Approval is required to release a document and allow its data to be linked to other data in Synthesis



Documents Life-Cycle

- Changes made to documents must be justified by the document author, so reviewers know the scope and context of the changes
- Any changed data can be compared to its previous version

Document Search Home Show Previous Version Comment Summary View Approver Sign Off Approving

IAS Widget Operations Design SSRD NC Version NC-1.2 In Approval

Document

- Review and Approvals
- Header
- Contents
 - 1. Introduction
 - 2. Operations Requirements
 - 2.1. Display Functionality
 - 2.1.1. Databus
 - 2.1.2. Text Size (Modified)
 - 2.2. Day Night Operations
 - 2.2.1. Daytime Colorset
 - 2.2.2. Nighttime Colorset

Changes made

- Section content
- Requirements modified

Justification of Changes

Added the source of the calculation for the size of the widget text.

2.1.2 Text Size

These are the IAS Widget sizing design requirements. The size is determined by computing the size to be a minimum of 1 arc-second displacement from the pilots eye perspective, from 3 feet away. This computes as 0.57 inches.

Show Difference

Comments

Requirements

[68.2]

The widget display shall display text to be 0.57 inches high

Show Difference

Text Comparison

Changes made

Deleted Text Inserted Text Changed Text

Previous version: Current version:

These are the day and night time design requirements These are the IAS Widget day and night time design requirements.

Documents Review / Approval

- Notification is automatically sent for users assigned to review or approve
- Comments are managed, captured, and dispositioned inline
- Modifications and comments are shown to allow other users to understand what has changed and other user comments

Comments (1)

Click to enter comment

Reviewer commented on 2018-06-11 at 12:01:22:

I agree with the change. **Good Job.**

Document Search Home Show Previous Version Comment Summary View

Reviewer Sign Off

Reviewing

IAS Widget Operations Design SSRD NC Version NC-1.1 In Review

Document

- Review and Approvals
- Header
- Contents
 - 1. Introduction (Modified)
 - 2. Operations Requirements
 - 2.1. Display Functionality
 - 2.1.1. Databus (New Comments) (M)
 - 2.1.2. Text Size (New Comments) (A)
 - 2.2. Day Night Operations (New Comments) (M)
 - 2.2.1. Daytime Colorset
 - 2.2.2. Nighttime Colorset

Approvals and Signatures

This document is still undergoing review. Only comments from users finished their review will be shown until the review is completed.

Name	Supplier	Status	Revert
Author	Widgets R Us	Review in progress	
Reviewer	Widgets R Us	Review completed on 2018-06-11 12:07:49	

Revision Record

Minor editorial changes.

Building a Project – Verification

- Test plans (which are also documents) need to be created to define test procedures
- Each requirement specified must be tested
- Synthesis considers a requirement to be completed when all requirements and tests linked to it have been passed
- When all requirements in a project are complete, the project is complete
- The simplest project may have requirements, which are linked to a single test which is then passed.
- More complex projects can have multiple levels of requirements, linked together, and linked to tests

Test Plans

- Template-based test plans
- Test procedure templates with definition, hazard identification & mitigation, pass fail criteria, link to requirement
- Test points can be manipulated quickly by an author to construct simple (pass/fail) to very complex tests with multiple configurations, conditions, and recorded data.
- Risk level and mitigations is carried with the test point to ensure safety throughout

Procedure Title

Test procedure 027: 23.201 Stall demonstration

Test Procedure Definition

The test objectives is to confirm that there are no significant gear effects on the published 1/2 flap stall speeds.

Test Blocks

Wings-level stall procedure

This test should be conducted at minimum of 5000 feet AGL in **Configuration E:**

1. Record aircraft weight, OAT, and pressure altitude (29.92");
2. Determine the predicted 1/2-flap stall speed and 1.2 Vs for the current weight;
3. ENG Auto Ignition – ARM;
4. SAS Clutch or Servo Switch – ON;
5. SAS Fault Light – OFF;
6. Gear – Up;
7. Flaps – 1/2 (below 180 KIAS);
8. Propellers – Full Increase;
9. Power levers – Flight Idle;
10. Trim for 1.5 V_{s1} (approx. 141 KIAS at 16,000 lb). **Do not readjust the trim after this step;**
11. Adjust the pitch input to achieve a 1 kt/sec airspeed bleed rate;
12. Initiate the AFM stall recovery at the first of the following events:
 1. The stick pusher fires;
 2. The predicted stall speed is achieved, even if the stick pusher has not activated;
 3. An uncontrollable downward pitching motion occurs;
 4. The elevator control reaches the aft stop.
13. Recover from the stall in the manner specified by the Flight Manual, but do not add power until 1.2 V_{s1} (approximately 113 KIAS at 16,000 lb);
14. Record the time, stall warning IAS, stick pusher IAS, loss of altitude, and any wing drop encountered in the stall between the altitude at which the airplane pitched down and the altitude at which horizontal flight was regained;
15. Repeat the steps (8 – 12) two more times;
16. If the results vary by more than 2 knots, repeat steps (8 – 12) three more times;
17. Repeat the entire procedure with the Gear Down and 1/2-flaps.

Test #	Name	Alt (ft)	Trim Speed (kts)	Torque (%)	RPM (%)	Bank (deg)	Flaps (%)	Gear None	Test result <small>(Click to see history)</small>
001	Half-flap Stall Gear DN	5000	1.5 Vs1	Flight Idle	100	0	1/2 (180 KIAS)	DN	Not set
<div>FUEL_WEIGHT_LBS ALT ALTITUDE LOSS STALL WARNING IAS STALL BREAK IAS</div>									
002	Half-flap Stall Gear UP	5000	1.5 Vs1	Flight Idle	100	0	1/2 (180 KIAS)	Up	Not set
<div>FUEL_WEIGHT_LBS ALT ALTITUDE LOSS STALL WARNING IAS STALL BREAK IAS</div>									
003	Half-flap Stall Gear DN	5000	1.5 Vs1	Flight Idle	100	0	1/2 (180 KIAS)	DN	Not set
<div>FUEL_WEIGHT_LBS ALT ALTITUDE LOSS STALL WARNING IAS STALL BREAK IAS</div>									
004	Half-flap Stall Gear UP	5000	1.5 Vs1	Flight Idle	100	0	1/2 (180 KIAS)	Up	Not set
<div>FUEL_WEIGHT_LBS ALT ALTITUDE LOSS STALL WARNING IAS STALL BREAK IAS</div>									

Click to enter text...

Hazard Identification

Risk Assessment Level: Low

1. Loss of control
2. Overstress
3. CFIT
4. Personal injury

Risk Reduction Method

1. Minimum entry altitude 7,000 ft agl
2. Engine ignitions ON
3. Clear differentiation between PF and PM (Test Director) duties
4. Operating TCAS
5. Operating EGPWS

Test Cards

- All tests defined in a test plan are tested on a test card
- Test cards allow on-the-fly batches of tests to be run (e.g.: A flight test, bench test, “desktop” testing)
- Test cards auto-filter by test environment and product, and only offer users test points that can be tested together in the same environment
- Test points can also be filtered by any test parameter value

The screenshot displays a test management interface with several panels:

- Left Panel:** Contains buttons for 'Add', 'Remove', 'Remove passed tests', 'Save & Return', 'Discard & Return', 'Hide Advanced Filter' (highlighted with a yellow border), and 'Update outdated'. Below these is a status box stating 'No document filter applied'.
- Filter Panel:**
 - Active Test Docs by Date:** Includes radio buttons for 'No date filter' (selected), 'Last 2 weeks', and 'Between dates'. It also has 'From' and 'To' date input fields.
 - Document Properties:** Includes a 'Keyword (Test Doc Name/Title):' text field and an 'ATA Chapter:' dropdown menu currently set to 'All'.
 - Test Point Properties:** Features a 'Test Param:' dropdown menu with 'AFCS Coupled' selected. A list of options is visible: 'AFCS Coupled', 'Direction', 'GEAR', 'GND SPLRS', 'IAS', and 'WT'. There are 'Add', 'Apply filter', and 'Reset' buttons.
- Right Panel:** Titled 'Released Test Documents for Project: 190 - Test, Test Environment: 10002(2) [42.1]'. It shows a tree structure of test documents:
 - Test Documents (2 of 2 TDS documents)
 - Project tests Ver. NC-2.0 Product: Test (2 procedure(s))
 - Proc General tests (1 test block(s))
 - Proc More general tests (1 test block(s))
 - Block 1 (1 of 1 test point(s))
 - Second general point 001
 - Software tests - functional Ver. NC-2.0 Product: Test (2 procedure(s))
 - Proc proc 1 (1 test block(s))
 - Block 1 (2 of 2 test point(s))
 - PR9278B1-TP2 002 AFCS Coupled='Opt' Direction='Opt' IAS='Opt'
 - PR9278B1-TP3 003 AFCS Coupled='Opt' Direction='Opt' IAS='Opt'
 - Proc Copy of - proc 1

Test Cards

- Test cards can be completed in PDF forms on a laptop or tablet
- Completed test card PDFs can be uploaded, and Synthesis will automatically extract test data and statuses and add the PDF to the test card
- Test status can be also be completed in Synthesis directly
- Test results are shown directly in test plans as they are completed, including snags and test plan report details

# (Seq.)	Name	AFCS Coupled	Direction	IAS	Status
001	PR9278B1-TP1	Opt	Right	500	Exec: Pass

Time: 2020-09-15 14:17:12.0 **Execution Time:** Start: 00:45:00 End: 00:50:00

Direction IAS

Data Comment:

Result Comment:

See above image for details.

# (Seq.)	Name	AFCS Coupled	Direction	IAS	Status
002	PR9278B1-TP2	Opt	Opt	Opt	Not Exec

AFCS Coupled **Direction** **IAS**

New test data:

Start time End time

Collected data

AFCS Coupled

Direction

IAS

Set status now? ☐

Result

Comment

Tracking Progress

- The main source of tracking data in Synthesis is the project status page
- This allows users to see requirements, what each requirement is linked to
- The report can be used to navigate to requirements and test documentation

Requirements trace reports

Project: 190 - Test
Req. level: System

0 of 13 requirement(s) satisfied (0.0% coverage/satisfied)
3 incomplete requirement(s),
10 requirements with no compliance artifacts

0.0%

Id	Requirement Header	Document	State	Compliance Artifact(s)
[121126.1]	Software Guidelines - DO-178B	System software requirements NC 1.0 20...	Not Satisfied	None
[121127.1]	Sec. 23.1 23-6 Applicability. Statement Maris QTP Yes...	System software requirements NC 1.0 20...	Not Satisfied	None
[121128.1]	Sec. 23.3 23-6 Airplane categories. Statement Maris...	System software requirements NC 1.0 20...	Not Satisfied	None
[121129.1]	Sec. 23.21 23-6 Proof of compliance. Flight Test Maris...	System software requirements NC 1.0 20...	Not Satisfied	None
[121130.1]	Sec. 23.21 23-6 Proof of compliance. Analysis Sadek...	System software requirements NC 1.0 20...	Not Satisfied	None
[121131.1]	Sec. 23.23 23-6 Load distribution limits. Flight Test ...	System software requirements NC 1.0 20...	Not Satisfied	None
[121132.1]	Sec. 23.25 23-6 Weight limits. Test Maris QTP Yes ...	System software requirements NC 1.0 20...	Not Satisfied	None
[121133.1]	Sec. 23.29 23-6 Empty weight and corresponding center of...	System software requirements NC 1.0 20...	Not Satisfied	None
[121134.1]	Sec. 23.31 23-6 Removable ballast. Inspection,...	System software requirements NC 1.0 20...	Not Satisfied	None
[121179.1]	QMS AS9100	System software requirements NC 1.0 20...	Not Satisfied	None
[121180.1]	Func - User input - Stick	System software requirements NC 1.0 20...	Not Satisfied	Test Document(s): • Software tests - functional NC 2.0 with Procedure(s): proc 1 [1/3] - Incomplete
[121181.1]	Func - User input - Directional output	System software requirements NC 1.0 20...	Not Satisfied	Test Document(s): • Software tests - functional NC 2.0 with Procedure(s): proc 1 [1/3] - Incomplete
[121182.1]	Func - User Input - Directional output format	System software requirements NC 1.0 20...	Not Satisfied	Test Document(s): • Software tests - functional NC 2.0 with Procedure(s): Copy of - proc 1 [0/3] - Incomplete

Generate PDF report View requirement Summary chart Create MS Project Sync status with DOORS Close

Tracking Progress (cont'd)

- “0 of 13 requirements coverage/satisfied ...” - How many of the total number of requirements has been satisfied by having all related tests completed for it.
- “3 incomplete requirements” – number of requirements that have some data associated, but the data has not been completed (e.g.: testing not complete)
- “10 requirements with no compliance artifacts” – the number of requirements which do not have any link to either a requirement or a test/test procedure.
- Left hand column is the requirement number, and version (number.version), then header (clicking on the requirement shows the trace dialog)
- Middle column shows the document the requirement is contained in, clicking the link will navigate to that document
- Last column shows any child requirements, and/or tests linked to the requirement. Clicking on the links will navigate to the requirement or test document

Requirements trace reports

Project: 190 - Test
Req. level: System

0 of 13 requirement(s) satisfied (0.0% coverage/satisfied)
3 incomplete requirement(s),
10 requirements with no compliance artifacts

0.0%

Id	Requirement Header	Document	State	Compliance Artifact(s)
[121126.1]	Software Guidelines - DO-178B	System software requirements NC 1.0 20...	Not Satisfied	None
[121127.1]	Sec. 23.1 23-6 Applicability. Statement Maris QTP Yes...	System software requirements NC 1.0 20...	Not Satisfied	None
[121128.1]	Sec. 23.3 23-6 Airplane categories. Statement Maris...	System software requirements NC 1.0 20...	Not Satisfied	None
[121129.1]	Sec. 23.21 23-6 Proof of compliance. Flight Test Maris...	System software requirements NC 1.0 20...	Not Satisfied	None
[121130.1]	Sec. 23.21 23-6 Proof of compliance. Analysis Sadek...	System software requirements NC 1.0 20...	Not Satisfied	None
[121131.1]	Sec. 23.23 23-6 Load distribution limits. Flight Test ...	System software requirements NC 1.0 20...	Not Satisfied	None
[121132.1]	Sec. 23.25 23-6 Weight limits. Test Maris QTP Yes ...	System software requirements NC 1.0 20...	Not Satisfied	None
[121133.1]	Sec. 23.29 23-6 Empty weight and corresponding center of...	System software requirements NC 1.0 20...	Not Satisfied	None
[121134.1]	Sec. 23.31 23-6 Removable ballast. Inspection,...	System software requirements NC 1.0 20...	Not Satisfied	None
[121179.1]	QMS A59100	System software requirements NC 1.0 20...	Not Satisfied	None
[121180.1]	Func - User input - Stick	System software requirements NC 1.0 20...	Not Satisfied	Test Document(s): • Software tests - functional NC 2.0 with Procedure(s): proc 1 [1/3] - Incomplete
[121181.1]	Func - User input - Directional output	System software requirements NC 1.0 20...	Not Satisfied	Test Document(s): • Software tests - functional NC 2.0 with Procedure(s): proc 1 [1/3] - Incomplete
[121182.1]	Func - User input - Directional output format	System software requirements NC 1.0 20...	Not Satisfied	Test Document(s): • Software tests - functional NC 2.0 with Procedure(s): Copy of - proc 1 [0/3] - Incomplete

Generate PDF report View requirement Summary chart Create MS Project Sync status with DOORS Close

Reporting

- Any requirement can be clicked on in the project status, document (requirement or test plan), and test card to see its status
- Compliance data is also available (tests and other requirements)
- Versioning and history of the requirement is also listed
- This also allows what-if analysis: *If I modify this requirement, what is the impact?*

The screenshot displays a software requirement management interface. On the left, a 'Parent-Child Trace' panel shows a hierarchy of requirements. The top requirement is 'Regulatory [121123.1]' with the description 'Project regs NC-1.0'. Below it is a requirement marked 'System' with a green checkmark, labeled '[121180.1]' and 'System software requirements NC-1.0'. The main panel on the right is titled 'Requirement Content' and 'Tests and Compliance'. It contains a message box stating: 'This tool helps you track the parent-child relationship of a requirement, including all of its previous versions. The current version of the requirement is highlighted in green. Select a version of a requirement to see its content or the content of any of its relatives.' Below this, the requirement details for ID 121180.1 are shown: Level: System, Enabled: Yes, Status: Review Required, Type: None, Parent: 121123.1: TSO-C4c: The system shall meet TSO-C4c for Bank and P... The 'Header' field contains 'Func - User input - Stick'. The 'Content' field contains 'The software shall read directional user input from control stick 1 per CTRL-API-01.' The 'Last updated' date is 2020-07-22 09:32 by An Author. At the bottom, a 'Status' section shows 'Status: Not Satisfied', 'Documents: 0/2', 'Procedures: 0/2', and 'Test Points: 1/9'. Below this is a 'Test Documents' table with columns for Version, Status, Title, and Procedures.

Version	Status	Title	Procedures
NC 2.0	Release	Software tests - functional NC 2.0	• proc 1 [1/3] Incomplete
NC 0.1	Draft	Test plan demo NC 0.1	• Functional stick input test [0/6] Incomplete

New Projects

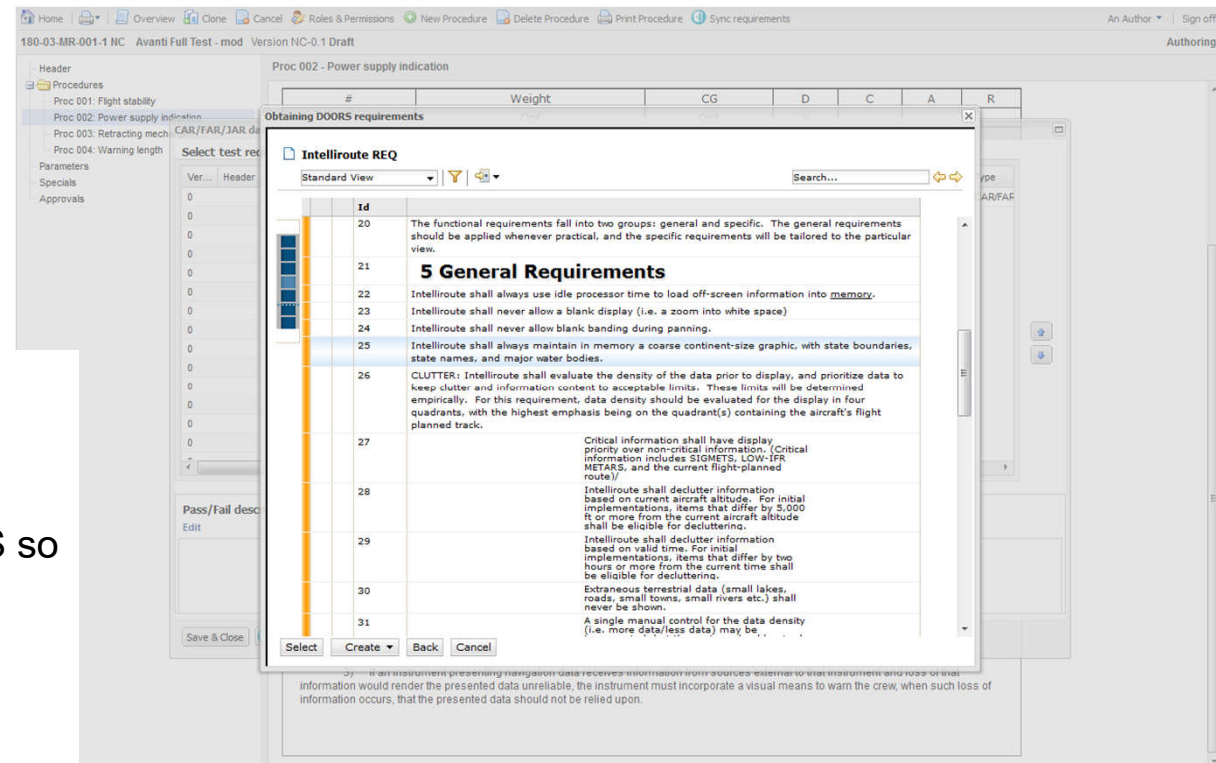
- New projects can clone data (or even an entire project) from an existing project
- This means similar project data, requirements, and tests can be leveraged easily with minor modifications for new projects
- Continuing a project is also possible – baseline (snapshot) a project, then change requirements, and update any effected data. Previous history is always saved in Synthesis.

The screenshot displays the Synthesis software interface. On the left, the 'Parent-Child Trace' panel shows a 'Versions' sidebar with two entries: 'Regulatory [121123.1] Project regs NC-1.0' and 'System [121180.1] System software requirements NC-1.0'. The 'System' entry is highlighted with a green checkmark. The main area on the right is titled 'Requirement Content' and 'Tests and Compliance'. It features a 'Status' section with four cards: 'Status' (Not Satisfied), 'Documents' (0/2), 'Procedures' (0/2), and 'Test Points' (1/9). Below this is a 'Test Documents' table with columns for Version, Status, Title, and Procedures.

Version	Status	Title	Procedures
NC 2.0	Release	Software tests - functional NC 2.0	• proc 1 [1/3] Incomplete
NC 0.1	Draft	Test plan demo NC 0.1	• Functional stick input test [0/6] Incomplete

Requirements Import From DOORS (et al)

- Requirements can be directly imported and synched with DOORS (or other software)
- Requirements are referenced from DOORS so integrity is maintained
- All requirements, versions and updates are stored and linked



Requirements Analysis (Optional)

- All requirements are analyzed for strength of accuracy/ambiguity
- Accuracy check highlights the problem with the language used
- Solutions are offered and require user acceptance and input

The screenshot displays the QVscribe Requirements Analysis tool interface. The main window shows a list of requirements under the heading "2. Requirements". A pop-up window titled "QVscribe requirement rating" is open, showing a table with columns for "Problem type" and "Trigger word". The table lists four categories: "Multiple Imperatives", "Negative Imperatives", "Vague Words", and "Simultaneous". The "Score" is indicated as "1/5".

Problem type	Trigger word
Multiple Imperatives	must, will not
Negative Imperatives	will not
Vague Words	simultaneous

Arrows from the bullet points on the left point to specific elements in the interface: the first arrow points to the "Requirements" list, the second arrow points to the "QVscribe requirement rating" pop-up window, and the third arrow points to the "Close" button in the pop-up window.

Example: Test Pdf. For Inputs

- 001 Test has been passed and is locked.
- 002 Test is open “Not Exec”
- All fields can be input directly into the pdf. and record.
- Test is uploaded once connection is re-established

Tests

Software tests - functional NC-2.0: proc 1

Risk Assessment Level: Low

Test Procedure Definition

Record Direction and IAS and other data as defined in each test point.

Block 1					
# (Seq.)	Name	AFCS Coupled	Direction	IAS	Status
001	PR9278B1-TP1	Opt	Right	500	Exec: Pass

Time: 2020-09-15 14:17:12.0 Execution Time: Start: 00:45:00 End: 00:50:00

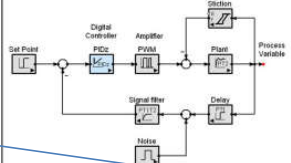
Collected data:

Direction = Right IAS = 47

Data Comment:

Direction and IAS correct for configuration.

Result Comment:



See above image for details.

# (Seq.)	Name	AFCS Coupled	Direction	IAS	Status
002	PR9278B1-TP2	Opt	Opt	Opt	Not Exec

Collected data:

AFCS Coupled Direction IAS

New test data:

Start time: 18:00 End time: 18:15

Collected data

AFCS coupled: Yes

Direction: Right

IAS: 210

Set status now? ☒

Result: Pass

Comment: See collected data - all data correct and in range



Need for Synthesis[®] Tools Suite



Ever increasing complexity of projects with external regulations / requirements / acceptance criteria -
COMPLIANCE

- Constantly changing
- Currently Ad-Hoc tools
- Not integrated
- Lots of paper
- Difficult to status, manage, predict, optimize
- Almost impossible to re-use data



50 Rabastalière est, suite 23, Saint-Bruno QC
J3V 2A5, CANADA,
Tel: (1) 450-441-6464, Fax: (1) 450-441-2411



MR. ALISTAIR CHAPMAN

Marketing Director
Alistair.chapman@marinvent.com



Commercial in confidence. Copyright Marinvent Corporation 2019