**Title:** Assessing Spontaneous Combustion Instability with Recurrence Quantification Analysis

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**Primary Author** (NOTE: will receive all correspondence regarding participation in this program and is assumed to be presenter)

* Name: Chad J. Eberhart  * U.S. Citizen  [ ] Yes  [ ] No

* Organization (contractors provide company name): Jacobs Technology, ESSSA Group, MSFC ER42

* Address: Mailstop ER42

* City: Marshall Space Flight Center  * State: Alabama  * ZIP Code: 35812

* Phone: 256-544-3175  * Fax: 256-544-2032  * Email: chad.j.eberhart@nasa.gov

**2nd Author** Please provide full contact information for each author.

Name: Matthew J. Casiano  * U.S. Citizen  [ ] Yes  [ ] No

Organization (contractors provide company name): MSFC ER42

Address: Mailstop ER42

City: Marshall Space Flight Center  * State: Alabama  * ZIP Code: 35812

Phone: 256-544-6057  * Fax: 256-544-2032  * Email: matthew.j.casiano@nasa.gov

**3rd Author** Please provide full contact information for each author.

Name:  * U.S. Citizen  [ ] Yes  [ ] No

Organization (contractors provide company name):

Address:

City:  * State:  * ZIP Code:

Phone:  * Fax:  * Email:

**4th Author** Please provide full contact information for each author.

Name:  * U.S. Citizen  [ ] Yes  [ ] No

Organization (contractors provide company name):

Address:

City:  * State:  * ZIP Code:

Phone:  * Fax:  * Email:

☐ Check this box if you are listing additional authors on page 2 after the abstract.

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☐ Author(s) has confirmed management support (i.e., required resources) is available to prepare, submit, and present this paper at the above subject JANNAF Meeting.

The presenting author for this paper will be Chad J. Eberhart.

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Spontaneous instabilities can pose a significant challenge to verification of combustion stability, and characterizing its onset is an important avenue of improvement for stability assessments of liquid propellant rocket engines. Recurrence Quantification Analysis (RQA) is used here to explore nonlinear combustion dynamics that might give insight into instability. Multiple types of patterns representative of different dynamical states are identified within fluctuating chamber pressure data, and markers for impending instability are found. A class of metrics which describe these patterns is also calculated. RQA metrics are compared with and interpreted against another metric from nonlinear time series analysis, the Hurst exponent, to help better distinguish between stable and unstable operation.