Mars Atmosphere Resources Recovery System (MARRS)

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A revolutionary system is proposed for producing abundant oxygen, water, and other valuable products on Mars by compressing, cooling and liquefying the mostly-CO2 martian atmosphere. Oxygen, carbon monoxide, nitrogen, and argon are recovered by utilizing their low solubility in condensed CO2. Water is separated as ice. Reserve liquid CO2, available in large amounts, is used in expansion engines for reliable emergency power and local transportation.

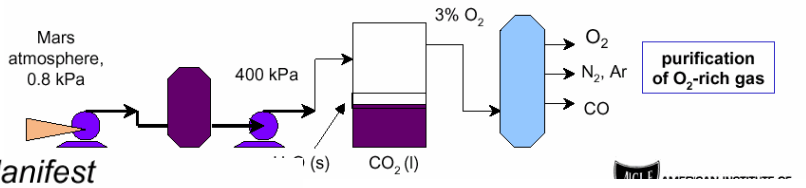
The proposed Mars Atmosphere Resource Recovery System (MARRS) depends on (1) efficient compression and liquefaction of the thin CO2-dominated atmosphere and (2) effective recovery of low-concentration atmospheric components by stage separation. Preliminary studies have confirmed that MARRS can satisfy both these needs by taking advantage of the low ambient temperature and the condensable atmosphere.

This proposal focuses on defining the separation technology and energy recovery needed to establish a MARRS design. Follow-on studies will establish an efficient compression methodology and extend the entire system architecture.

The proposed oxygen and water recovery system is the critical initial technology of a new architecture for human and large robotic presence on Mars. MARRS provides the basis for an architecture that will provide the high redundancy and reliability needed for human-tended missions. It offers the unique prospect of unifying the needed martian surface technologies of air and water production, power production, energy storage and propellant precursor production.

NIAC's objectives for revolutionary systems and architectures are met with a strikingly capable system that uses only thermal energy and physical processing of the atmosphere to produce oxygen and water. Producing up to 2750 kg/day of oxygen and 725 kg/day of water, MARRS can supply the basic resources needed for NASA's Mars Reference Mission. For NASA's Human Exploration and Development of Space (HEDS) enterprise, MARRS is enabling technology for human presence on Mars.

1. **Compress** the atmosphere,
2. **Condense** the carbon dioxide,
3. **Separate** the carbon dioxide from the permanent gases,
4. **Concentrate** and use the resulting oxygen, water, CO, N2 and Ar



MARRS Product Manifest