

## **Aerospace Fiber Optics**

### **Facilitator Class Activity and Exercise Guide**

#### **Session 1:**

Set up time: 15 minutes

#### Materials:

- Sample fibers in various conditions and as many types as possible.
- Fiber scope
- Cleaning materials

#### Handouts:

- Definition handout

## Session 2:

### Exercise 1: Assemble Fiber Optic Cables

Set up time: 30 minutes

Exercise length: 1.5 hours

#### Materials:

Part number/ item	Quantity
180-091NF06-17-8SN – D38999 Plug	1 per team
180-091XMH7-17-8PN – D38999 Receptacle	1 per team
ARINC 801 Plug	1 per team
FO1ABAD-E01-005 cables	5 per team.
FO1ABAC-E01-005 cables	5 per team
MS27488-16-2 seal plugs	10 per team
1.6 mm (D38999) insertion tools	2 per team
1.6 mm (D38999) removal tools	2 per team
1.25 mm (Luxis) insertion tools	2 per team
1.25 mm (Luxis) removal tools	2 per team
Circular back shells	2 per team.
Rectangular back shell	1 per team
Roll of fiber glass tape.	1 per team
Tie wrap.	1 per team
187-250 MPX Radiall test adapter	1 for instructor
YR-170XL Laser fault finder	1 for instructor
1.25mm fiber probe w/ alignment sleeve	1 for instructor

#### Handouts:

- Exercise 1 Project Directions (one for each team)- handout 1
- Project Check List (one for each team)- handout 2
- Fiber Cable Diagram (one for each team)- handout 3

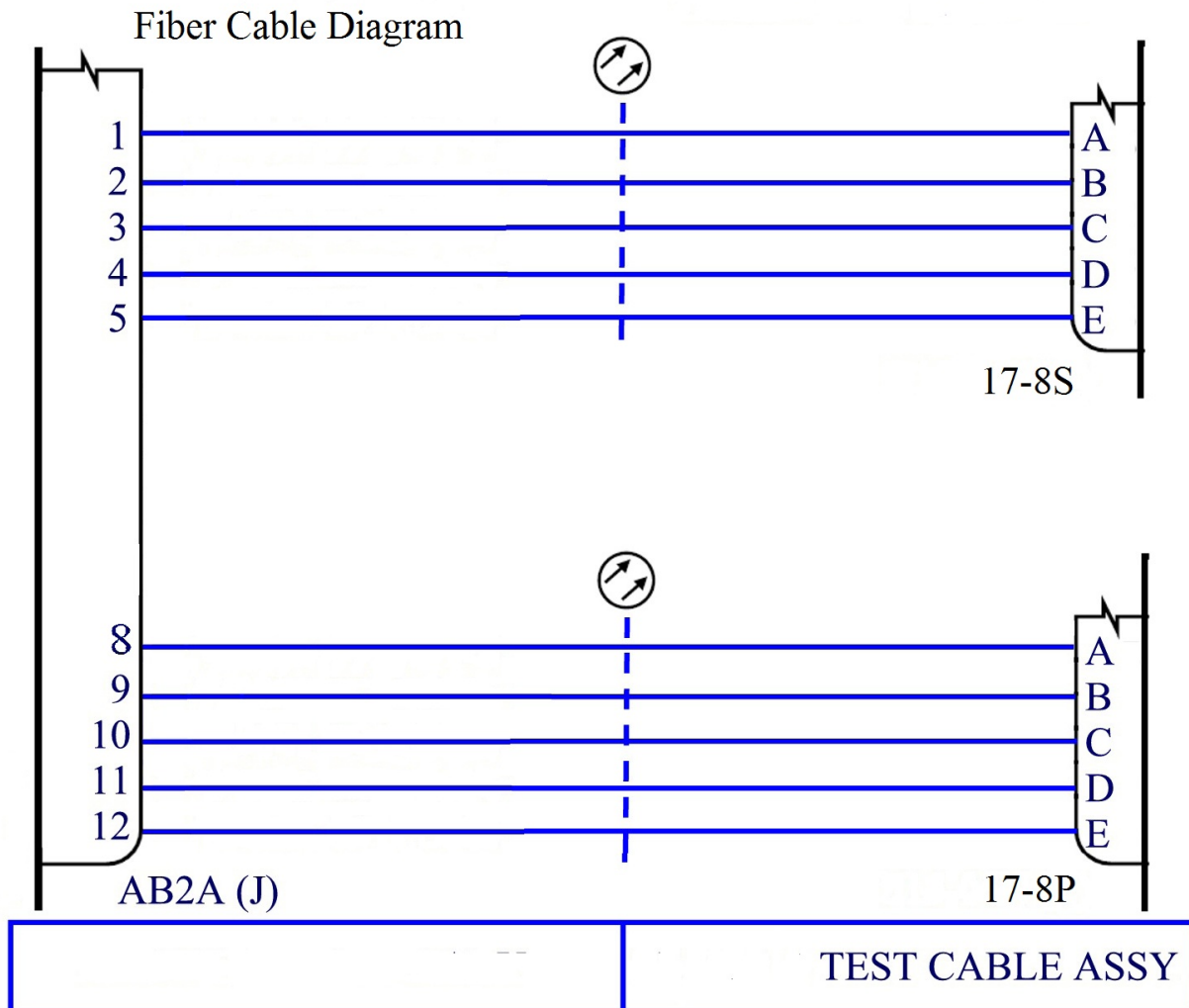
Exercise 1: Assemble Fiber Optic Cables  
Handout 2

**Project Check List**

Name of Team members: \_\_\_\_\_

	<b>Requirement</b>	<b>Yes</b>	<b>No</b>
1.	The termini remain locked in the insert retention clips.		
2.	The cable jackets are not cut, cracked, or flattened.		
3.	The connector grommets are not torn between the termini insert cavities.		
4.	The inserts lock into the connector shell and can not be pushed out.		
5.	The inserts are in the correct insert cavities.		
6.	For the rectangular connectors, the polarization keys are in position A.		
7.	The back shell is firmly attached to the connector shell and is free from damage.		
8.	A minimum of 4 wraps of protective tape is between the cable and the tie on the backshells.		
9.	Bundle ties are applied properly.		
10.	When a light is shone into the front face of one connector, light shines out of the connector at the other end of the optical path.		
11.	The bend radius of the fiber optic cable is at least 1.5 inch at all points?		

Exercise 1: Assemble Fiber Optic Cables  
Handout 3



### Session 3:

#### Exercise 2: Installation and Routing Practice

Set up time: 20 minutes

Exercise length: 1.5 hours

#### Materials:

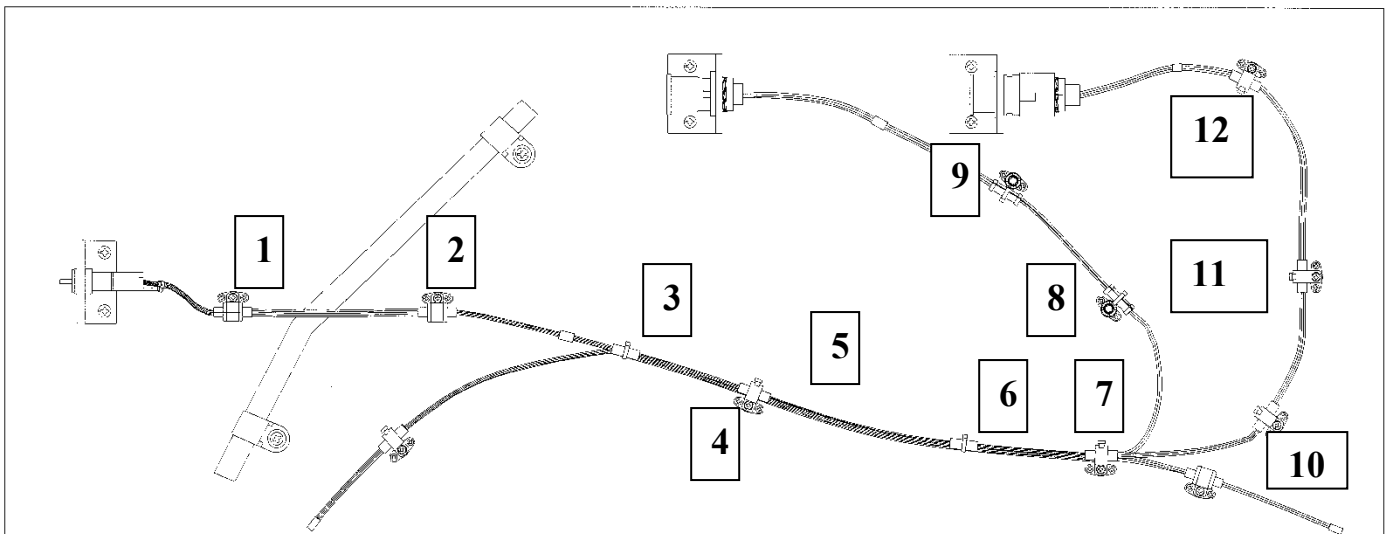
Part number/ item	Quantity
Roll of Scotch 70	1 per team
Roll of lock stitch (string tie)	1 per team
Roll of fiber glass tape	1 per team
Assorted tie wraps	
Assorted cable clamps	
Routing board	1 per team
Cable built in session 2, Exercise 1	1 per team.

- Handouts:
  - Exercise 2 Project Directions (one for each team)- handout 1
  - Fiber Optics Installation Project Map (one for each team)- handout 2
  - Project Check List (one for each team)- handout 3

Exercise 2: Installation and Routing Practice  
Handout 2

Fiber Optics Installation Project Map

<u>Flag #</u>	<u>Callout</u>
1.	Cushion clamp
2.	Cushion clamp
3.	Install Scotch 70 tape this location with string tie
4.	Butcher clamp
5.	Install Scotch Super 20 tie tape this location
6.	Install Scotch 70 tape this location with plastic tie
7.	Butcher clamp
8.	Ring post & plastic tie
9.	Ring post & plastic tie
10.	Butcher clamp
11.	Butcher clamp
12.	Butcher clamp



Exercise 2: Installation and Routing Practice  
Handout 3

**Project Check List**

	<b>Requirement</b>	<b>Yes</b>	<b>No</b>
1.	Is the bend radius of fiber cable greater than a three inch diameter at all points?		
2.	Are the cables routed to avoid contact with any objects that may cause damage?		
3.	Are the cables supported either loosely at least 1/4" or tightly at least 2" from tubing?		
4.	Are the fiber optic cables combed out properly?		
5.	In cases where there are only fiber cables bundled together, is there at least 4 wraps of protective tape between the fiber cables and the support devices?		
6.	Is there an adequate drip loop prior to the connection point?		
7.	Are the bundles containing <i>ONLY</i> fiber optic cables tied securely together with Scotch Super 20 adhesive tie?		
8.	Are the bundles containing fiber optic cables and other wires tied appropriately?		
9.	Is there a maximum distance of 12" between bundle ties?		
10.	Are the cables tied at a minimum distance of 1.5" from breakouts?		
11.	Are the fiber optic cables excluded from the last tie at the breakout point?		
12.	Do the adhesive ties meet the following requirements: <ul style="list-style-type: none"> <li>▪ The overlap of the adhesive ties at least 1/3 of the diameter of the bundle circumference?</li> <li>▪ The ends of the adhesive ties bond properly?</li> <li>▪ There is less than 1/3" between the layers of the adhesive ties?</li> </ul>		
13.	Are all ties secure so that they do not slip along the bundle?		
14.	Are the receptacles properly installed?		
15.	Are the cables free from deformity?		

#### Session 4:

##### Exercise 3: End Face Examination

Set up time: 30 minutes

Exercise length: 1.5 hours

##### Materials:

Part number/ item	Quantity
Routing boards with cables from sessions 2 & 3	1 per team.
FCL-P1005 – Clean Blast	1 per team.
FBPP-BAP3 – Barrel assy narrow	1 per team.
FBPT-A801-1002P – Plug ARINC type1 size 15-06	1 per team.
FBPT-A801-1002R – Receptacle ARINC type1 size 15-06	1 per team.
FBPT-A801-2001P – Plug arinc type 2 F12 pins	1 per team.
FBPT-A801-2001R – Receptacle arinc type 2 F12	1 per team.
FBPT-A801-2002P – Plug arinc type 2 F12	1 per team.
FBPT-A801-2002R – Receptacle arinc type 2 F12	1 per team.
FBPT-U12M – Tip Universal 1.25MM	1 per team.
FBPT-U12M-N – Tip 1.25MIL termini for FBP	1 per team.
FCLT-BAP3-125 – Cleaning tip ARINC	1 per team.
FCLT-MIL2 – Cleaning tip MIL 29504/4/5	1 per team.
FCLT-U12 – Cleaning tip Universal 1.25MM	1 per team.
FCLT-U12-MA – Cleaning mating adapter 1.25MM	1 per team.
FCLT-U25 – Cleaning tip Universal 2.5MM	1 per team.
FCLT-U25-MA – Cleaning mating adapter 2.5MM	1 per team.
GCT-001 – Fiber optic assembly	1 per team.
GIT-001 – Fiber optic Inspection tip	1 per team.
YR-170XL – Visual fault finder	1 per team.
K-Y-200U – Microscope	1 per team.
21755st1bo1n2 – Calibration artifact	1 per team.

##### Handouts:

- Exercise 3 Project Directions (one for each team)- handout 1



### Exercise 3: End Face Examination

Note to Facilitator: Please read the following to class prior to going over the directions for the exercise. (Refer to slide #20 of Session 4 PowerPoint for exercise directions).

- You will be required to wear the proper personal protective equipment when performing all tasks.
- You will be required to clean up after the assessment and dispose of any hazardous waste.
- You will be expected to be able to discriminate between acceptable and unacceptable termini end faces.
- You will be expected to verify and accept your work according to the requirements.
- You will be expected to inspect and evaluate all mating surfaces. If they are good document it, if they are unacceptable document it and be specific as to what the problem is.

## Session 5:

### Exercise 4: Cleaning Practice

Set up time: 30 minutes

Exercise length: 1.5 hours

#### Materials:

Part number/ item	Quantity
Routing boards with cables from sessions 2 & 3	1 per team
FCL-P1005 – Clean Blast	1 per team
FBPP-BAP3 – Barrel assy narrow	1 per team
FBPT-A801-1002P – Plug arinc type1 size 15-06	1 per team
FBPT-A801-1002R – Receptacle arinc type1 size 15-06	1 per team
FBPT-A801-2001P – Plug arinc type 2 F12 pins	1 per team
FBPT-A801-2001R – Receptacle arinc type 2 F12	1 per team
FBPT-A801-2002P – Plug arinc type 2 F12	1 per team
FBPT-A801-2002R – Receptacle arinc type 2 F12	1 per team
FBPT-U12M – Tip Universal 1.25MM	1 per team
FBPT-U12M-N – Tip 1.25MIL termini for FBP	1 per team
FCLT-BAP3-125 – Cleaning tip ARINC	1 per team
FCLT-MIL2 – Cleaning tip MIL 29504/4/5	1 per team
FCLT-U12 – Cleaning tip Universal 1.25MM	1 per team.
FCLT-U12-MA – Cleaning mating adapter 1.25MM	1 per team
FCLT-U25 – Cleaning tip Universal 2.5MM	1 per team
FCLT-U25-MA – Cleaning mating adapter 2.5MM	1 per team.
GCT-001 – Fiber optic assembly	1 per team
GIT-001 – Fiber optic Inspection tip	1 per team
YR-170XL – Visual fault finder	1 per team
K-Y-200U – Microscope	1 per team.
21755st1bo1n2 – Calibration artifact	1 per team
3615001-01 – Kim wipes	1 box per team
NFC-Swabs 2.5mm – Fiber optic cleaning swabs	10 swabs per team
Fiber optic cleaning pen 1.25mm	1 per team
Fiber optic cleaning pen 1.6mm	1 per team
Small water tight jar	2 per class
Canned air filtered to .2 microns	1 per team
Isopropyl alcohol	1 container per team

#### Handouts:

- Exercise 4 Project Directions (one for each team)- handout 1

#### Exercise 4: Cleaning Practice

Note to Facilitator: Please read the following to class prior to going over the directions for the exercise. (Refer to slide #16 of Session 5 PowerPoint for exercise directions).

- You will be required to wear the proper personal protective equipment when performing all tasks.
- You will be required to clean up after the assessment and dispose of any hazardous waste.
- You will be expected to be able to discriminate between acceptable and unacceptable termini end faces.
- You will be expected to verify and accept your work according to the requirements.
- You will be expected to clean all mating surfaces and alignment sleeves that have been identified. . Re-inspect and re-clean if necessary, re-inspect and re-clean using a manual cleaning process if necessary. If they are good document it, if they are unacceptable document it and be specific as to what the problem is.

## Session 6:

### Exercise 5: Testing Practice

Set up time: 30 minutes

Exercise length: 1 hour

#### Materials:

Part number/ item	Quantity
Routing boards with cables from sessions 2 & 3	1 per team.
YR-000 577XL – LED Source 850nm Tempo	1 per team.
YR-000ATS-108 – ST Adapter	1 per team.
YR-000 560XL – Optical Power Meter Tempo	1 per team.
YR-1030 – ST Adapter	1 per team.
187-250MPX – ARINC 801 test adapter	1 per team.
187-223SY – ARINC 801 test adapter	1 per team.
180-155-C – Test Probe Coupler (1.6 to 1.25um)	1 per team.
ABC54705-B-C-2 – Test Probe M29504 type (62.5um)	1 per team.
FA00861-C-C-2 – Test Probe ARINC 801 type (62.5um)	1 per team.
180-044NF06-17-8S – D38999 Plug Adapter	1 per team.
180-044NF07-17-8P – D38999 Receptacle Adapter	1 per team.
3615001-01 – Kim wipes	1 box per team.
K-Y-200U – Microscope	1 per team.

#### Handouts:

- Exercise 5 Project Directions (one for each team)- handout 1

## Exercise 5: Testing Practice

Note to Facilitator: Please read the following to class prior to going over the directions for the exercise. (Refer to slide #10 of Session 6 PowerPoint for exercise directions).

- You will be required to wear the proper personal protective equipment when performing all tasks.
- You will be required to clean up after the assessment and dispose of any hazardous waste.
- You will be expected to be able to:
  - Discriminate between acceptable and unacceptable test results.
  - Verify and accept your work according to the requirements.
  - Inspect and clean each terminus, alignment sleeve and test equipment prior to mating.
  - Connect one end of Probe Cable Assembly to a Light Source (SLS) and the other to an alignment sleeve.
  - Connect one end of another Probe Cable Assembly to an Optical Power Meter (OPM) and the other to the other end to the alignment sleeve above.
  - Turn on OPM and SLS.
  - Select proper wave length.
  - Zero out the OPM.
  - Disconnect cables at the alignment sleeve.
  - Connect each probe to the fiber to be tested.
  - Read Insertion Loss on the OPM.
  - Reverse CUT and re-measure insertion loss.
  - Average readings and verify light loss does not exceed 0.5dB.
  - Repeat above for all Channels Cable Assembly to be tested.

### Assure

- You do not look into the end of transmitting equipment.

### Measure

- Both directions and average the readings.