Finding an Element Tracer for use in the Early Detection of 4 ½ bearing Failure in J52P408 Engines by EDXRF

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The J52P408 engines suffers from a catastrophic failure that involves the 4 ½ bearing assembly. The U.S. Navy's J52 engineering group uses FilterCheck (FC) 300 instruments to perform filter debris analysis (FDA) on J52P408 engines to detect the failure of the 4 ½ bearing assembly. The failure of the 4 ½ bearing assembly is detected through the FDA process by presence of excessive amounts of M-50. However, the J52P408 engine has 5 other bearing assemblies with the same alloy compositions and all seven bearing assemblies are plated with silver (Ag).

In an attempt to ascertain when the 4 ½ bearing assembly has failed, the U.S. Navy J52 engineers contracted Pratt & Whitney Aerospace to plate 4 ½ bearing cages with various elements other than Ag and see if these elements could perform as good as or better than Ag when a bearing cage is fractured. The candidate elements are cobalt (Co), rhodium (Rh), gold (Au), platinum (Pt), palladium (Pd), Indium (In) and Ag. Napoleon Engineering Services, Inc. (NES) was subcontracted by Pratt & Whitney Aerospace to set up and run a test rig with fractured 4 ½ bearing assemblies that were plated with candidate elements. The Joint Oil Analysis Program Technical Support Center (JOAP-TSC) performed FDA with a FC300 instrument on filter elements from the test rig and Spectro, Inc. performed traditional rotrode atomic emission spectroscopy (RAES) and rotrode filter spectroscopy analyses on oil samples (RFS) to detect particles of the plating material being liberated from a fractured bearing cage. Early on in the testing, it became apparent that RAES and RFS could not detect the candidate plating material. Only FDA using the FC300 instrument could detect the plating candidates/elements. This paper will outline the results of the evaluation of the candidate elements/plating materials.