

Composite Burn Mojave Test Center

October 31, 2003



Representative Organizations

Mojave Test Center Fire Department
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Edwards AFB FD Training Officer
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Overview

- Purpose
- Type of Composites
- Test Conditions
- Burn Observations
- Conclusion

Purpose

- Try various extinguishment techniques for a smoldering condition
- Use a thermal imager during a smoldering condition
- Illustrate post-fire composite issues and clean-up procedure

Type of Composite Structures Burned for the test

- Large amount of Carbon Fiber Epoxy Sandwich Structures
 - Pickup Truck Load (Total Weight Unknown)
- Small amount of Carbon Fiber Epoxy Solid Structures
- Samples of various aircraft material
 - Foam
 - Rubber
 - Copper Coated Carbon Fiber
 - Nickel Coated Carbon Fiber

Test Conditions

- Concrete pad
- Pile of composite structures resting on cement blocks
- 5-10 gallons of JP8 underneath the pile
- Winds about 15 knots

TEST PAD



Test Conditions

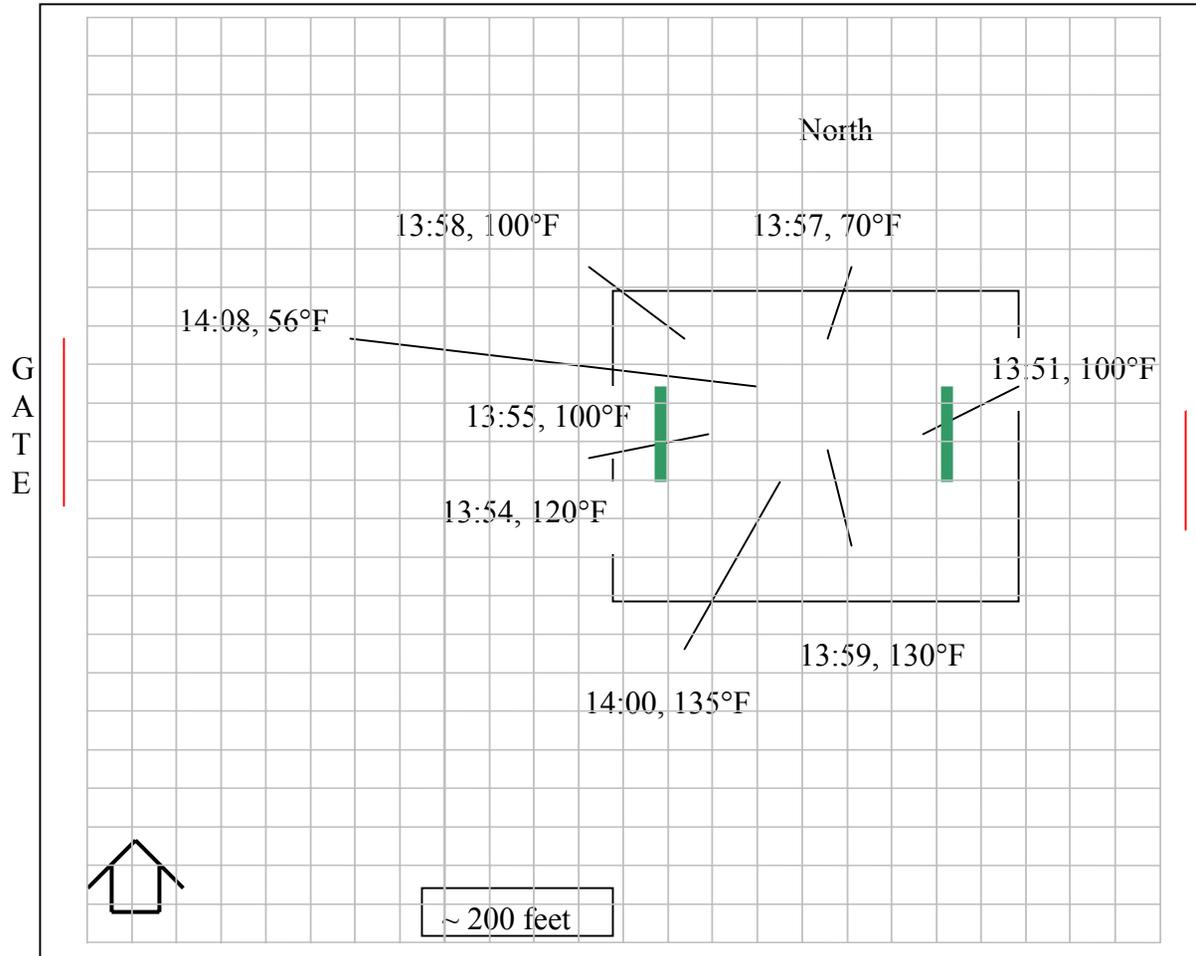
- The pile was allowed to burn for ~ 5 minutes
 - Want burn time long enough to set up a self-sustained condition for epoxy
 - Create a typical response time scenario
- AFFF was applied for ~ 3 minutes using various penetration techniques

Mishap/Date: Firefighting Exercise, 20031031
Composite Description: C/E, mostly sandwich structures –
foam core, small size solid structures, fabric
Site Location: Mohave Flight Test Center
Fuel Source: 5-10 Gallons JP8
Agent: AFFF

Weather: Cloudy

Wind: 15 knots W, SW

Terrain Description: Flat Desert



**NOT TO
SCALE**

Timing Notes:

- 13:28 Light/start test
- 13:36 Knockdown
- 14:08 Ambient

Advanced Composite Office Notes:

- 5 minutes to AFFF application
- 3 minutes application time
- Internal resin smoldering still exists after 3 minute application, see smoldering temperatures above

Fire Observations

- JP8:
 - black smoke for about 3 minutes
- Composite:
 - Dark red flame, ~1600-1800 F
 - White flame, ~2400 F
 - Brown vapor, resin burning
 - Glowing red combustion, carbon fiber combustion, ~1400 F

TEST PAD AFTER FIRE



Smoldering Observation

- Surface layers were extinguished
 - No visible smoke
 - Temperature dropped to ambient
- Internal layers emitted white smoke when the pile was disturbed
 - Internal layers not at ambient when surface layers were

COMPOSITE PILE AFTER FIRE



Post Fire Observation

- No visible evidence of carbon fiber lingering around the burnt debris or downwind
- Cleanup concerns were right at the burnt debris

COMPOSITE PILE AFTER FIRE



COMPOSITE PILE AFTER FIRE



COMPOSITE PILE AFTER FIRE



COMPOSITE PILE AFTER FIRE



Conclusion

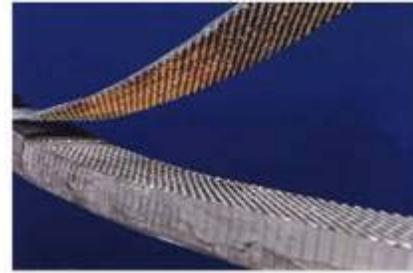
- Fire and Smoldering experiences were as written in T.O. 00-105E-9, Revision 8, Chapter 3
 - What we expected is what happened

Conclusion

- Contain the liquid fuel fire first
- Continuous application is needed for 3 minutes to stop smoldering combustion
- Expect a pile of composite debris in fuel-fed fire to smolder. Do not allow people to work around smoldering debris.

Conclusion

- The pile was mainly sandwich structure
- Which means
 - A smaller amount of resin in comparison to a solid structure of the same size
 - Less fuel available to burn
- A longer smoldering period might have been expected if the pile was mainly of thick solid structure composites



Conclusion

- Initial approach assessment – post fire:
 - Use terminology found in T.O to describe the debris
 - Circle the debris field and walk downwind for ~200-300 feet. Look for carbon fiber clusters.
 - Clusters will travel in the downwind direction.
 - Clusters tell you that there was a fair amount of unidirectional tape fibers that has the potential to release burnt fiber particles.
 - If there is a lot of cluster – KEEP People out of downwind direction and make sure next response team is aware of this.

