NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

June 5, 2015

Computed Tomography Specialist's Factual Report

CEN-15-FA-048

A. ACCIDENT

Operator:	Central Airlines, Inc., dba Central Air Southwest
Location:	Chicago, IL
Date:	November 18, 2014
Time:	0245 central standard time
Vehicle:	Aero Commander model 500 B airplane, N30MB

B. GROUP

Computed Tomography Specialist:	Scott Warren National Transportation Safety Board Washington, D.C.

C. SUMMARY

On November 18, 2014, about 0245 central standard time, an Aero Commander model 500 B airplane, N30MB, impacted a residence while attempting to return after takeoff from the Chicago Midway International Airport (MDW), Chicago, Illinois. The pilot was fatally injured. The airplane was substantially damaged. The airplane was registered to and operated by Central Airlines, Inc., dba Central Air Southwest, under the provisions of 14 Code of Federal Regulations Part 135 as an on-demand cargo charter flight. Night visual meteorological conditions prevailed for the flight, which was operated on an instrument flight rules flight plan. The flight originated from MDW about 0238. The intended destination was the Ohio State University Airport (OSU), Columbus, Ohio.

The internal configurations of the left and right propeller governors were documented using radiographic images that were collected from December 5-24, 2014 in Chicago, Illinois. A total of 3,614 computed tomography (CT) slices were examined, processed, and analyzed by the NTSB to evaluate the components.

Review of the images determined that the left propeller governor flyweight mechanism was located at a position close to the upper wall of the flyweight mechanism cavity, and that the splines for the driveshaft and the flyweight mechanism were aligned so that the drive shaft was not inserted into the flyweight mechanism.

D. DETAILS OF THE INVESTIGATION

1.0 General

The left and right propeller governors were subjected to x-ray computed tomography (CT) scanning to document their internal conditions. The scanning was conducted from December 5-24, 2014. The scans were performed by Varian Medical Systems, Inc (formerly Bio-Imaging Research, Inc. (BIR)) under the direction of the NTSB using a combination of the Varian Actis 500/225 microfocus CT system and the Actis 500/450 standard focus CT system.

For the CT scans, the components were loaded into the imaging unit and placed on a turntable. They were then rotated in front of the x-ray source, and the x-rays were captured by a detector after they went through the part. The x-ray source produced a fan beam of x-rays, and the portion of the part imaged was adjusted slightly after each scan was completed until the entire assembly was scanned. The x-ray energy levels captured by the detector were recorded at several thousand different points during each rotation, and this information was converted into axial slice images using reconstruction algorithms.

The components were scanned using a total of 3,614 axial slices. The total size of the combined data sets was 28.9 Gb. The left propeller governor was scanned multiple times with different scanning protocols using both the microfocus imaging system and the 450 kV standard focus imaging systems. The right propeller governor was only scanned with

the standard focus (450 kV) imaging system. The microfocus scans provided the best possible spatial resolution, but this type of imaging was constrained to a lower power level that sometimes resulted in streaking artifacts within the images. The standard focus scans used a higher power level (with a lower spatial resolution), but these higher power levels eliminated the streak artifacts and had an inherently higher contrast resolution. Target CT imaging using the microfocus system was used for selected areas to get the highest possible resolution. The complete scan protocols for each component are given in table 1. The CT axial slice images were provided to the NTSB where they were examined, processed, and analyzed to evaluate the components.

Table 1
Scan Protocol

Component	Left Propeller Governor – Microfocus (entire part)	Left Propeller Governor – Microfocus (target CT)	Left Propeller Governor – Standard focus (entire part)	Right Propeller Governor – Standard focus (entire part)
Number of slices	2091	501	511	511
Voxel Size - X Direction (mm)	0.097	0.03	0.098	0.098
Voxel Size - Y Direction (mm)	0.097	0.03	0.098	0.098
Voxel Size - Z Direction (mm)	0.1	0.06	0.4	0.4
Image Projections per Revolution	2160	3600	1800	1800
Exposure time (ms)	286	286	56	56
Frames to Avg (frames per projection)	2	2	1	1
X-ray Source Voltage (kV)	222	223	450	450
X-ray Source Current (mA)	0.525	0.55	2	2
Source Filter Material	Brass	Brass	Brass	Brass
Source Filter Thickness (mm)	1	1	0.5	0.5
Image Matrix Size (pixels)	2048 x 2048	2048 x 2048	2048 x 2048	2048 x 2048

Each data set of slice images was examined, processed, and analyzed by the NTSB using the VGStudioMax software package to convert the axial slice data into orthogonal slice images and a three-dimensional reconstructed image of the component. As part of the evaluation, some sections of the components were digitally removed to allow closer observation of interior parts. In the images, the high density areas are shown as brighter shades of gray and lower density areas are shown as darker shades of gray. The pointers shown in some of the images denote specific areas of interest within that image.

The images of the components were examined for any signs of missing or damaged parts, contamination, or any other anomalies. Specific results (including example images) are presented in subsequent sections of this report.

2.0 Computed Tomography Results

2.1 Left Propeller Governor

The computed tomography (CT) results for the left propeller governor are shown in figures 1 through 10. Review of the images indicated:

1. The flyweights were found to be in a position near the top of the flyweight cavity;

2. The driveshaft splines and the flyweight splines were aligned so that the driveshaft was not inserted into the flyweight mechanism;

3. All of the bearings within the governor appeared to be intact;

4. There was a high density material fragment noted within the flyweight cavity.

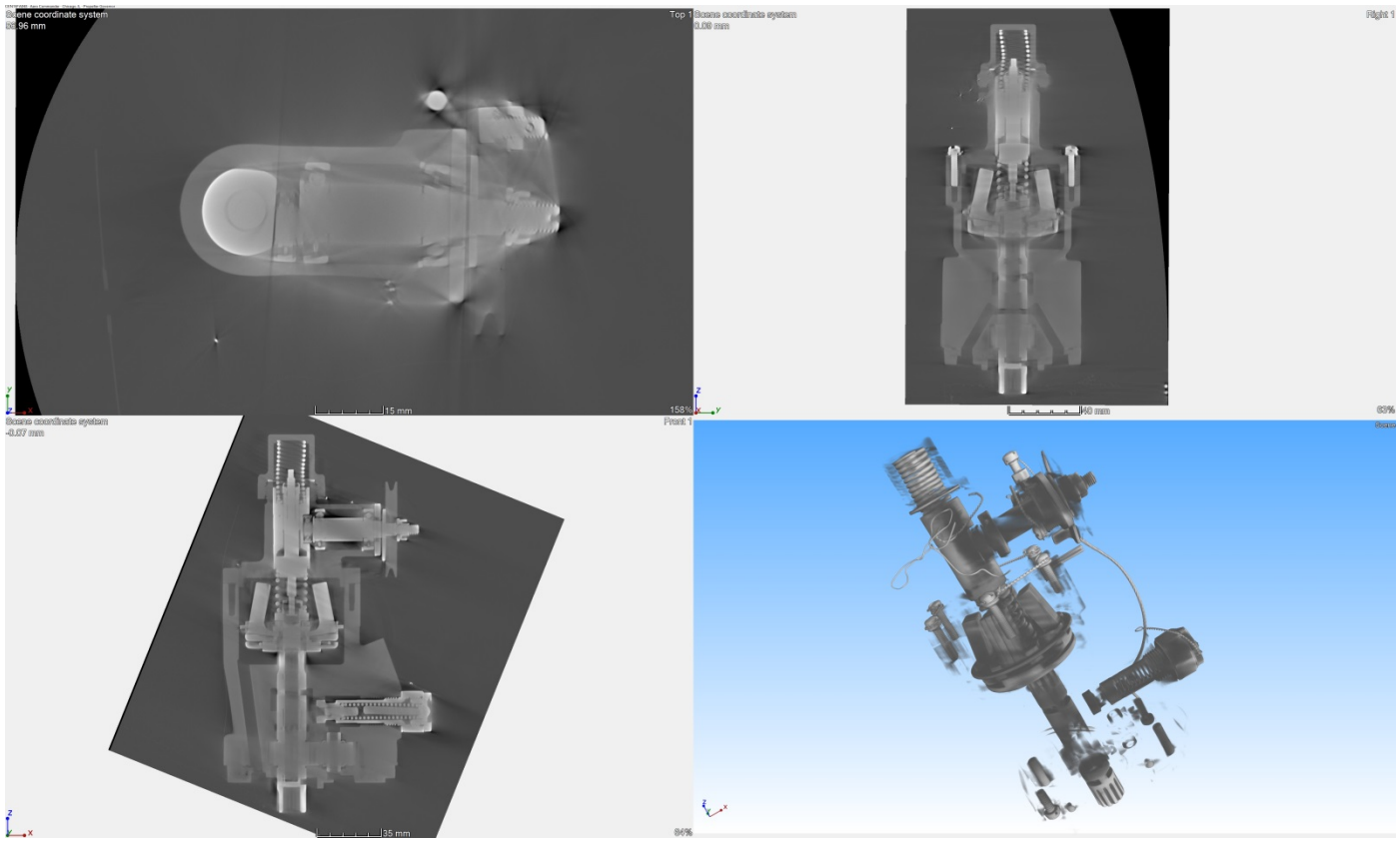

Figure 1
Left propeller governor – microfocus – Overall cross section

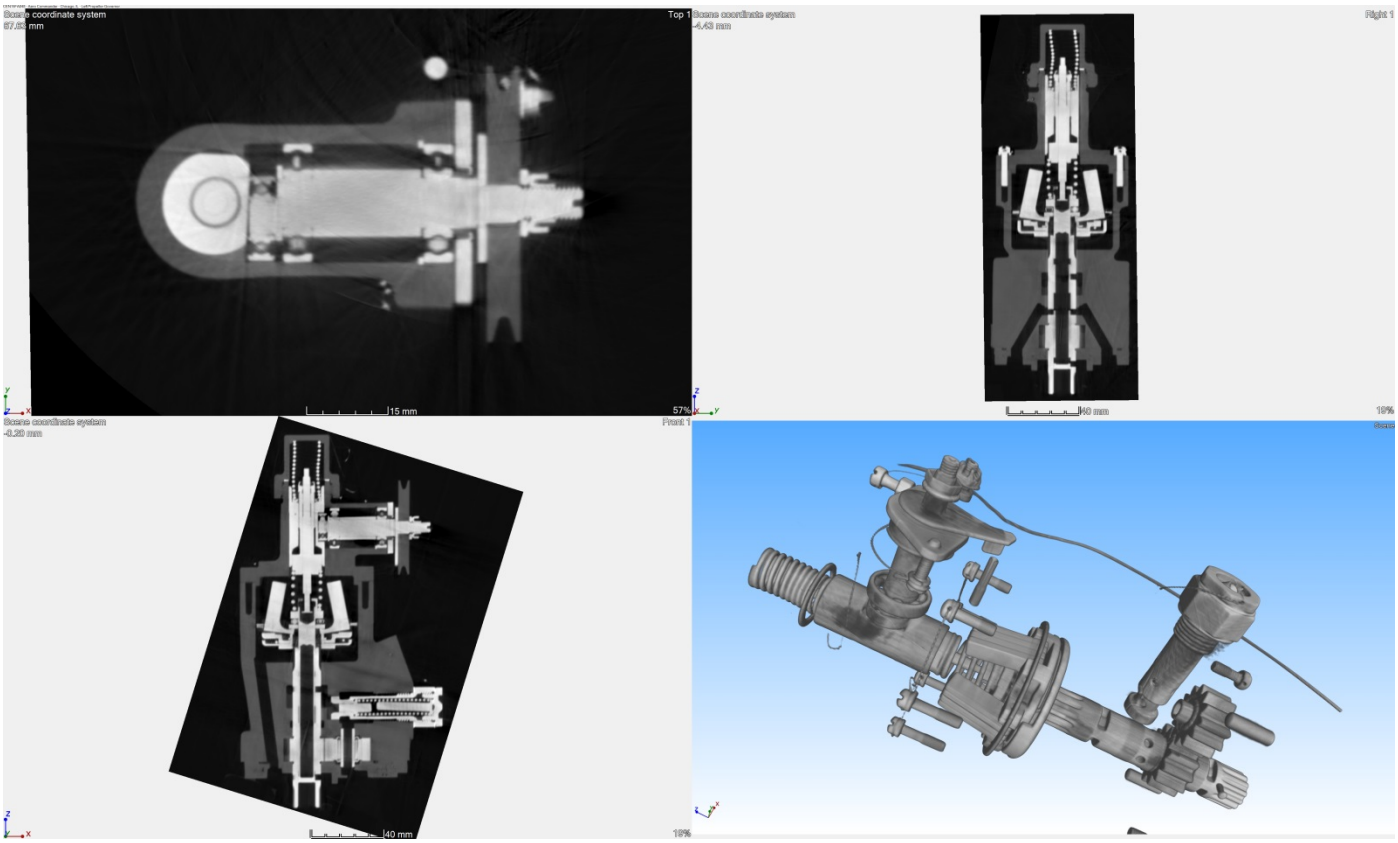

Figure 2
Left propeller governor – standard focus – Overall cross section

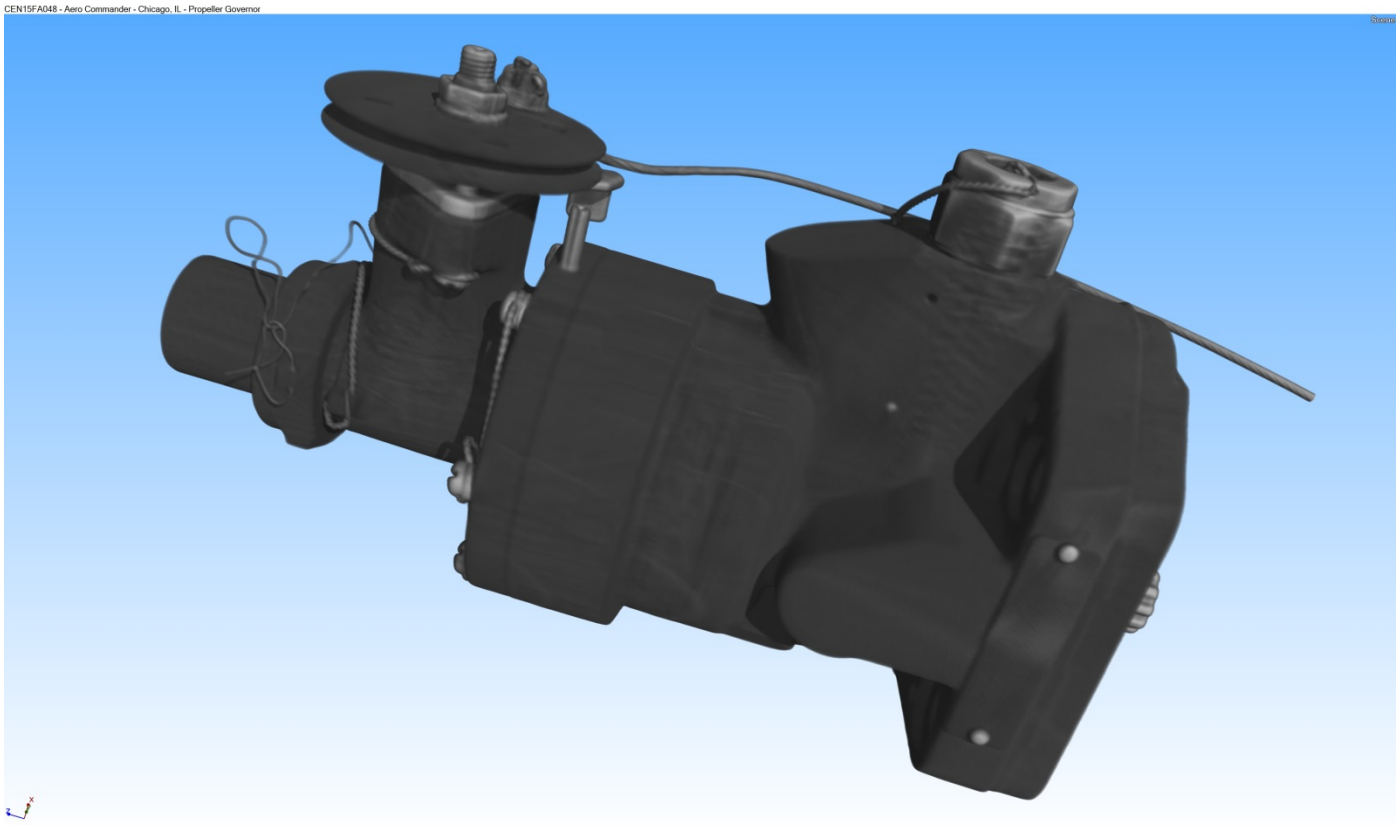

Figure 3
Left propeller governor – 3D view – Outer surface

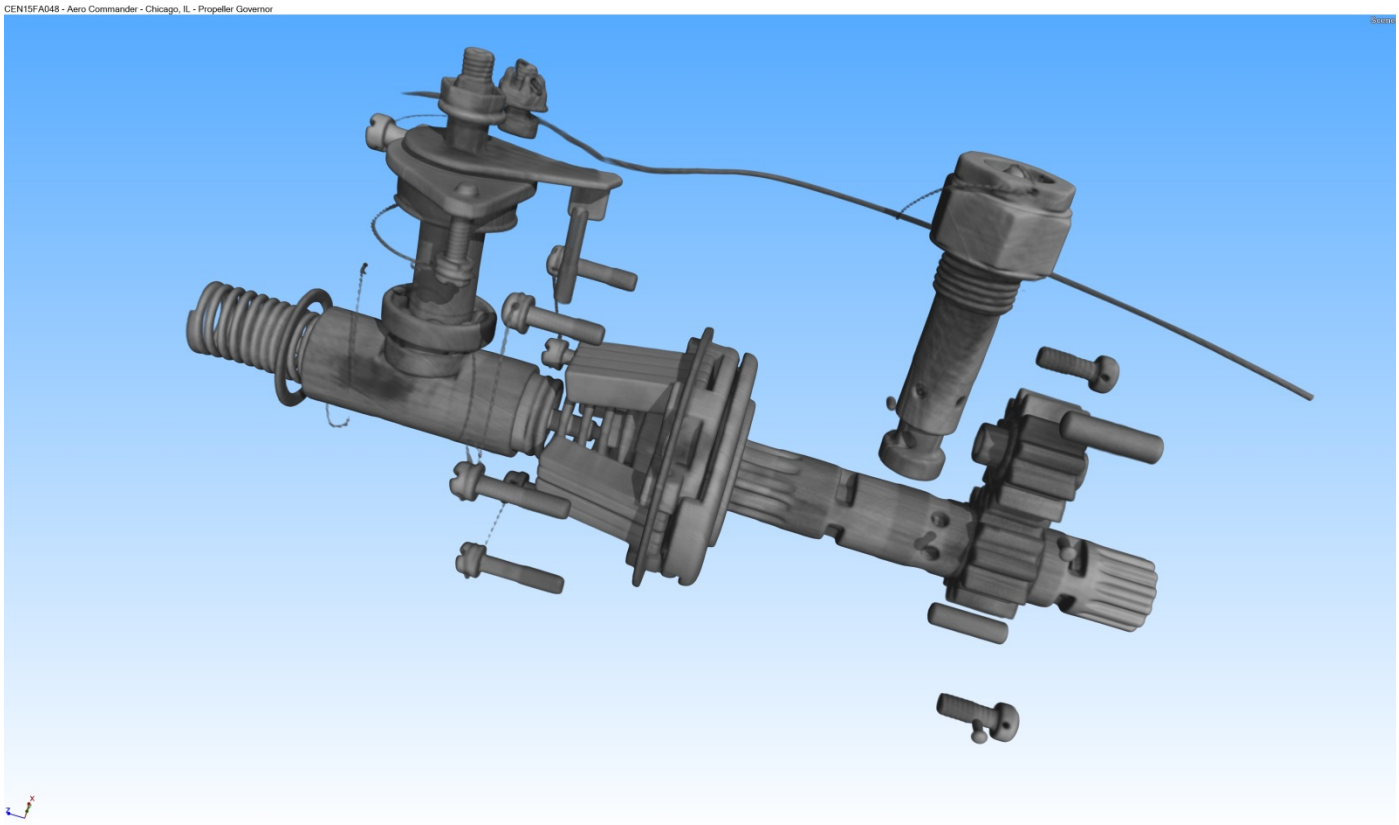

Figure 4
Left propeller governor – 3D view – high density components

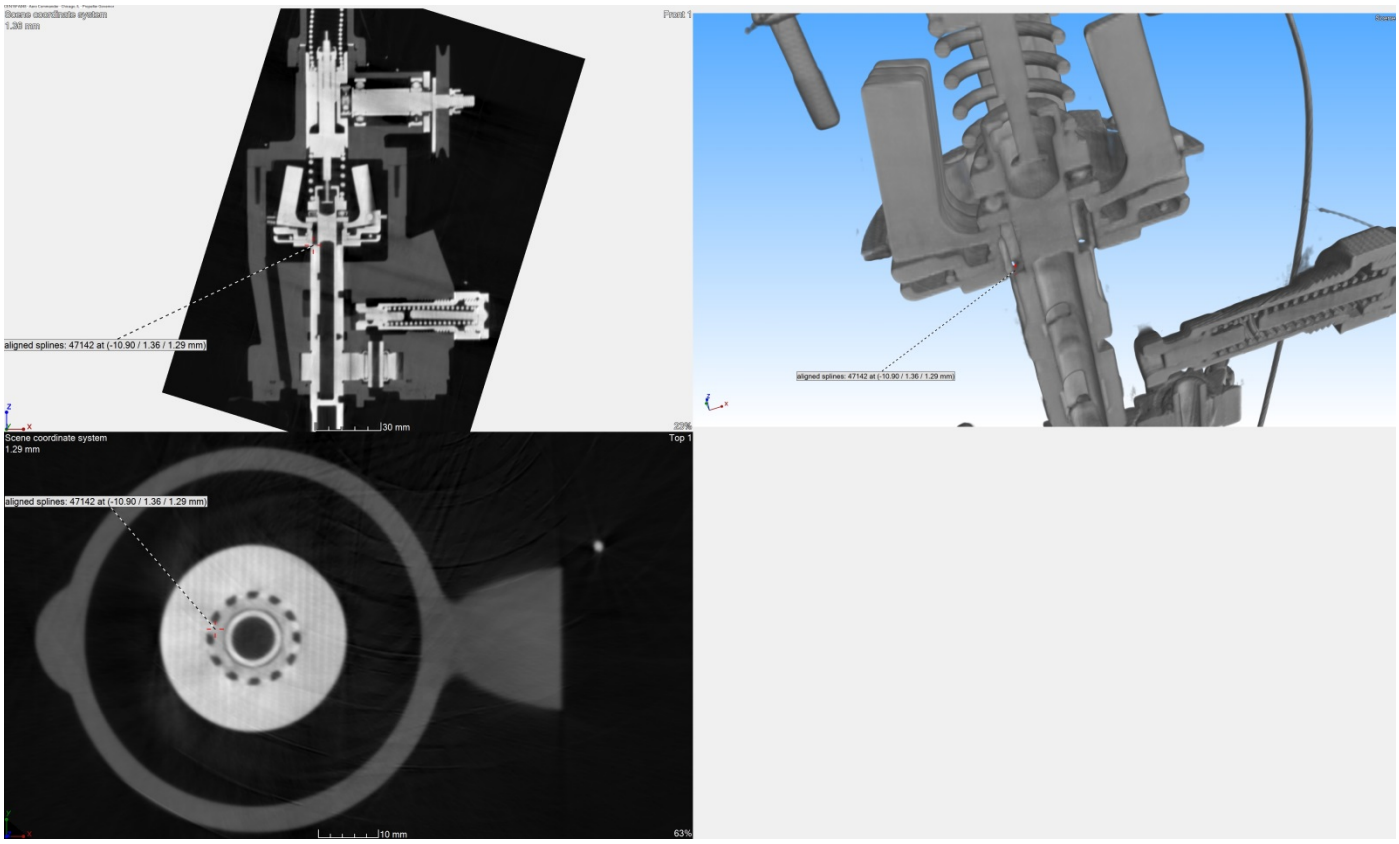

Figure 5
Left propeller governor – standard focus – aligned shaft and flyweight splines

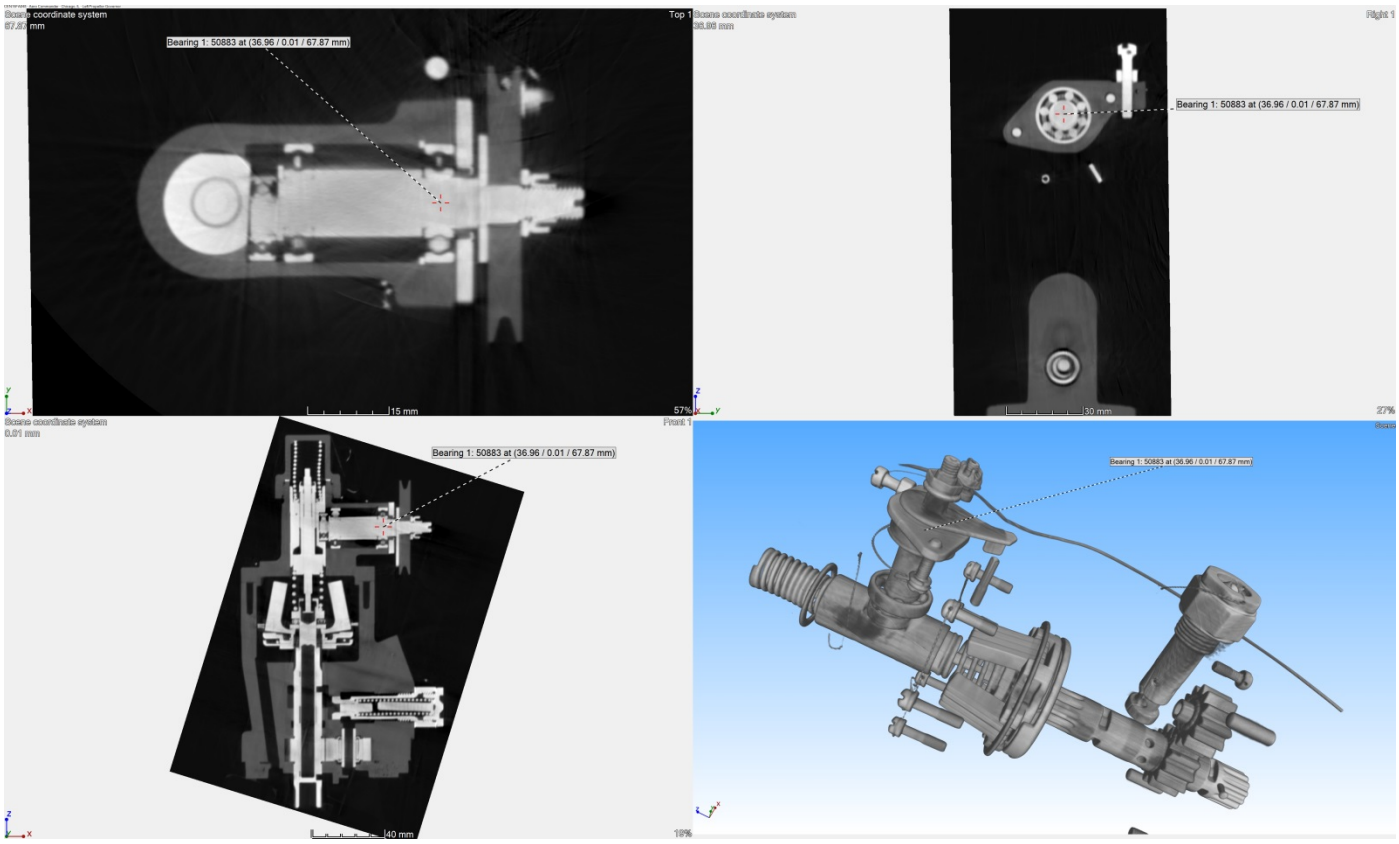

Figure 6
Left propeller governor – standard focus – bearing number 1

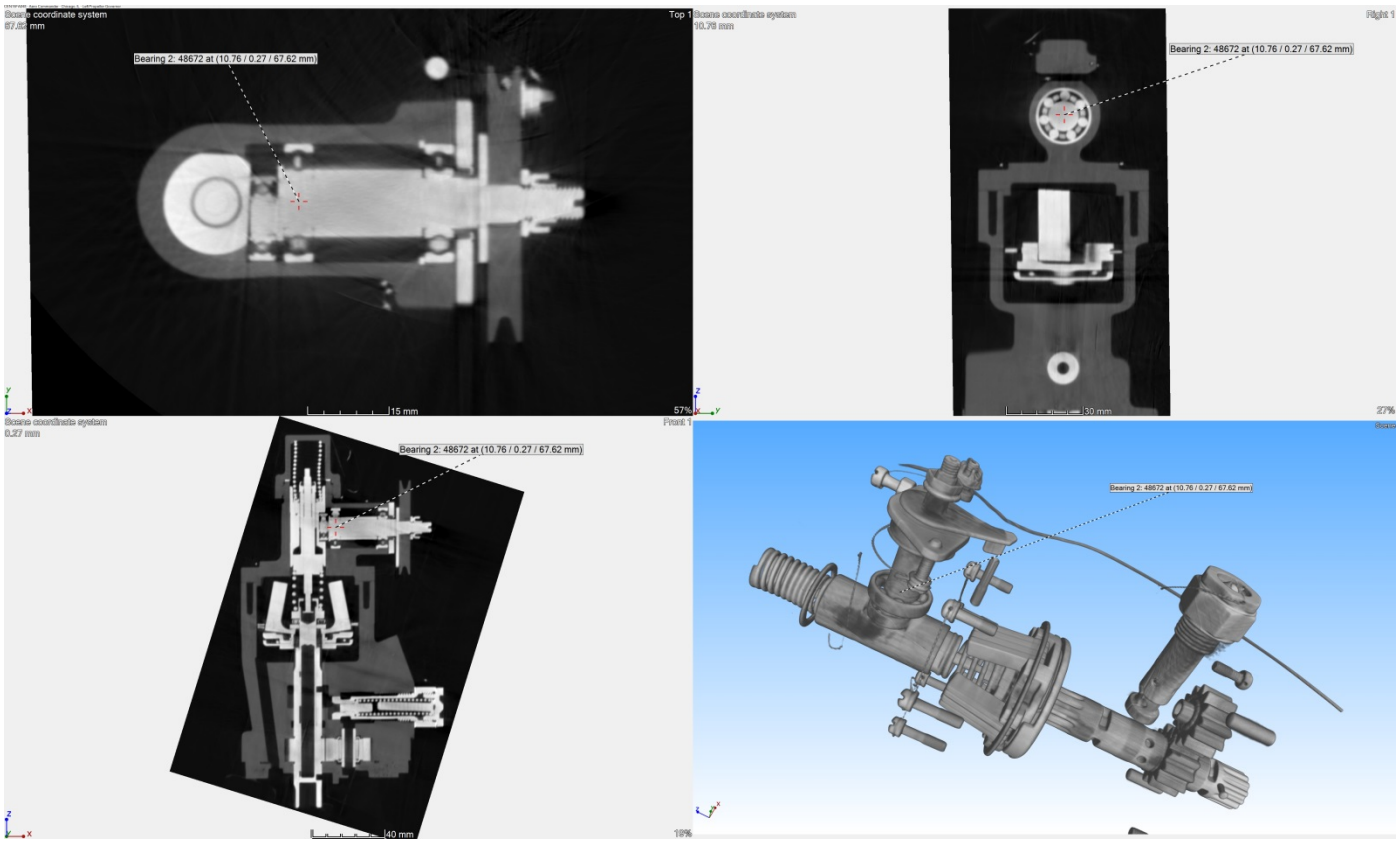

Figure 7
Left propeller governor – standard focus – bearing number 2

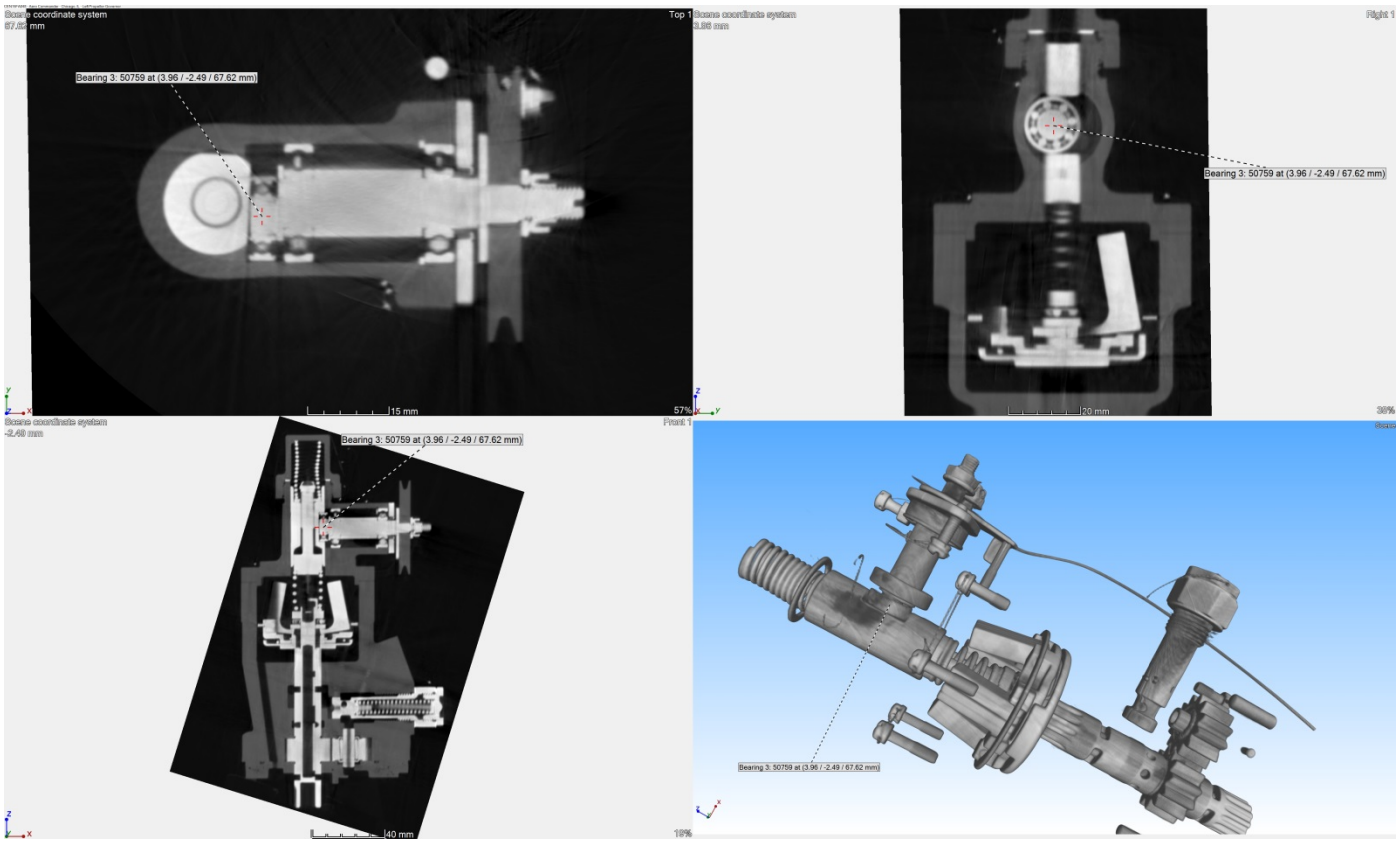

Figure 8
Left propeller governor – standard focus – bearing number 3

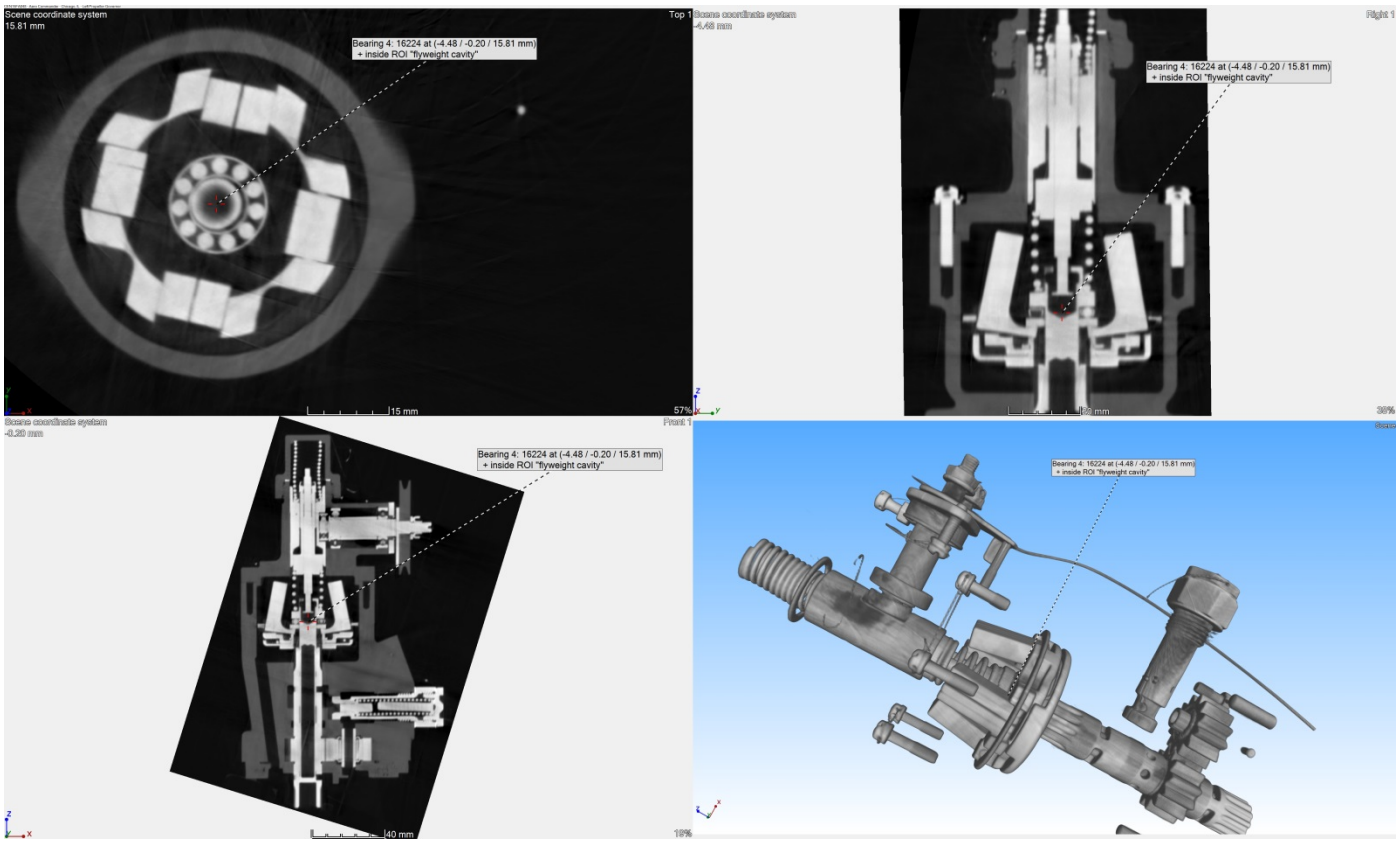

Figure 9
Left propeller governor – standard focus – bearing number 4

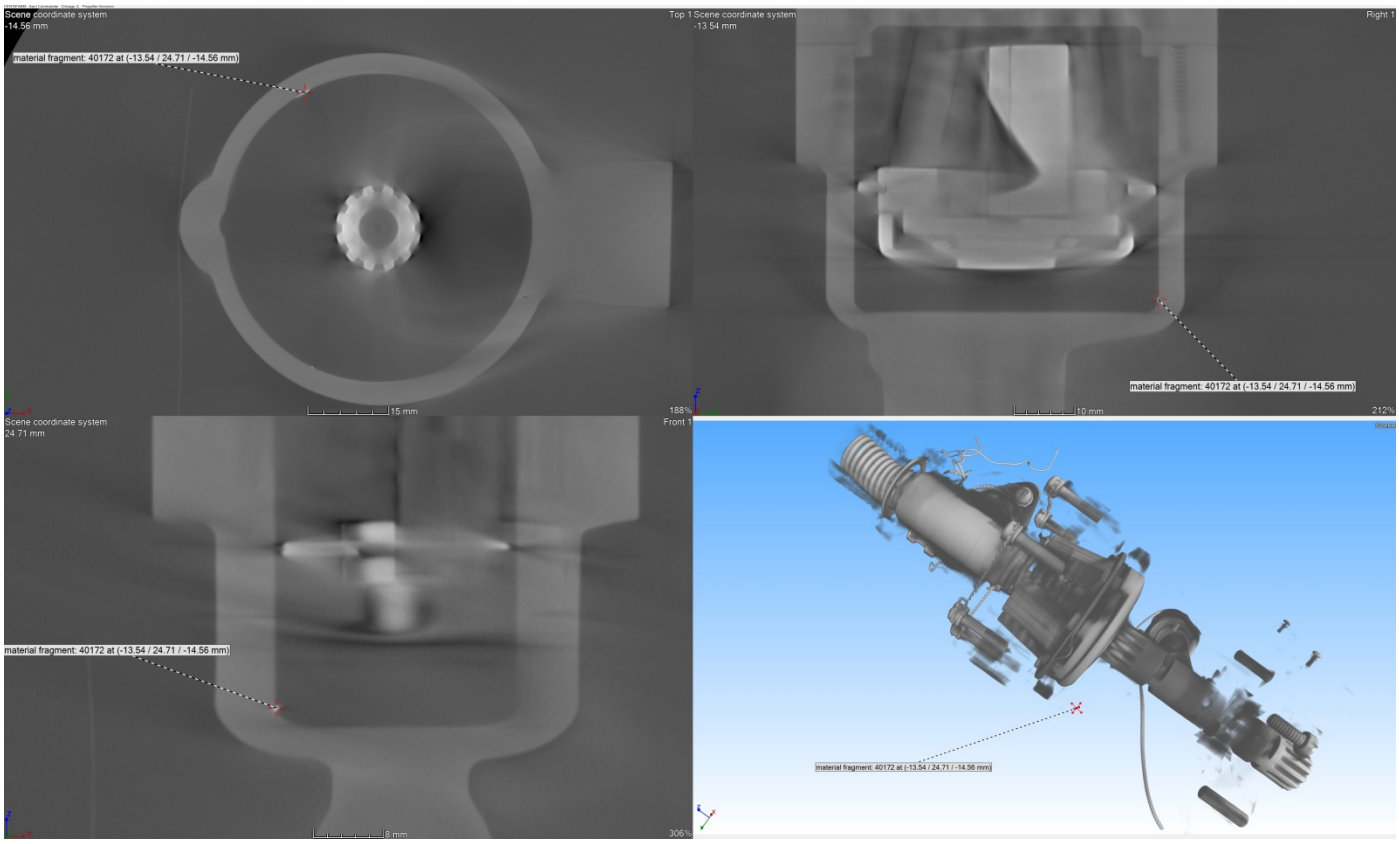

Figure 10
Left propeller governor – microfocus – material fragment within flyweight cavity

2.2 Right Propeller Governor

The computed tomography (CT) results for the right propeller governor are shown in figures 11 through 15. Review of the images indicated:

1. The bottom of the flyweight mechanism was located at the bottom of the flyweight cavity and the driveshaft appeared to be seated inside the flyweight mechanism;

2. All of the bearings within the governor appeared to be intact.

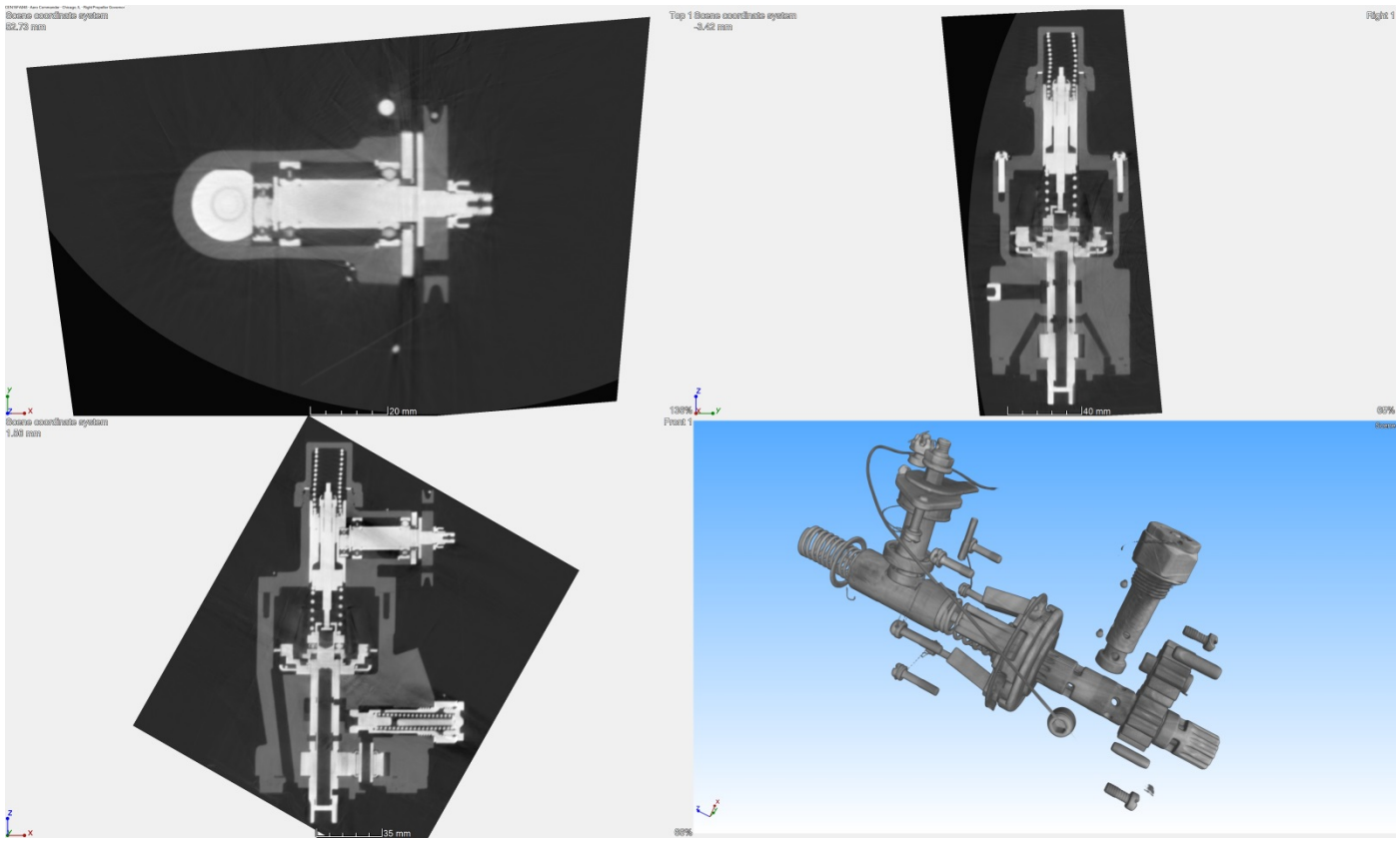

Figure 11
Right propeller governor – standard focus – Overall cross section

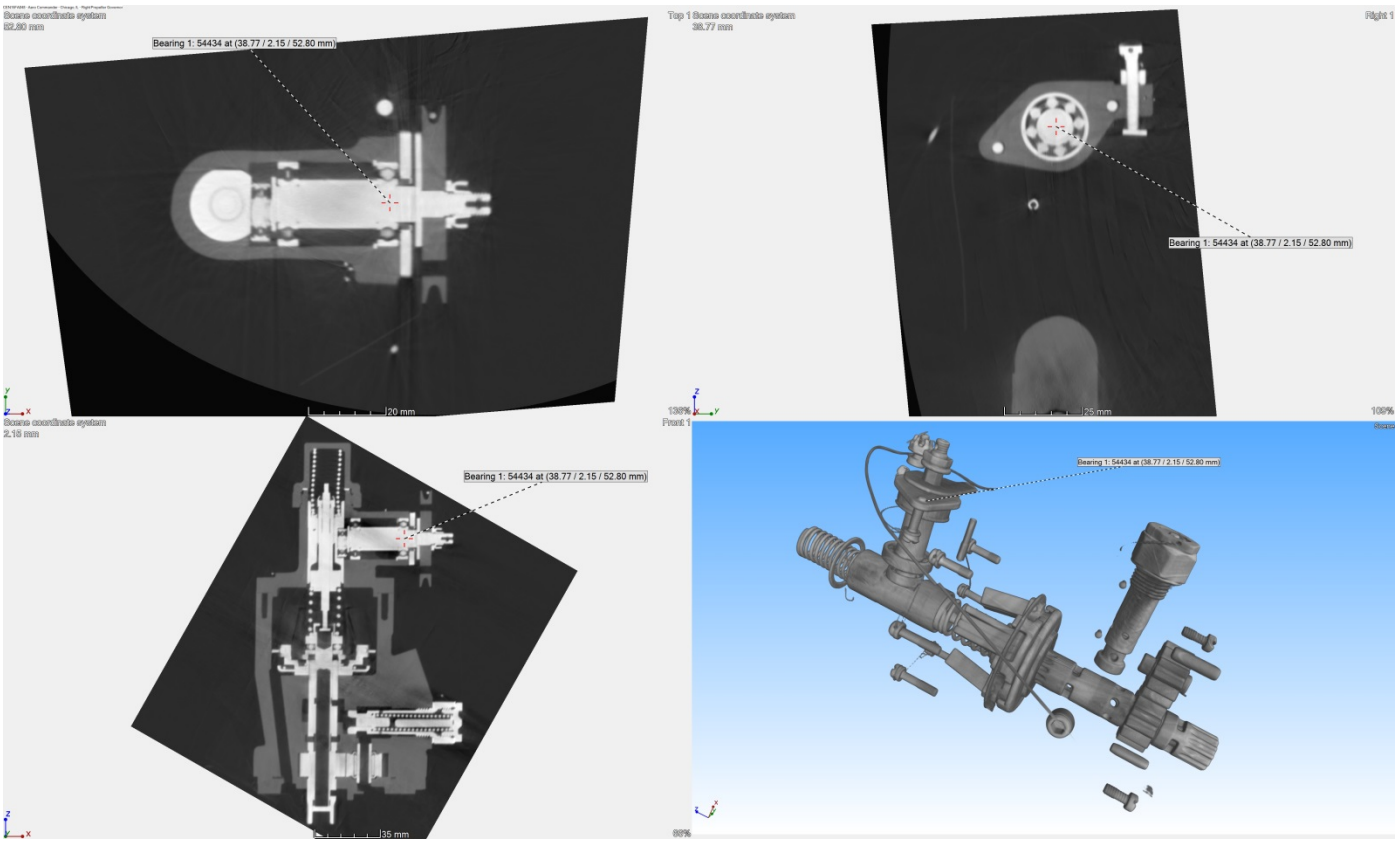

Figure 12
Right propeller governor – standard focus – bearing number 1

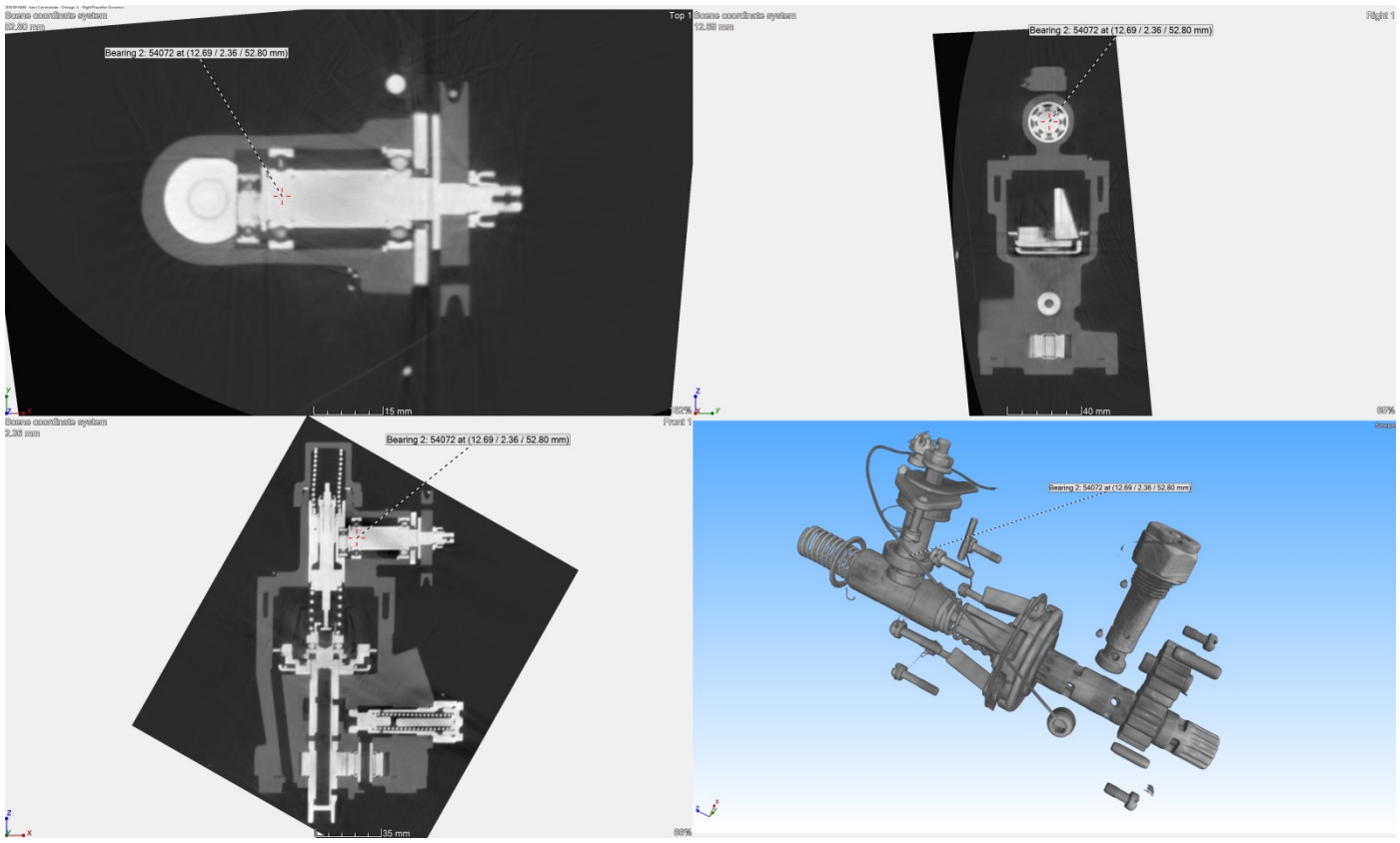

Figure 13
Right propeller governor – standard focus – bearing number 2

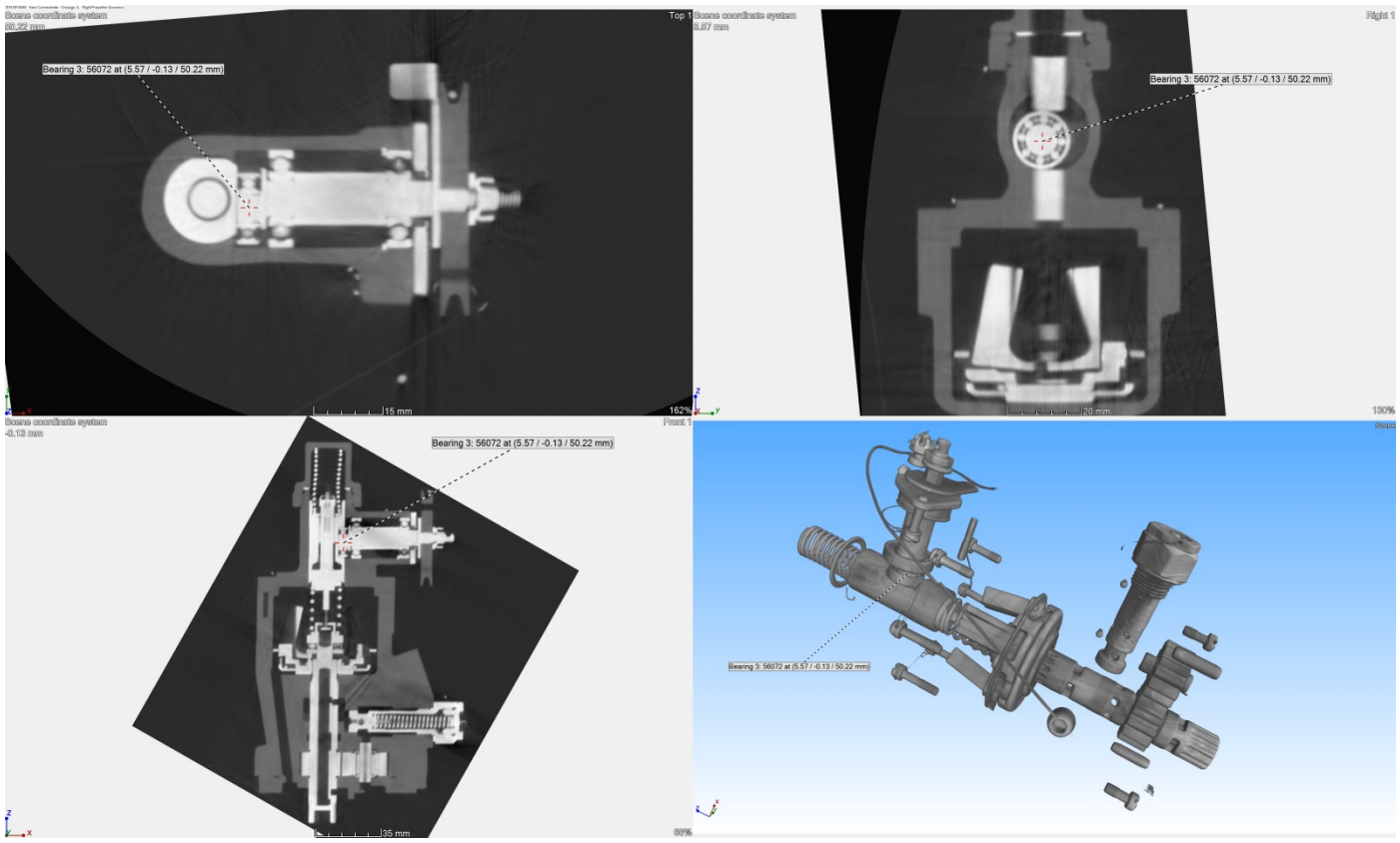

Figure 14
Right propeller governor – standard focus – bearing number 3

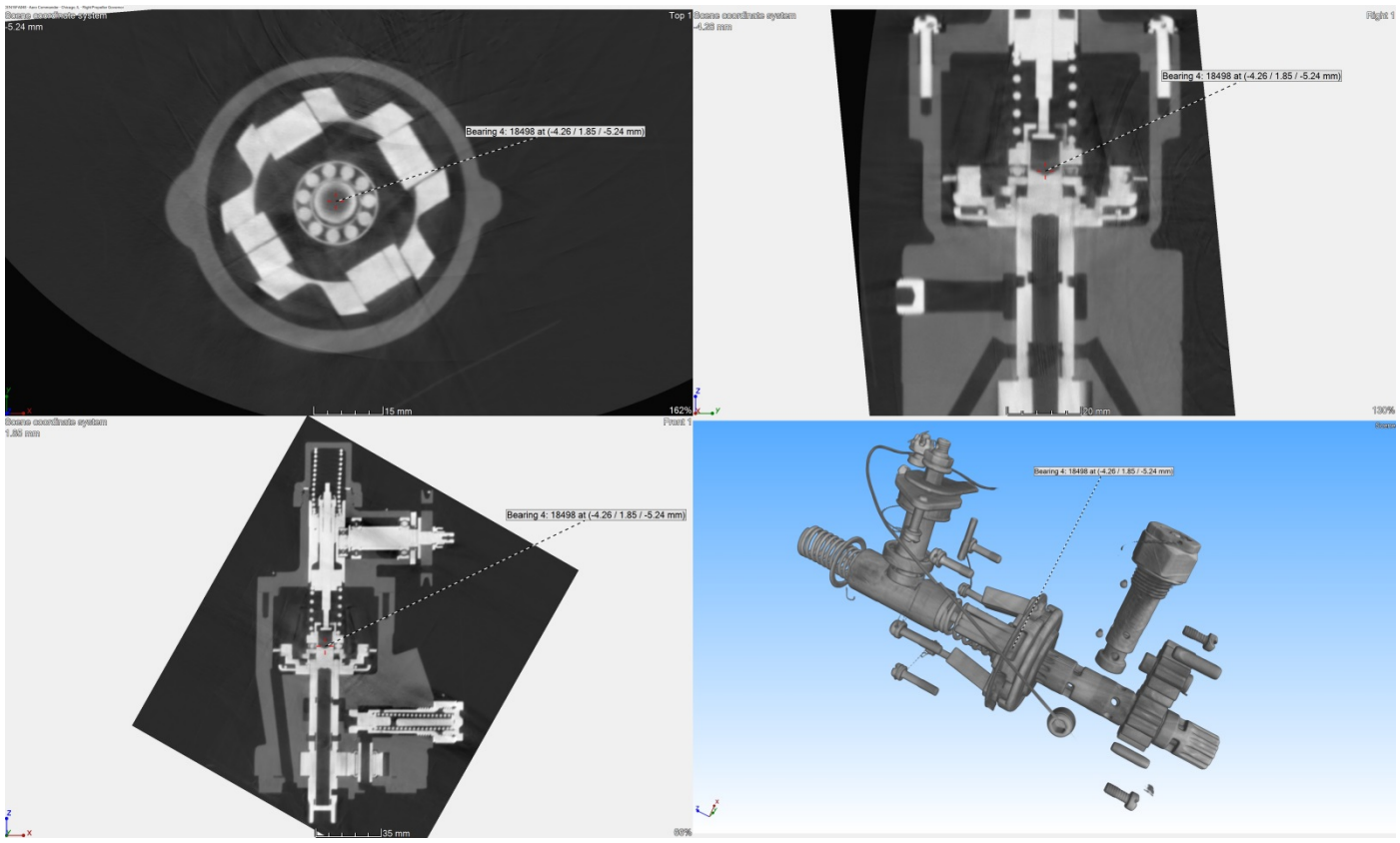

Figure 15
Right propeller governor – standard focus – bearing number 4

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