Bolder Systems, LLC

Document No. 2007-06-11 Rev. 1.1 **Revision date: 01/11/2007**
Title: Dalsa Camera Repair Procedure

1. Scope:
This document applies to the two types of cameras serviced:
a. Serial cameras with a scintillator screen
b. Serial cameras with a crystal scintillator

2. Incoming inspection steps:
Fill out Form No. 2007-06-11-1. This form captures the information about the customer, the condition of the package upon arrival, the contents of the package, camera model and serial numbers, its state of assembly, the condition of the connectors and the carbon fiber cover plate.
Retain all paperwork included by the customer; e.g. description of the problem.
Note: Do not proceed to the power test unless the connector terminals are in good condition.

3. Power test:
This test is performed with the Camera Test Work Station.
Before proceeding vacuum the camera housing and the fan.
Check the operation of the cooling fan and its noise level. Enter the finding on Form No. 2007-06-11-2.
Note: Do not proceed to the camera operational test unless the fan is in working condition.

4. Camera functional test:
This step is performed on the Camera Test Work Station under x-ray exposure conditions. Verify customer's description of the problem, and enter your findings on Form No. 2007-06-11-2.

The next step in the procedure depends on the nature of the problem, but at least some camera disassembly will be required. This work should be performed on the ESD qualified workbench. Use the tools In the camera disassembly kit TK-001. Always use a new hex wrench on the 4-40 and 6-32 flat head screws. Discard all removed flat head screws, including the two 8-32 nylon screws.
At every stage of dismantling vacuum the camera.

5. Optical bench test:
If it is suspected that the CCD chip is defective transfer the camera to the optical bench test work station. Follow the steps in the document

No. 2007-06-12 if a scintillator screen is used; if a crystal scintillator is used follow the steps in document No. 2007-06-13.

6. Electrical tests:

Troubleshooting, whether carried out on the optical or x-ray test stand, requires the same instrumentation complement: A two or four channel oscilloscope; a function generator; a digital multimeter; and a universal programmer. The expected voltage levels and oscilloscope traces are shown in document No. 2007-06-14.

7. Scintillator replacement:

Follow the steps in 2007-2006-15 for the crystal replacement; for screen replacement follow the steps in 2007-06-16.

8. CCD replacement:

For KAF-1001e chip replacement follow the procedure in document No. 2007-06-17; the obsolete KAF-1000 is replaced with KAF-1001e, which also requires camera PCB modifications. Follow the steps in document No. 2007-06-18.

9. Imaging tests:

The repaired camera is tested under x-ray exposure conditions. The following image quality parameters are evaluated:

- **a. Assembled camera response in ADU per milli-Roentgen**
- **b. Response uniformity**
- **c. Image resolution uniformity (a qualitative test)**
- **d. Signal modulation at 9 cy/mm and 10 cy/mm near the top and bottom of the image field (a quantitative test of resolution)**
- **e. Contrast-detail test with a proprietary C/D phantom**
- **f. A count of cold pixels, defined as the number of pixels with ADU less than 40% of the average ADU under x-ray exposure**
- **g. A count of hot pixels, defined as the number of pixels with ADU value greater than the mean ADU value of a 5 s dark image plus 700 ADU**
- **h. The mean value, and its standard deviation, of 5 s integration time dark image.**
- **h. A count of cluster and dead columns**
- **i. Corrected image of a flat field phantom, 18 mm Acrylic plate, is acquired. The SD of the image is compared to a quantum limited theoretical result.**

The test results are captured in the Form 2007-06-11-3; this form is submitted to the customer. Also included shall be the following images: raw and corrected flat field; C/D phantom; line pair phantom; plots of the 9 lp/mm and the 10 lp/mm.