Version 2.0.1

24 October 2017

Spider 6 Instruction Manual

Applicable for the Spider 6.

Appends:

- Minor Modification Summary Report
- Structure Test Procedure
- Electromagnetic Compatibility Test Procedure
- RTCA DO-160 Test Reports

spidertracks

Real-time aircraft tracking. **Made easy.**

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Record of Revision and Approvals

RECORD OF REVISIONS AND APPROVALS					
Rev	Date	Description	Pages Affected	Released by	Approved by
IR	24. Nov. 2015	Initial release	All	S. Ridder	D. Blackwell
1.0.1	30. May 2016	Rephrasing of chapter 3.3	8	S. Ridder	L. McCarthy
2.0.0	03. Feb. 2017	Revised and broadened scope	All	S. Ridder	D. Blackwell
2.0.1	24 Oct 2017	Fix error in 3.4 SOS description	8	L. McCarthy	C. Bond

1. Installing your Spider 6

1.1. Positioning the Spider 6

Correct positioning of the Spider's antenna is critical in achieving effective performance from the Spidertracks system as a whole. When installing any Spider product that has the antenna integrated within the device, particular attention is required. In this case the Spider should be mounted up on top of the instrument panel in the aircraft, as far forward under the glare shield as possible to maximise visibility with the sky, and free from any obstructions.

In order to function nominally, the Spider is required to receive GPS signal and then transmit that information, along with other flight data, to the Iridium satellite network. The GPS antenna is able to receive GPS information at any angle, as long as it is not obstructed by metallic material, such as the centre windshield pillar, however, the Iridium antenna must have an unobstructed, horizon-horizon view of the sky in all directions to function nominally (Figure1). Obstructions consist of any metallic or carbon composite object, but also electrically heated windshield filaments that act as an RF shield whether they are turned on or not (Faraday Cage effect). The Spider is able to transmit through glass, fibre glass, or plastic. Please see installation examples on our support website.

NB: If you are attempting to fit a Spider with integrated antennae into an aircraft with electrically heated windshields please stop and contact your distributor for advice.

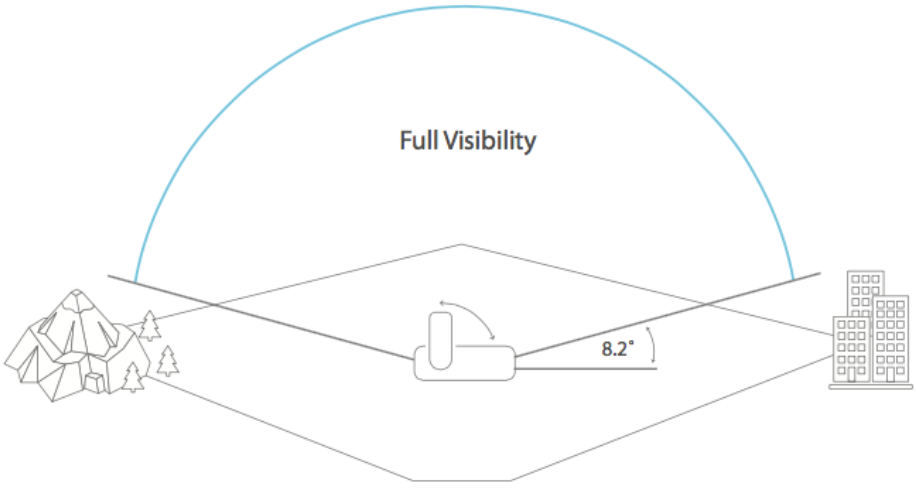


Figure 1: Visibility of the sky requirements for an Iridium transmitting product

The Spider is not subject to Specific Absorption Rate testing, however, it is recommended to have separation of at least 200mm between the device and a person.

Secure the Spider to the airframe using the bracket supplied. Please allow 12 hours for the VHB tape to cure.

1.2. Power

The Spider can be powered using the supplied power lead - just plug into your aircraft's 10 to 28 volt DC (cigarette lighter) power supply. The power supply must be capable of delivering up to 1.5 A peak current. An alternative option to using the cigarette lighter, would be to hard-wire the power supply in your vehicle. Hardwiring the power lead and keeping the Spider portable would normally be done as a minor modification by a Licensed Aircraft Maintenance Engineer or technician.

Power supply must be stable in the range of 10-28 VDC and capable of delivering at least 1.5 A peak current. The Spider must be fuse protected, in which case we recommend using a 3A in-line fuse.

The power lead supplied has three wires. Brown is positive, black is earth, and blue is not required (see Appendix (D) Wiring Diagram - Power Lead).

2. Installation

Figure 2 provides a visual reference for content discussed within Sections 2 and 3 of this document.

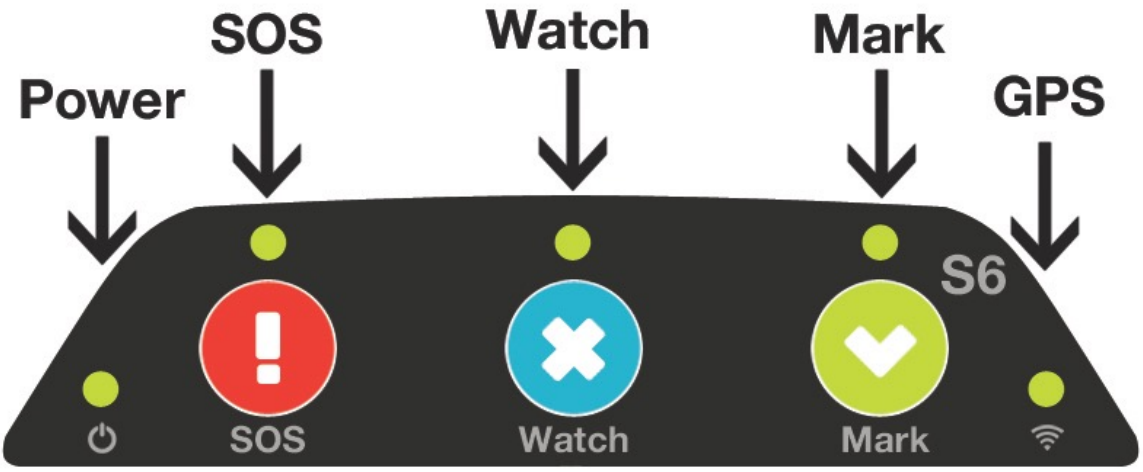


Figure 2: Spider 6 Keypad

2.1. Start Up

When the Spider is first powered the LEDs will cycle through a start-up sequence (that indicates firmware version) and should then display a solid Power LED indicator only.

2.2. GPS Signal

In order to acquire a GPS lock, the aircraft will need to be outside and in full view of the sky (refer to 1.1) with the power on. Once a GPS lock is attained the Signal LED indicator (bottom right) will turn orange. A GPS lock should be acquired within 60s in the general case.

2.3. Iridium Connectivity

Once a GPS lock has been attained the Spider will immediately attempt to send the first position report to the Iridium satellites. Once a connection has been made with the Iridium network the Signal LED indicator will turn from orange to green and should remain green throughout the duration of the flight.

Under normal operating conditions the time taken from startup through GPS lock and connection with the Iridium network should be less than 2 minutes.

3. Operation

Tracking, communication and other flight data transmitted via the Spider can be viewed on the Spidertracks website and mobile application, however, this will first need to be configured at go.spidertracks.com. For setting up your account, please refer to the User Guide for the Spidertracks website.

Reporting parameters are configured within the website and not on the Spider itself. When such parameters are initialised, or changed, the Spidertracks system queues a configuration message for delivery to the Spider. This sits on the gateway until the next subsequent 'session' that the Spider establishes, at which point the message is delivered and the Spider's operating system is updated accordingly. Configuration updates can be made in real time while the aircraft is in flight.

When powered and in full view of the sky, the Spider will begin to send position reports consistent with how it has been configured without any interaction required by the pilot. The purpose of the keypad is to provide visual indication on the state of the Spider as well as additional functionality but is not required for the Spider to report aircraft position.

3.1. System Attributes

There are many features of the Spidertracks system that are delivered through software services and are not specific to any of the Spider product variants. The full range of these are beyond the scope of this document, however, the following two sub-sections summarise cornerstone attributes and provides context for Spider functions discussed in this section.

3.1.1. Tracking Modes

Spidertracks provides both *passive* and *active* tracking capabilities (referred to as *normal* and *watch* modes respectively).

Under normal tracking conditions, the Spider will report positional information and flight events in real time, however, if the aircraft were to encounter an emergency situation in flight, ground personnel would not be alerted to this unless there was a conscious SOS button press by the crew.

In watch mode, the Spidertracks system is actively monitoring the status of the flight. If communication with the aircraft is lost for a period of ten minutes a tier one alert will be pushed through to the emergency management framework.

Watch mode can be activated either manually or automatically (by speed trigger). In either case, the watch button must be pressed to disable the watch system - there is no auto-off.

3.1.2. Emergency Management Framework

The Spidertracks system comes with a two tiered emergency management framework, which are aligned with the ICAO definitions of *uncertainty* and *alert*. Recipients of these alert notifications are fully customisable within the Organisational Settings of the website.

3.2. Watch Button

The Watch button has two purposes:

1. To manually activate/deactivate the watch system at any stage of flight when operating in normal reporting mode; or,
2. To turn the Watch system off when operating under automated watch mode. Note that the aircraft must be below the configured speed threshold in order to disable the watch system when operating in automated watch mode.

The watch button will toggle on/off - do not press and hold the button. When disabling the system the LED indicator will begin to flash once toggled. The Spider has now sent a watch-off message. Until the message has been sent successfully the Spider's Watch LED will continue to flash. It is normal operation for this to take up to 60 seconds. While this is in process the aircraft must remain in full view of the sky. If the Spider is powered off before sending the watch-off message, a tier one alert will be raised.

3.3. Mark Button

Up to four pre-programmed macro messages can be delivered by way of toggling the Mark button the corresponding number of times, i.e. a single toggle will trigger Mark 1 message to be sent, toggling twice will trigger Mark 2 message to be sent. Each message is geo-stamped and includes all other parameters of a standard position report.

Configuration of macro messages, recipients and delivery mechanism are configured within the Organisational Settings of the website.

3.4. SOS Function

A tier-one alert can be initiated immediately by pressing the SOS button. When the SOS function has been toggled all LEDs across the top of the keypad will flash simultaneously and the Spider will default to a rapid reporting state (8-10s intervals in the general case).

NB: The SOS state can not be disabled any other way than to power-cycle the Spider.

3.5. Adjusting the LED Brightness

You can adjust the LED brightness on the keypad by pressing and holding the Mark button. The LED will cycle through the levels of brightness. Release the Mark button when your desired brightness is reached.

3.6. Spidertxt 2.0

The Spider 6 is equipped with Low Energy Bluetooth (BLE) technology and is compatible with Spidertxt 2.0. This enables two-way freeform messaging to/from the cockpit using a mobile device connected to the Spider.

For more information on Spidertxt 2.0 please refer to STL Manual Spidertxt.pdf or contact Spidertracks support.

3.7.Rate of altitude change events

You can send position reports automatically when the Spider exceeds a rate of climb or rate of descent that you define. These rate of climb or rate of descent position reports can be sent to anyone that you would like as notification text or email messages. The rate of climb or rate of decent are managed within the organisation settings. Via selecting an aircraft from the dropdown the aircraft settings page is loaded. At the bottom of the settings page you will see rate of climb and rate of descent settings.

Altitude events must be turned on for both rates or off for both rates, however, if you require one to be on but not the other, we recommend setting the rate high so that it is unlikely to be triggered. On clicking save the rate of climb or descent configuration message will be sent to the Spider. It may take a few minutes of the Spider being turned on and in clear view of the sky, for the message to be updated.

4. Troubleshooting

4.1. Discontinuous Tracks

Intermittent power supply power issues are often the case of the and are easily recognisable by:

- Several short tracks which constitute what should have been one track between point A and B
- An excessive number of 0 min tracks
- Missing tracks (last track terminates at point C, next track originates at point D)
- Last point in track is at a high altitude and/or airspeed (in the absence of a point delay issue)
- In the case where a Spider is operating in Watch mode, an undesirable outcome of erratic power cycling may be a tier one alert being fired

Generic Causality

- Spider is powered by auxiliary power outlet (cigarette lighter) which is subject to interruption from bumps, knocks, and vibration
- Spider is powered by a battery pack which is unable to deliver enough current, and/or is running flat

4.2. Lost GPS

If the GPS signal is lost, the GPS LED on the Spider will turn off. It is not uncommon to drop a GPS lock but occurrences should be infrequent and not last for periods of more than a few seconds.

4.3. Lost Iridium Connectivity

If the Spider can not connect to an Iridium Satellite for a short period of time there will be a transmission delay. If the delay exceeds 120 seconds, the GPS LED on the Spider 6 will turn orange.

The Spider uses a queue and can store a maximum of 10 points, therefore even if the Spider is struggling to send position points, it can still add points to the queue as long as there is a GPS lock. Once the Satellite connection is re-established, the Satellite LED on the Spider will turn back on and the Signal LED on the keypad will turn green.

Appendix

(A) Spider 6 Minor Modification Summary Report

(A)1.Description

The subject modification consists of the installation of a Spider 6 real-time aircraft tracking device.

(A)2.Modification Approval Basis

Spidertracks recommends classifying the subject modification as a minor modification. This recommendation is based on the evaluations of the modification against: (1) Transport Canada Civil Aviation Standard 571 Appendix A, Criteria for the Classification of Modifications and Repairs; and (2) Federal Aviation Administration FAR Part 43 Appendix A. Therefore, acceptable data will be employed to support the installation of the Spider 6. Compliance is at owner's discretion.

(A)3.Configuration Control Data

Chapter	Version	Date
Spider 6 Instruction Manual	2.0.0	03/02/2017

(A)4.Post Installation Testing

Complete post installation in accordance with the following guidelines:

Title	Version	Date
Appendix (B): Spider 6 Structure Test Procedure	IR	24/11/2015
Appendix (C) : Spider 6 Electromagnetic Compatibility Test Procedure	IR	24/11/2015

(A)5.Operation and Limitations

Refer to Spider Tracks Limited, Spider 6 Instruction Manual for operational instructions. Basic flight manual limitations remain applicable.

(A)6.Weight and Balance

Update aircraft weight and balance report as required:

Description	Weight [kg]	Arm [mm]	Moment [kg-mm]
Installation, Spider 6	0.165		

(A)7.Electrical Load

Installation of the Spider 6 introduces a maximum continuous draw of 1.0A at 12VDC. Update the aircraft electrical load analysis report as required.

(A)8.Continuing Airworthiness

Maintenance of the modification is in accordance with the applicable OEM maintenance manual. Instructions for Continued Airworthiness (ICA) are not required.

(B) Spider 6 Structure Test Procedure

(B)1.Test Definition

The purpose of these test procedures is to demonstrate structural integrity for the installation of the Spider 6.

(B)2.Special Tools and Equipment

A calibrated digital or analogue fish hook type scale (e.g. Transducer Techniques HFG-110) is required to conduct the structural testing.

(B)3.Test Conditions

The Spider 6 must be installed prior to starting the structural testing. Allow for adequate time for the adhesive to fully bond to the installation location.

(B)4.Applied Loads

Conservative ultimate load factors for structural testing purposes are provided for FAR 23 (normal, acrobatic and utility category airplanes) and FAR 27 (normal rotorcraft) installations. For additional information, refer to the acceptable data source, FAA AC43.13-2B, Chapter 1, Paragraphs 103 through 105.

Load Case	Ultimate Load Factor	Weight of Spider 6	Minimum Applied Load [Load Factor x Weight]
Forward	18.0g	0.165 kg	2.970 kg
Downward	20.0g	0.165 kg	3.300 kg
Upward	5.7g	0.165 kg	0.941 kg
Side	8.0g	0.165 kg	1.320 kg

Table 1: Minimum Applied Loads.

(B)5.Test Procedure

The following procedures detail the methodology for the structural test.

1. Record the serial number of the Spider 6 being used in the test and complete the test record information.
2. Apply the minimum loads listed in Chapter 3.4 to the centre of the Spider 6 in accordance with AC 43.13-2B, Para 105. Record the actual applied loads:

Forward	
Downward	
Upward	
Side	

(B)6.Pass/Fail Criteria

When no damage or permanent deformation occurs after 7 seconds of applied static load in all directions, the Spider 6 installation is acceptable. Should permanent deformation occur after 3 seconds, reinforcements are required (e.g. doubler installation) to the affected structure and repeat test.

(B)7.Test Record

Date of Test	
Spider 6 S/N	
Location of Test	
A/C Registration	

LAME conducting testing:

Print Name	Signature	License No.

(C)Spider 6 Electromagnetic Compatibility Test Procedure

(C)1.Test Definition

The purpose of these test procedures is to demonstrate Electromagnetic Compatibility (EMC) between the aircraft's electrical or electronic systems, and the Spider 6 being tested. This test procedure is an aircraft-level test to determine if there is any electromagnetic or radio frequency interference (EMI/RFI) to the various critical aircraft systems, radios and installed equipment.

(C)2.Special Tools and Equipment

The following equipment may be required depending on aircraft installed equipment and availability of navigation aids and ATC radar in the area where testing is conducted.

a. NAV/COM Ramp Tester (e.g. NAV-402AP, IFR-4000);
b. Transponder/DME Ramp Tester (e.g. ATC-600A, ATC-601, IFR-6000);
c. TCAS Ramp Tester (e.g. TCAS-201, IFR-6000);
d. Headsets; and
e. Other equipment as required to exercise all modes of operation for systems under test.

(C)3.Test Conditions

All aircraft systems under test must be functional prior to starting the EMC test. Any reduced functionality of the system(s) should be noted. All testing shall be conducted in day VFR conditions with a clear view of the sky to ensure that a GPS fix can be obtained for starting the Iridium transmission.

For the test, the following conditions are required:

a. All engines running with all generators online (for part of the test);
b. All electrical busses powered; and
c. All avionics/electrical systems and installed equipment powered and active.

(C)4.Test Procedure

The following procedures detail the methodology for the EMC test.

1. Identify all aircraft systems under testing from the test matrix table and strike out those that are not applicable to the respective aircraft used in the test.
2. Record the serial number of the Spider 6 being used in the test and complete the test record information.
3. Power up the Spider 6. The left LED on the keypad of the Spider will glow green and the right LED will turn amber when it has a GPS fix.
4. Achieve a Bluetooth connection with the Spider 6 and an appropriate device (e.g. Apple iPhone).
5. Operate each aircraft system under test in all the modes of operation, while monitoring the system for interference. If there is no interference observed, insert a check mark in the “passed” column. If interference is observed, describe the interference in the respective observation column and contact Spider Tracks Limited for further assistance.
6. Multiple systems may be monitored in tandem to expedite the test whenever possible.
7. Systems should be tested on the ground unless the aircraft system/equipment can only be tested in flight.
8. If there are avionics/electrical systems on the aircraft that are not listed, add them at the end of the table.
9. Ensure there is no interference to aircraft systems from the use of the Spider 6.
10. When test is complete, note any comments or differences in the test procedures “Comments” section remembering to sign and date the appropriate areas at the end of this document.

(C)5.Pass/Fail Criteria

EMC testing is subjective in nature since an interference can be deemed acceptable or unacceptable. If an interference is observed, the decision of acceptability should be determined by the person who will be making a compliance finding against the applicable airworthiness standards. In general, the systems under test shall have no unintentional changes in operating mode, unexpected responses, intermittent behaviours, or unacceptable noise.

(C)6.Test Record

Date of Test	
Spider 6 S/N	
Location of Test	
A/C Registration	

Aircraft System Under Test	Test Instructions	Passed	Observations
VHF 1	Open squelch. Tune to 118, 120, 124, 128, 132, 136MHz. Listen for noise. Verify transmit and reception.	☐	
VHF 2	Open squelch. Tune to 118, 120, 124, 128, 132, 136MHz. Listen for noise. Verify transmit and reception.	☐	
VHF 3	Open squelch. Tune to 118, 120, 124, 128, 132, 136MHz. Listen for noise. Verify transmit and reception.	☐	
HF 1	Tune to 3, 6, 9, 15, 21, 27MHz. Listen for noise. Verify transmit and reception in both AM and SBB modes for each channel.	☐	
VHF/FM 1	Tune to test frequency. Verify transmit and reception.	☐	
VHF/FM 2	Tune to test frequency. Verify transmit and reception.	☐	
UHF 1	Tune to test frequency. Verify transmit and reception.	☐	
VOR 1	Tune in to local stations and/or use ramp tester. Verify VOR bearing display and station audio ident.	☐	
VOR 2	Tune in to local stations and/or use ramp tester. Verify VOR bearing display and station audio ident.	☐	
SATCOM	Verify operation in all modes.	☐	

Aircraft System Under Test	Test Instructions	Passed	Observations
ILS 1	Tune in to local stations and/or use ramp tester. Verify GS / LOC display and station audio ident.	☐	
ILS 2	Tune in to local stations and/or use ramp tester. Verify GS / LOC display and station audio ident.	☐	
DME 1	Tune in to local stations and/or use ramp tester. Verify correct DME and station audio ident.	☐	
DME 2	Tune in to local stations and/or use ramp tester. Verify correct DME and station audio ident.	☐	
ADF 1	Tune in to local stations and/or use ramp tester. Verify correct indication and station audio ident.	☐	
GPS 1	Display GPS satellite data. Verify signal quality and number of satellites tracking. Verify GPS position is reasonable.	☐	
GPS 2	Display GPS satellite data. Verify signal quality and number of satellites tracking. Verify GPS position is reasonable.	☐	
GPS 3	Display GPS satellite data. Verify signal quality and number of satellites tracking. Verify GPS position is reasonable.	☐	
RAD ALT 1	Verify RAD ALT displays zero feet on ground.	☐	
RAD ALT 2	Verify RAD ALT displays zero feet on ground.	☐	
ELT	Monitor ELT for inadvertent trigger.	☐	
WX RADAR	Operate weather radar in all available modes. And verify no erroneous indications.	☐	
CLOCKS	Verify no erroneous indications.	☐	
STBY INST	Verify no erroneous indications.	☐	
STBY COMPASS	Monitor for erratic indications.	☐	

Aircraft System Under Test	Test Instructions	Passed	Observations
HSI/DG 1	Monitor for erratic indications.	☐	
HSI/DG 2	Monitor for erratic indications.	☐	
AHRS 1	Monitor for erratic attitude and heading indications.	☐	
AHRS 2	Monitor for erratic attitude and heading indications.	☐	
CVR	Run self-test if available. Verify no flags or lights appear.	☐	
FDR	Run self-test if available. Verify no flags or lights appear.	☐	
COCKPIT LIGHTS	Verify normal operation.	☐	
EXTERNAL LIGHTS	Verify normal operation.	☐	
HTAWS	Monitor for erroneous indications. Perform self-test if available.	☐	
TCAS	Monitor for erroneous indications. Perform self-test if available.	☐	
MFD	Monitor for erroneous indications. Perform self-test if available.	☐	
TRANSPONDER	Use ramp tester or check in flight to establish Mode C interrogations.	☐	
CAUTION PANEL	Monitor for erroneous indications.	☐	
CIRCUIT BREAKERS	Monitor for erroneous indications.	☐	
SPAS	Perform system test and monitor for erroneous indications.	☐	
AFCS / SCAS / CSAS	Perform system test and monitor for erroneous indications.	☐	
FLIGHT DIRECTOR 1	Engage flight director in all modes of operation.	☐	
FLIGHT DIRECTOR 2	Engage flight director in all modes of operation.	☐	
ADC 1	Perform a system function test. Verify correct display of airspeed, altitude, TAT, TAS.	☐	

Aircraft System Under Test	Test Instructions	Passed	Observations
ADC 2	Perform a system function test. Verify correct display of airspeed, altitude, TAT, TAS.	☐	
HEATER / ECS	Operate in all modes.	☐	
FUEL QUANTITY	Monitor for erroneous or erratic indications.	☐	
FUEL SYSTEM	Monitor for erroneous or erratic indications.	☐	
HYDRAULIC SYS	Cycle hydraulic pumps. Monitor for erroneous or erratic indications.	☐	
FUEL CONTROL	Cycle system to manual and back to auto. Monitor for erroneous or erratic indications.	☐	
FIRE DETECTION SYSTEM(S)	Monitor for erroneous or erratic indications.	☐	
ENGINE INDICATING	Run engines. Verify proper functioning. Monitor for erroneous or erratic indications. Transfer electrical busses to all engine driven generator(s).	☐	
AC/DC ELECTRICAL SYSTEMS	Configure the electrical systems in different modes. Verify no interference when switching loads from one bus to another.	☐	
MAST MOMENT INDICATOR	Monitor for erroneous or erratic indications.	☐	
FADEC / DECU	Run engines in all modes. Monitor for erroneous or erratic indications.	☐	
VEMD	Run engines in all modes. Monitor for erroneous or erratic indications.	☐	
PITOT STATIC HEAT	Confirm correct operation.	☐	
EMERGENCY LIGHTS	Monitor for inadvertent activation.	☐	
PARTICLE SEPERATOR	Monitor for erroneous indications.	☐	

Aircraft System Under Test	Test Instructions	Passed	Observations
CYCLIC TRIM	Verify for normal operation and monitor for inadvertent activation.	☐	
ENGINE TRIM	Verify for normal operation and monitor for inadvertent activation.	☐	
CARGO HOOK	Verify for normal operation and monitor for inadvertent activation.	☐	
LONG LINE RELEASE	Verify for normal operation and monitor for inadvertent activation.	☐	
		☐	
		☐	
		☐	

Comments

Indicate any deviations from the test procedure, or observations regarding the test results:

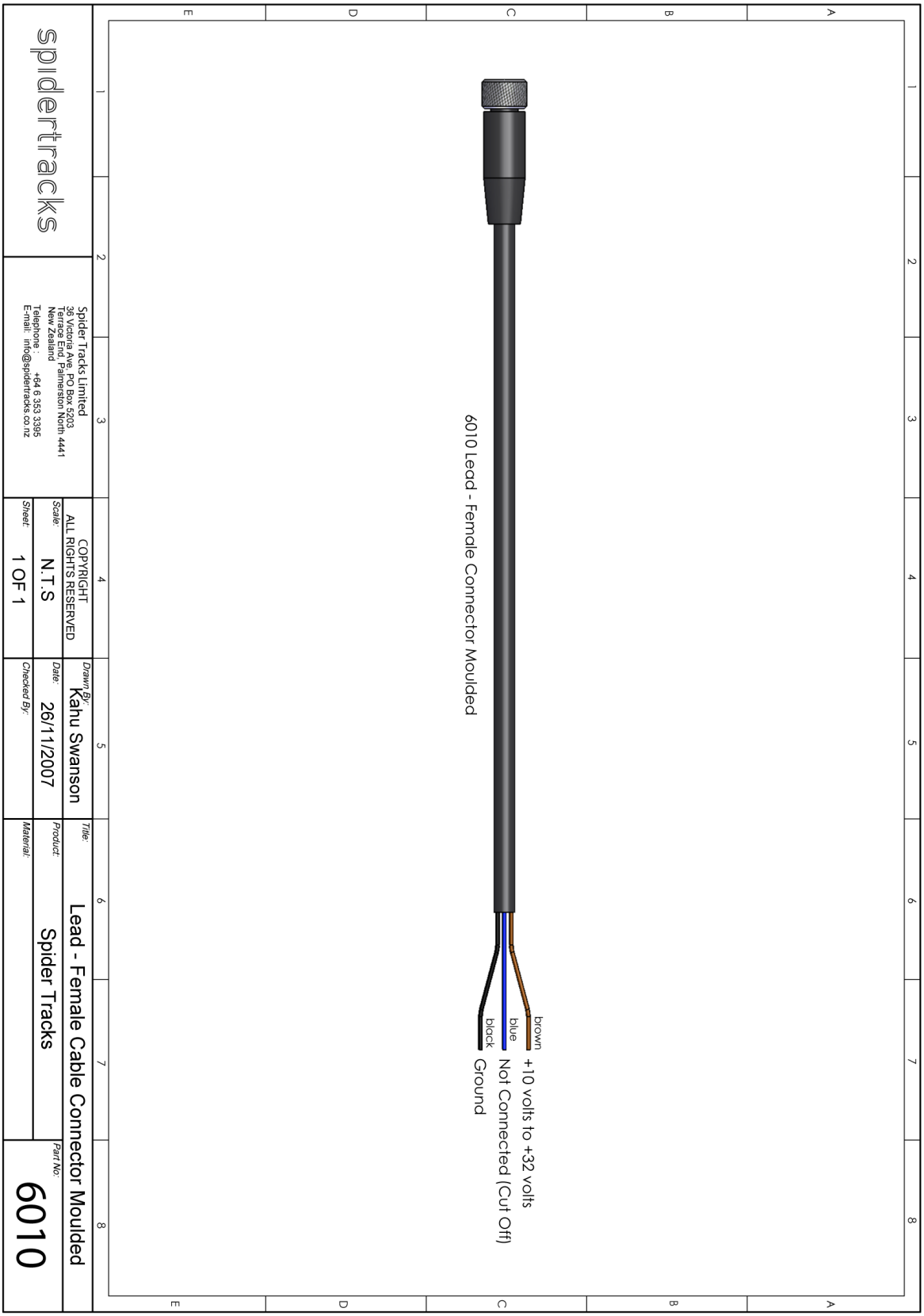
LAME conducting testing:

PRINT NAME	SIGNATURE	LICENSE NO

Pilot conducting testing:

PRINT NAME	SIGNATURE	LICENSE NO

(D)Wiring Diagram - Power Lead



(E) RTCA DO-160 Test Reports

Links to download:

- DO-160F Sections 15 and 21: Magnetic Effect & RF Emissions
- DO-160G Sections 7 and 8: Shock and Vibration
- DO-160G Section 17: Voltage Spike
- DO-160G Section 26: Flammability