USING DIRECTED AERIAL ROBOT EXPLORERS (DARE) TO CHARACTERIZE MARTIAN ATMOSPERIC METHANE IN THE NEAR-TERM. M.A. North[1], NWFSC, Eglin AFB, FL 32542, NORTHM1@NWFSC. D.B. North[2], The McLynn Group, Charlotte, NC. Dr. R. Calhoun[3], NWFSC, Niceville, FL.

Introduction: The Pegasus Mars Rover Mission is an ambitious incorporation of the objectives of several cancelled missions developed through the Mars Scout Program. The Pegasus Mars Rover is designed to incorporate two scientific instrument clusters; one would remain on board the rover for surface sampling, while a second cluster would be released into the atmosphere via an atmospheric balloon.

Goals: The Pegasus Mars Rover has 3 primary goals:

1) Examine the cratering process on Mars.
2) Analyze the Martian Atmosphere.
3) Determine the Martian Atmospheric evolution.

The scientific objectives of the Pegasus Mars Rover would be:

1) Characterize the Martian atmospheric methane: where it is being emitted and how often it is being emitted.
2) Measure the structure and dynamics of the upper atmosphere, including the potentially biogenic atmospheric constituents such as methane.
3) Determine the distribution and composition of minerals, rocks and soils of the Martian surface.
4) Analyze the characteristics of rocks and soils to help determine the process that created them.
5) Retrieve mineral compositions of craters to compare the cratering process of Mars to that of the Moon.

Rover Design: Many of the aspects of the Pegasus Mars Rover will be similar to the Mars Science Laboratory launched in 2011. Pegasus will be launched and travel to Mars in the same rocket and travel configuration. It would land using the same "Sky Crane" system for a more accurate landing target area. This means the Pegasus Rover would be roughly the same size and weight as the Mars Science Laboratory. Many of the instruments have already been designed, built, and tested; making them cheaper, more reliable, and easier to replicate.

The current designs from the Jet Propulsion Laboratory of the Mars Aerobot / Balloon System (MABS) is designed to carry a scientific payload of 5 Kgs with a total floating mass of 80.2 Kgs and stay aloft for 90 days [1]. The Global Aerospace Corporation has been working with the NASA Institute for Advance Concepts to explore the weights and designs of a new Mars atmospheric balloon, the Directed Aerial Robot Explorers (DARE) system [2]. This system would allow for an increase of total floating mass to 111 kg and a scientific payload of 10kg – 20kg [3]. The DARE system is designed to guide the Atmospheric Balloon through the atmosphere, as opposed to simply floating with the wind. The increased payload capacity will allow for larger and more complex scientific instruments to stay aloft in the Martian atmosphere and collect samples, while the ability to guide the balloon will facilitate sample collection over a larger area that can be strategically planned.

The Pegasus Atmospheric Balloon will use the DARE system to lift a gondola of scientific instruments off the main body of the Pegasus Rover to analyze the Martian atmosphere. The gondola will incorporate several scientific instruments like the gas chromatographs currently on the Sample Analysis at Mars (SAM), and the Rover Environmental Monitoring Station (REMS) provided by Spain [4]. These instruments will sample the Martian atmosphere and provide answers about the levels of Methane and potential sources of the unexplained methane in the Martian atmosphere.

The DARE system will allow the insturument package to stay aloft for a projected 90 days or longer, circling the planet multiple times and covering several thousand miles. The distance would be dependant on the air currents of the Martian Upper Atmosphere. After 90 days the DARE system would unlikely be able to keep the instrument cluster aloft and would fall through the atmosphere back to the Martian surface. The communications package and scientific instruments would likely not survive the fall from the Upper Atmosphere, however, if the instrument cluster survives the trip back to the Martian surface, it would remain as a permenant stationary scientific observation platform on the Martian surface.

References: [1] NASA Institute for Advance Concepts. (2002) *Planetary Science from Directed Aerial Robot Explorers (DARE)*. Rep. no. 510-09911-00, 25. [2] B.H. (2005) *Mars Balloon Could Offer Supersharp, Superfast Surveys.* Daily Nature and Science News and Headlines | National Geographic News. [3]NASA Institute for Advance Concepts. (2002) *Planetary Science from Directed Aerial Robot Explorers (DARE)*. Rep. no. 510-09911-00, 58. [4] Mars Science Laboratory Launch Press Kit / November 2011. (2011) *NASA*, 17-19. [5] M.N. and D.N. (2012) *Pegasus Mars Rover Proposal*, 1-5.

Potential Rover Design: