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Covert Solar Power for Drawbridge (Spartan) Camera Test Results White Paper

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Company Name: WilliamsRDM, Inc.
Website: www.WilliamsRDM.com/START
Date of Incorporation: 4/1/1963
Number of Employees: 67

GSA Schedule: An application has been submitted by WilliamsRDM for the GSA schedule for covert power products. Award is pending.

Technology: START Covert Solar Power System

Maturity: The Covert Solar Power System is at a TRL 9, with production units sold and shipped to border patrol sectors and border sheriffs.

WilliamsRDM Inc. is a woman-owned small business located in Fort Worth, Texas, which designs and manufactures military-grade automated test equipment, cable assemblies, connectors, adapters, electronic hardware, and sensor systems. We have over five decades of experience in all phases of electrical, mechanical, and software development, all of which is designed and manufactured at our facilities in Texas. WilliamsRDM is registered to the ISO 9001 and AS9100 quality management standards.

WilliamsRDM is proud to have held a 100% rating in quality and on-time delivery to the government for multiple consecutive years. We have also received dozens of other awards and recognitions over our five-plus decades of service to government and civilian industries alike. These recognitions and awards attest to our company's experience and expertise in developing and delivering quality products.

1 Test Summary

WilliamsRDM conducted two tests of the WilliamsRDM covert solar power product to evaluate its performance compared with a standard Drawbridge (Spartan) camera running on 12 AA batteries. The first test was a standard usage test while the second test was a heavy usage stress test. For both tests the cameras were set up outside the WilliamsRDM building and were configured to take pictures at different intervals depending on the test. The first test was a standard usage test where a picture was taken every 15 minutes and the second test was a stress test where a picture was taken every 2 minutes.

The battery powered control camera was powered from 12 AA alkaline Energizer batteries while the solar powered camera was powered from the WilliamsRDM Spartan Camera covert solar power solution. Figure 1 shows the Covert power solution which consists of a covert solar panel rated for 5W Max output, a battery box with 6V 5.5Ah battery and cables to connect the system to the camera's external power connector.

Figure 1: Drawbridge (Spartan) Camera Covert Power System

The test setup was the same for both tests, the cameras were set up outside the WilliamsRDM building near downtown Fort Worth, TX and were set up to take pictures at the different intervals depending on the test. For the first test the cameras were set up to take pictures every 15 minutes for a total of 96 pictures a day. For the second test the cameras were configured to take pictures every 2 minutes for a total of 720 pictures a day. The cameras were configured to their default picture settings with a Photo Size of 3MP, a thumbnail size of "Normal" 640x480 and the photo burst set to 1. The covert solar panel was placed on the ground in an area where it would receive full sunlight. Data was collected from the Spartan website where the cameras report their battery voltage and picture count each time a picture thumbnail is uploaded. The data was manually logged once per day. The Spartan Cameras only report three battery voltages, 5.7V, 5.1V and 4.8V corresponding to High, Medium and Low Battery.

Result Summary

The WilliamsRDM Covert Power Solution worked very well keeping the solar powered camera operating for the duration of both tests. The tables below summarize the overall test results while later sections provide additional detail about the tests.

Standard Usage Test (1 Pic / 15 Min)	
Camera Power Source	**Battery Life**
WilliamsRDM Covert Power	115 Days (Full Test Duration)
12 AA Alkaline Batteries	33 Days

Stress Test (1 Pic / 2 Min)	
Camera Power Source	**Battery Life**
WilliamsRDM Covert Power	10 Days (Full Test Duration)
12 AA Alkaline Batteries	3 Days

2 Test 1: Standard Usage Test

The standard usage test compared the battery life and picture taking performance of a Spartan Camera with and without a covert solar power system. Both cameras we set up to take a picture every 15 minutes. With this setup each camera took 96 images per day. We ran the test over three sets of 12 AA batteries in the battery powered camera for a total of 115 days. The camera running on the WilliamsRDM covert solar power system remained fully charged throughout the duration of the test while the battery powered camera used three sets of batteries. Additionally, the camera running from batteries collected 9,099 pictures while the camera powered from the WilliamsRDM covert power system collected 10,762 images. Figure 2 and Figure 3 show the detailed test results.

As you can see from Figure 2 the battery voltage reported by the battery powered camera fell over time while the solar powered camera remained at full change. The average battery life of the battery powered camera under these conditions was 33 days. Once the batteries were exhausted and the camera no longer functioned, we replaced the batteries are continued the test. There was a 12-day period over the holidays where the battery powered camera was exhausted and we were unable to replace the batteries. Figure 3 shows the effect this has by showing the cumulative picture count throughout the test. During this camera outage no pictures were taken which translates into loss of operational availability. Even when the batteries were changed quickly there was still some picture loss. To combat this the user would need to proactively change the batteries early to avoid the camera outage which results in wasted battery power. This outage example illustrates another benefit of the covert solar power system where battery changes are not always possible at the time they are needed resulting in system down time.

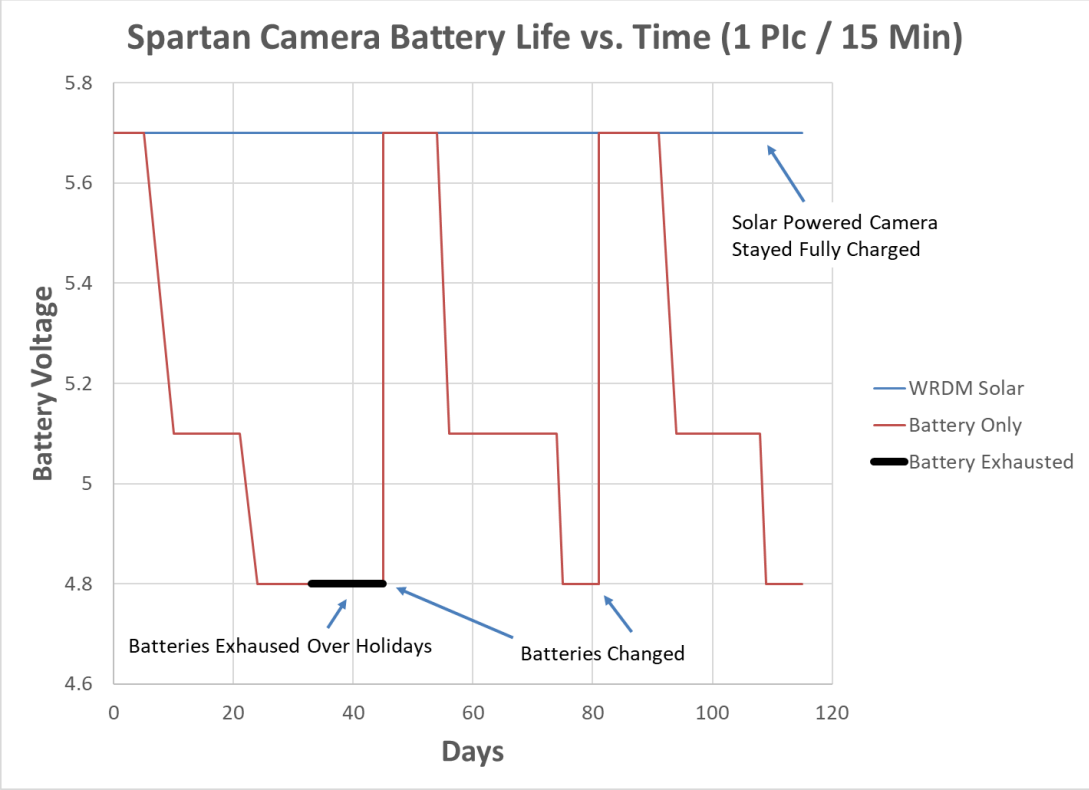

Figure 2: Test 1 Battery Life Vs Time

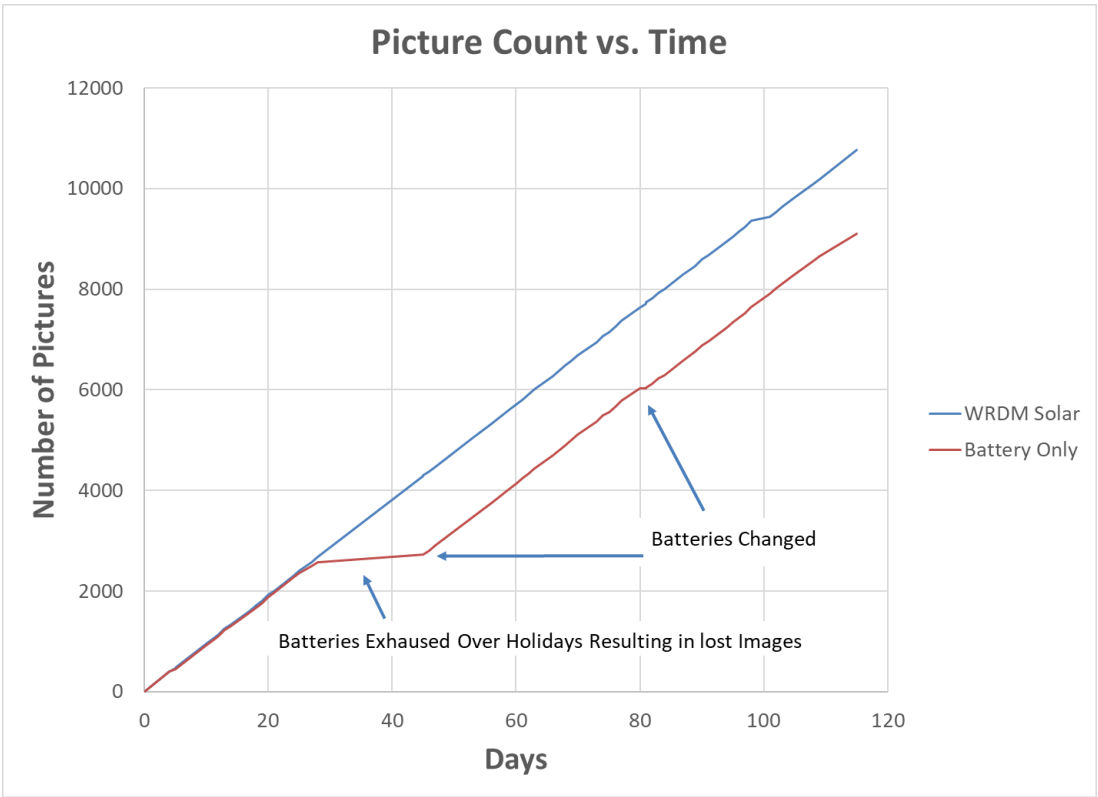

Figure 3: Test 1 Picture Count Vs Time

3 Test 2: Heavy Usage Stress Test

The heavy usage stress test was designed to test the performance of a standard Spartan camera running on 12 AA batteries to one using the WilliamsRDM covert solar power system under an extreme picture load. For this test, each camera was configured through the Spartan camera user interface to take 1 picture every 2 minutes for a total of 720 pictures a day. Because of the high picture volume, the test was conducted over a 10-day period. This test was conducted over a cloudy period which we felt was a good stress test of the system. It was only sunny on day 8 of the test. The camera running on the WilliamsRDM covert solar power system remained operational for the duration of the test, while the camera running on the 12 AA batteries would only last about 3 days. We replaced the batteries once in the battery powered camera when they were exhausted. Over the 10 day test the camera running on batteries collected 2,767 pictures while the camera running on solar power took 7,351 images which is a significant improvement. Figure 4 and Figure 5 show the detailed test results from this test.

As you can see from Figure 4 the battery powered camera was exhausted after 3 days during the stress test while the solar powered camera continued to operate. You can see a dip in solar powered battery voltage on days 7 and 8 of the test because the data was collected in the morning after running all night on battery power and the fact that is was cloudy for the previous several days of the test. Later in the day the battery voltage would rise back up to 5.7V even though it was cloudy but, this data was not collected as part of the graph. On day 8 we decided to start collecting data in the afternoon to illustrate this and the graph started showing 5.7V again. Figure 5 shows how many more image the solar powered camera was able to collect vs the battery powered camera. As you can see the WilliamsRDM covert solar solution provided a significant performance advantage.

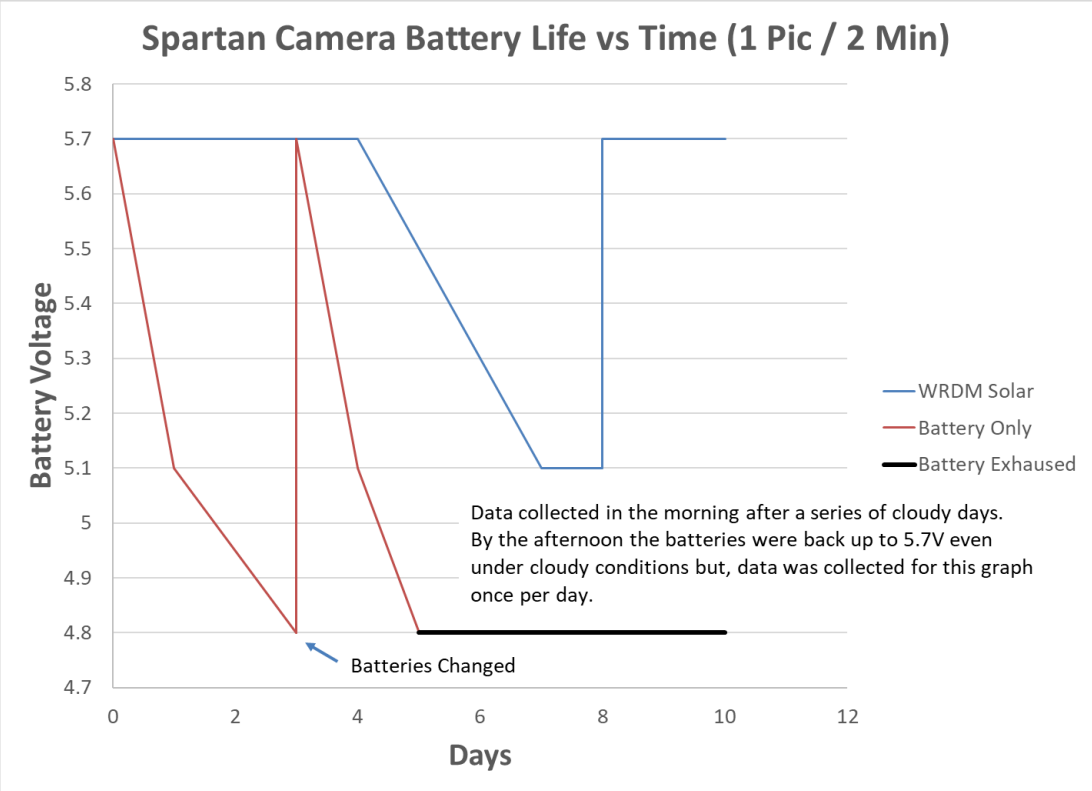

Figure 4: Test 2 Battery Life Vs Time

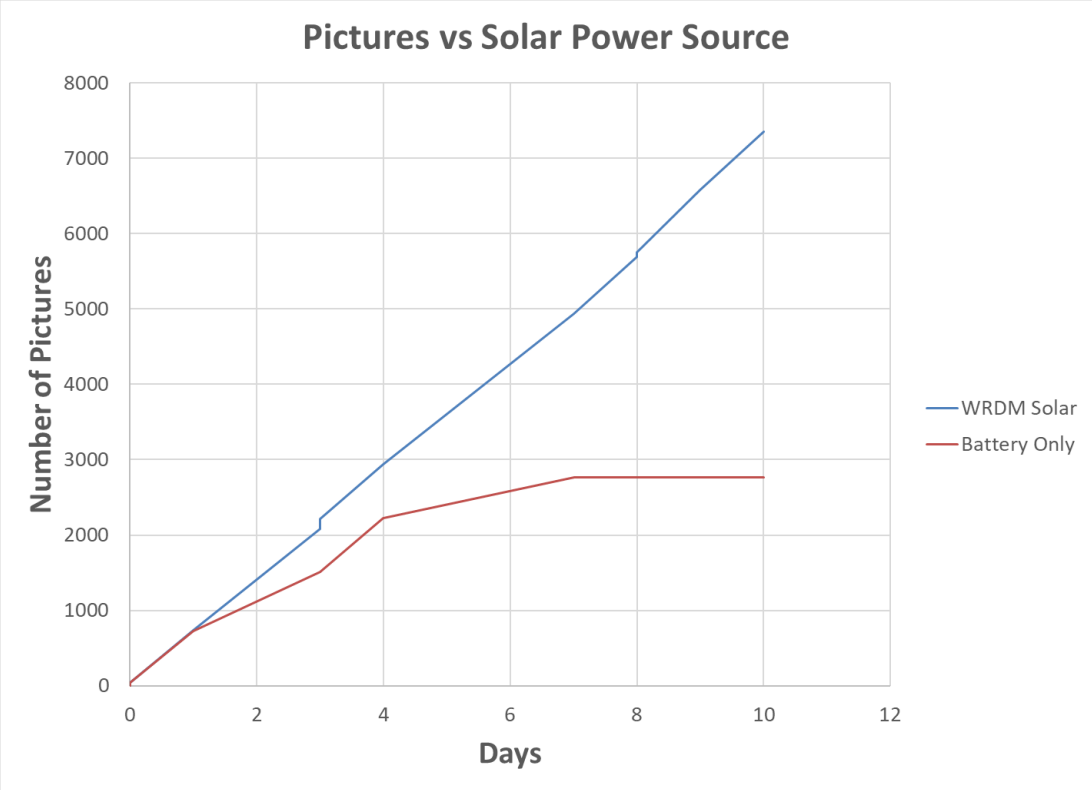

Figure 5: Test 2 Picture Count Vs Time

4 Summary

The test results clearly show that the WilliamsRDM Covert Solar Power System provides a significant improvement in system availability for the Drawbridge (Spartan) camera system compared to using standard AA batteries. This improvement in battery life translates into reduced manpower needed to change batteries and minimized disturbances to the deployment site which can compromise the mission. In both the standard use (1 picture / 15 minutes) and stress test (1 picture / 2 minutes) scenarios the WilliamsRDM Covert Solar Power System provided 100% operational effectiveness for the camera while the battery powered cameras only operated for 33 and 3 days respectively.