

Group Dynamics in Long –term blind endeavors on Earth

0.1 As an analog for Remote Space Missions

(Lewis & Clark Expedition, 1803 – 1806, Dynamic Analysis)

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In 1803, President Thomas Jefferson set fourth a military expedition led by Captains M. Lewis and W. Clark (L_C Expedition) on an exploration to learn more about the large territory of land the U.S. had just purchased from France (Cavan, 1991). Their mission was to find a direct water route to the Pacific Ocean “for the purpose of commerce” and further industrial development (Edwards, 1999). Looking back at the events of this exploration, there are many similarities to the experiences future human space explorers will face as we look to colonize the Moon and travel to Mars and beyond (NASA Vision for Space Exploration, 2004):

- The L_C Expedition lasted almost three years and involved a crew of 43 men traveling up the Missouri River to explore the unknown lands and a possible water route to the Pacific Ocean;
- The expedition took place far away from customary comfortable environments known to European settlers in early 18th century;
- The expedition involved a remotely confined high-perceived risk environment with high levels of uncertainty providing stresses and every day challenges for the crew;
- Supplies brought on the mission were limited (mainly a mass/weight issue rather than cost), therefore the discovery and use of environmental resources (In-Situ Resource Utilization approach, including info-resources to mitigate uncertainty) was necessary for crew survival.

The environments astronauts will encounter in space and on the Moon and Mars due to high risk and uncertainty will be in many aspects similar to what Lewis and Clark’s crew experienced, as the environments will be hostile and unforgiving if problems

arise and aren't resolved quickly. The analysis provided in the paper is specifically interesting because the L_C Expedition needed to move extensively and with minimal supplies. Polar remote settings, which were analyzed extensively (Stuster, 1996), were different from this expedition due to the fact that these missions did not encompass extensive movement of crew facilities and supplies and were more like space missions orbiting the Earth. A dynamic phase analysis of the expedition (supported by attempts of math modeling for uncertainty level in relation to small group current status) shows the existence of at least three critical group dynamic development phases of the expedition when risk of failure increases:

- early-mission (when leadership is tested and crew uncertainty for the future is maximal);
- mid-mission (when fatigue accumulation from everyday challenging routines and monotony decreases crew performance);
- and late-mission (when expedition resources including Human Factor potential are depleted).

Understanding the leadership qualities of Lewis and Clark (and relations established and maintained with one another), the selection and diversity of their crew, and the group dynamics that were developed and maintained so carefully during the expedition is important. With this knowledge and understanding one can gain enormous insights useful in the planning and preparation for future long-duration space exploratory missions with high level of autonomy, mobility, minimal primary life support supply and high dependence on material re-circulation and ISRU approach.