

# Welcome and Introductions



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## NIAR

I have been at NIAR for the past 16 months working as the Layup Room Manager. I am looking forward to work with composites material and processes associated with the Biomedical Industry in the future.

## Hawker Beechcraft

- In 1983 I was hired at Raytheon Aircraft to performed material testing to support certification of Starship. I supported the certification effort by performing mechanical testing of Cytac E7K8 prepreg material.
- Starting in 1995 I served as M&P shop support for the Resin Transfer Molding (RTM), Internal Pressure Molding (IPM) and Hand Layup part fabrication processes to support production of Premier 1 business jet.
- In 2004 became the M&P support for the Tape Placement process used to fabricate both Premier and Horizon fuselage shells.



## Purpose for this Lab

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- This lab gives the participant a hands on experience fabricating a carbon epoxy aerospace type parts using aerospace grade materials.
- The aviators clipboard simulates a laminate panel designed part.
- The wall plaque which simulate a sandwich panel designed part. ( core bevels, drilling, insert installation)
- The same techniques, terminology and documentation are used in the aircraft industry to fabricate production parts.

# Clipboard and Wall Plaque



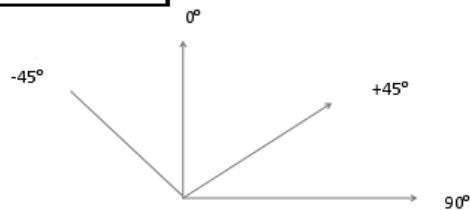
# Clipboard Work Instructions

<b>Project: FAA Workshop</b>	
Serial Number	
Panel Name	Aviators Clipboard
Panel Size	9.5' (90°) x 6' (0°) or ( fiber warp )
Reference Direction	Along the 9.5' (90°) or ( fiber fill )
See Rosette Below	

Description	Material Type / Batch / Lot
Woven Fiberglass	NB321-7781 / #63049
Woven Carbon Fiber	977-14AC/PW T 300 / #303008265-10

Ply No.	Description / Orientation
1	WF / BHS / 0 degree
2	WCF / PW / 0 degree
3	WCF / PW / 0 degree
4	WCF / PW / 0 degree
5	WCF / PW / 0 degree
6	WCF / PW / 0 degree
7	WCF / PW / 0 degree
8	WF / BHS / 0 degree

**Rosette**



## Room environment during kitting:

Start Kitting		Finish Kitting	
Date	9/23/2010	Date	9/23/2010
Time	8:00am.	Time	4:10pm.
Temp	70.2 F	Temp	71.2 F
Humidity	51.90%	Humidity	50.80%

## Room environment during layup:

Start Layup		Finish Layup	
Date		Date	
Time		Time	
Temp.		Temp.	
Humidity		Humidity	

Kitting Initials	Layup Initials
RP	
RP	
RP	
RP	
RP	
RP	
RP	

## Vacuum Bag Instructions:

Tool	Time	90-120 minutes
Non Perforated FEP release film	Temperature	250-275 F
Part	Pressure	20-40 psi.
Non Perforated FEP release film	Vacuum	Full
Caul Sheet	File name	
10 oz. Breather	Operator	
Bag Film (2-3mill)		
2ea. Thermocouples / tool		
2ea. Vacuum Ports / tool		
leak check 2hg./ 5 minutes		

## Cure Requirements:

# Clipboard Layup and Bagging Schematic



Nylon Vacuum Bag



10 oz. Breather

Aluminum Caul Sheet

NP Release Film



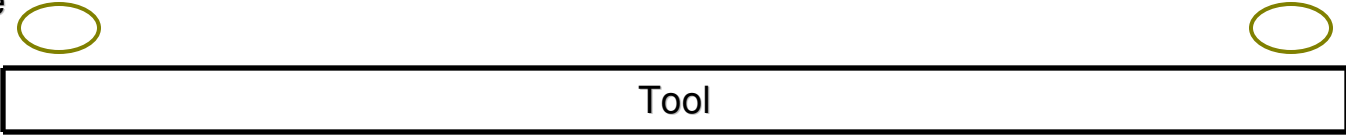
1ea.Woven fiberglass plies

6ea.Woven Carbon plies

Sealant  
Tape

NP Release Film

1ea.Woven fiberglass plies



# Laminate Panel Questions ?

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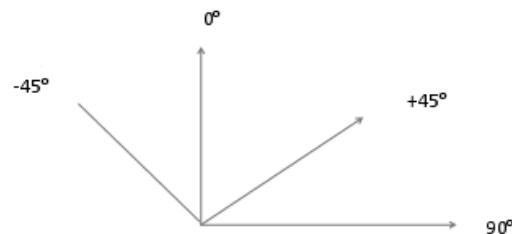
# Wall Plaque Work Instructions

<b>Project:</b>	<b>FAA Workshop</b>
Serial Number	
Panel Name	Wall Plaque
Panel Size	7.5' (90°) x 7.5'(0°) or ( fiber warp )
Reference Direction	Along the 7.5" (90°) or ( fiber fill )
See Rosette Below	

<b>Description</b>	<b>Material Type / Batch / Lot</b>
Surfacing / LS Ply	Surface Master 905M / 101
Woven Carbon Fiber	Cycrom 5208 Plain Weave / #790325
Film Adhesive	FM300 -2M / # 256
Core	HRH-10-1/8"-5.0lb / Block #19285

Tool Side Plies	Description / Orientation
	Surfacing / LS ply
1	WCF / PW / 0 degree
2	WCF / PW / -45 degree
3	WCF / PW / 90 degree
4	WCF / PW / 45 degree
	Film Adhesive
	.50" Core
	Film Adhesive
Bag Side Plies	Description / Orientation
1	WCF / PW / 45 degree
2	WCF / PW / 90 degree
3	WCF / PW / -45 degree
4	WCF / PW / 0 degree

**Rosette**



## Room environment during kitting:

Start Kitting		Finish Kitting	
Date	9/31/2010	Date	9/31/2010
Time	9:05am.	Time	4:10pm.
Temp	70.2 F	Temp	71.2 F
Humidity	51.70%	Humidity	51.00%

## Room environment during layup:

Start Layup		Finish Layup	
Date		Date	
Time		Time	
Temp.		Temp.	
Humidity		Humidity	

Kitting Initials	Layup Initials
RP	
RP	
RP	
RP	
RP	
RP	
RP	
RP	
RP	
RP	

## Vacuum Bag Instructions:

Tool
Non Perforated FEP release film
Part
Non Perforated FEP release film
Caul Sheet
10 oz. Breather
Bag Film (2-3mill)
2ea. Thermocouples / tool
2ea. Vacuum Ports / tool
leak check 2hg./ 5 minutes

## Cure Requirements:

Time	90-120 minutes
Temperature	300-350 F
Pressure	10-20 psi.
Vacuum	Full
File name	
Operator	

# Wall Plaque Layup and Bagging Schematic

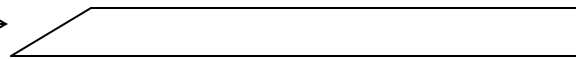
Nylon Vacuum Bag

Teflon Caul Sheet

10 oz Breather

NP Release Film

5 lb density hex. core  
30 degree bevel



1 ea. woven fiberglass plies

4ea. IML woven carbon plies

4ea. OML woven carbon plies

1 ea. surfacing film with LSP

Sealant  
Tape



NP Release Film



Tool



# Sandwich Panel Questions ?

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# Conclusion

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- ◆ Thank you for participating in the Lab.
- ◆ Please send any suggestions or ideals for improvement to me at [bbrummer@niar.wichita.edu](mailto:bbrummer@niar.wichita.edu)

# Bagging Materials and Prepreg Costs

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➤ Woven Carbon Epoxy	\$
➤ Woven Fiberglass Epoxy	\$
➤ Film Adhesive	\$
➤ 5 lb. Hex Core	\$ 27.63 / square foot
➤ NP Release Film	\$ 0.38 / square foot
➤ 10 oz. Breather	\$ 0.30 / square foot
➤ Nylon Bag Film	\$ 0.10 / square foot
➤ Sealant Tape	\$ 0.16 / foot
➤ Autoclave Cure	\$ 536 / Cycle

# Bagging Procedure Demo

- ◆ Apply sealant tape around the periphery of the tool
- ◆ Install Thermocouples into the edge of the part.
- ◆ Place and tape non perforated release film onto the tool.
- ◆ Place the clipboard on the tool.
- ◆ Place non perforated release film over clipboard.
- ◆ Tape the caul sheet to the release film centered over the clipboard.
- ◆ Place the breather over the tool surface.
- ◆ Choose the location for vacuum port and vacuum monitor.
- ◆ Cover the tool with bag film.
- ◆ Cut hole for vacuum port and assemble the ports.
- ◆ Check for vacuum integrity
- ◆ Perform leak check (less than 3-5" Hg in 5 min. interval)