

## MEMORANDUM FOR RECORD

SUBJECT: Portable Laser Coating Removal System (PLCRS) Preliminary Design Review (PDR) Meeting, 27-29 Aug 02

### MINUTES:

1. On 27-29 Aug 02 the PLCRS PDR Meeting was held at Wright-Patterson AFB OH. HQ AFMC Logistics Environmental Office hosted the meeting. Mr. Gerard Mongelli, Project Manager, led the meeting. A list of attendees is attached. There were representatives present from the Air Force, Navy, Marine Corps, Coast Guard, Army, NASA, Boeing, Lockheed Martin, Contractors, and United Kingdom Ministry of Defense (UK MOD).

2. The intent of this meeting was to give the interested stakeholders a chance to have a “hands-on experience” with the four laser systems selected for this project to determine areas for improvement and/or optimization. On Day 1 the following briefings were given: Update on the Laser Project, Air Sampling Report, Ergonomics/Safety Issues, and Specialty Coatings. Copies of available briefings are attached. The stakeholders were then taken the Laser Hardened Materials Evaluation Laboratory (LHMEL). At the LHMEL, stakeholders were able to use the lasers to get their full effect, i.e., weight, maneuverability, ease of handling, etc. Prior to arriving at the LHMEL, stakeholders were given Comment/Notes Sheets for each of the four laser systems.

3. On Days 2 and 3, the stakeholders were brought back together in Building 653, AFRL Cafetorium, to discuss their findings. The following laser systems were evaluated: SLCR – TEA:CO<sub>2</sub>, Laserline – Diode, Quantel – Nd:YAG, and Cleanlaser – Nd:YAG. Mr. Mongelli began the discussions by stating the Laserline - Diode was not yet ready for an evaluation because it was not up to par with the stated requirements. It was still in an X-Y Table mode instead of being a hand held unit as desired. Therefore, the discussions would cover the two Nd:YAG and the TEA:CO<sub>2</sub> laser systems.

a. Stefan Susta, SAIC Technical Engineer, gave general comments on the SLCR – TEA:CO<sub>2</sub>. He stated the other lasers have not been in the LHMEL long enough to give a fair assessment. He reminded everyone that none of the lasers would be best for all applications, but there would be applications for each laser. Some of the items mentioned were:

(1) Customized shipping containers. After some discussion, this was dismissed due to the lack of space at most areas. It was also determined in most cases once the system was set up, that is the location where it would remain.

(2) Filling the chiller tank was too difficult since it had to be filled from the bottom. A pressurized hose would help in that operation. Unsure about using chemicals in chiller to inhibit micro organism growth; do not know what long term effect that may have on the chiller’s operation.

(3) The mirrors can become misaligned during shipment. There needs to be a tool to realign them.

(4) The fact that a specialized gas mixture is required would make the SLCR unit not be flight line deployable. Units would have a difficult time getting a specialized gas mixture while deployed.

(5) The SLCR unit is more into robotics which limits its use. There could be problems if the mirrors got dirty. It was best used on flat panels.

(6) Problems with the source of supply. Need to have within the States instead of having to ship units back to Europe. This comment was the same for all the laser systems.

At this point, a comment was made that this program would help develop specifications for lasers so that any laser company could build the lasers that are required.

(7) The counter balance did not work well. The head had limited movement and the operator could not see what was being stripped until the head was moved out of the way. This one could not be used on hard-to-reach areas. One of the stakeholders commented that the handles on the end effector were too far apart for a small structured person.

(8) Operator will have to be trained and laser parameters set correctly to strip down to certain points. There is talk of color recognition software being developed.

(9) Concerns were voiced about using laser on panels where fuel has leaked through the seams. It will have to be tested to determine if vapors would ignite with the laser use.

(10) The vacuum hose was cumbersome. Need to check on repositioning the hose to where it would be better supported instead of the operator having to bear its weight.

(11) The question was asked whether the coatings make such a difference in removal rates. The reply was that training makes all the difference in how well the laser will work. When the operator goes over different types of coatings, he will need to adjust the parameters. It was suggested that during testing, several different settings can be determined to fit applications required.

(12) It was suggested that the makeup of the mirrors be looked at for long-term use and that cleaning of the mirrors would be an issue.

b. The next laser for comments is the Cleanlaser – Nd:YAG. Mr. Susta stated that it took about an hour to set up. It was easy to use in that you just turn the key, hit the button and it was ready to fire. The vacuum system removes ablated materials. They are not using the vacuum system that comes with the unit. The end effector can be used with or without the wheels. The parameters can be adjusted on the head itself.. The following comments were made by attendees:

(1) It was hard to maintain focus. The end effector had to be on the right angle. If used on something circular, it would be difficult to use. If the end effector was held still, the beam would cut through after a few moments. It needs to have a sensor shut off system.

(2) They couldn't see area being stripped. Single handed action was more user friendly. Users wanted to know if it would be possible to put in a small video to help visually. Selective stripping was good.

(3) The question was asked that if the head comes within 2-3 inches of the edge, would the capture system still pick up ablated materials? This raised the question whether the air sampling was conducted right at the point of lasing. Need to know what the exposure levels should be at operator level. Need to check OSHA standards. The new standard is to go into effect soon.

(4) Several commented they would like to see a small vacuum hose to take the weight off the user. Someone suggested using a belt attachment. Also commented a universal joint at the head for the fiber optic cable would improve maneuverability.

(5) The end effector was small enough to get into areas for small jobs and was very easy to use. Overall, it wasn't too heavy.

(6) The LH MEL laser technician stated it took him about an hour to get used to in comparison to the SLCR unit which took over a week.

(7) It was suggested that an additional handle on the side of the head would help in holding the end effector. The low level of noise was good. And this system would be easier to make more rugged for flight line use. The chiller was easy to fill from the top using ionized water.

(8) A transformer has to be used with the system in the States. It has a good mean time between maintenance schedules. With some minor modifications, this system would be a good candidate. It has adjustable rastering speed and width.

(9) The end effector is supposed to be held at a 45° angle to keep the laser focus. The SLCR unit is also supposed to be used at a set distance. The question was asked as to whether or not you had a problem with the fiber overloading from reflection if the head was not held at a certain angle?

c. The last system for discussion was the Quantel – Nd:YAG. Mr. Mongelli had Dr. Patel explain to everyone how they have experimented with the Quantel system on a bracket off the Tornado aircraft. This bracket is required to be inspected after every 40 landings. The old process used was taking anywhere from 70 hours up. Using the Quantel system, they have gotten it down to around 4 hours. Mr. Mongelli stated this would be a good system for use in a glovebox scenario. The laser rasters from left to right instead of up and down. The weight of the head was acceptable. They can get a longer fiber optic cable (40 ft). When the laser is off focus it stops. The shroud on the end effector is not for measuring distance. The working distance is over an inch so it is not as critical to stay focused.

(1) Using the shroud causes dust to be generated. It needs a better vacuuming system attached. The dust could cause lens to become clouded and need more cleaning. Need to make a better collector on the end effector to keep from losing flexibility.

(2) The chiller on this system is there to keep constant 70°F to keep electronics at the right temperature. The chiller should be developed to meet the requirements for the area where used.

(3) It could use a wider/adjustable beam. That should double the speed with uniform stripping. Mr. Susta replied that there are two adjustments: Power and Frequency.

d. The Quantel Nd:YAG laser system was placed in a prototype glovebox. The comments below dealt with the overall system:

(1) When used in a glovebox, operator would need right type of gloves such as UV/Ozone resistant. The height of the glovebox should be adjusted and having a different placement of the fiber optic cables would ease the handling of the laser. The handle is heavy so maybe another post added would help in holding.

(2) Maybe adding a Lazy Susie to the glovebox would help to turn parts in the glovebox.

(3) The glovebox should be sound proofed.

(4) The glovebox is slower than plastic media or wheat starch. As long as that media is within compliance, the laser in the glovebox would not be accepted. This is more so in depot maintenance at production level.

(5) By placing the laser in the glovebox, there is potential to change the laser from a Class 4 to a Class I. The glovebox protects surrounding persons from laser beams. They would not need protective gear except hearing protection.

e. To close out the discussions on the laser systems, Mr. Mongelli asked Dr. Patel to give a rundown on their (MOD UK) thoughts:

(1) Question hardware reliability.

(2) On the Laserblast – Chiller unit hose got kinked. Laser did not work. Tap water can be used to maintain temperature. Need an internal chiller for unit.

(3) Cleanlaser – When you back off laser (3”) laser should have automatic shut off.

(4) Believe you should test by coating both side of panel to ensure there is no effect on opposite side.

(5) Use of media to compare for NDI. Richard Slife suggested using material he had on hand, C141 aft cowl skins.

(6) They noticed there was no corrosion testing. Mr. Straw commented they were testing for corrosion in the Specialty Coatings project.

(7) Selective coating removal. Laser activating a coating. This will be looked at more in the Specialty Coatings project (Water immersion test).

(8) When using speed tape, the laser did not get under tape.

(9) Nd:YAG adjusted parameters narrowed scan width and max power cut through thick sealant.

(10) Questioned how they did dry film thicknesses on unknown panels? Dr. Patel stated they used a meter that has given good results. He will send the info to Mr. Mongelli via email.

(11) Suggested they look at materials with irregular shapes.

(12) Wanted to know if the other head for Cleanlaser was going to be used. Mr. Mongelli replied they would have to get approval for using another laser system.

4. With these final comments made, Mr. Mongelli closed out the meeting stating the comments would be consolidated in the minutes along with briefing materials from the first day of the meeting. If anyone had any other thoughts after departing, they were asked to send them via email to either Mr. Mongelli or Mr. Susta. Another meeting would be set in a few months to review the laser systems again after they have had some lab time.