Some Comments on the TA06 Roadmap Relevant to EVA Technology

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Overview

- There is a lot to like
  - Many promising technology directions with game changing potential
  - The broad vision of component subsystem development leading to ground integration and validation testing ultimately on ISS is sound.
- EVA system may be too narrowly viewed
- Some areas need more definition
- A few possible gaps are noted
- The elephant in the room

EVA System May be too Narrowly Viewed

- Includes not only PGA, PLSS, PAS as noted.
- Airlock & servicing systems, Tools, Mobility & positioning aids
  - Intersections (& overlap?) with ECLSS and TA07
  - Critical requirements drivers and enablers for noted technologies in PGA, PLSS, PAS

Some Areas Need More Definition

Need	Approach	Path to flight	Time?	Cost?	Value?
Better / faster pressure garment development	Enhanced suit / human computer models	Validated - Applied - ???	?	?	Y
More effective suits - lower mass, lower expendables, less injury, more durable…	Identify, evaluate, integrate, test, multifunctional materials	Coupon tests, ground tests, integrated flight tests	N?	N?	Y
	Game changing architectures, suit configurations and mobility elements - using Adv.Mat	???????	?	?	Y
LEA suits donned extremely quickly, integrated crew escape & crew survival, suit restraint, seat interface & support.	???????	???????	N?	?	Y
Long duration suited ops in contingency - waste management, food & drink, etc.	???????	???????	?	?	Y
Better emergency breathing supply	Oxygen generation, rebreather, filtration	?????? (Solutions apply to different situations and needs)	Y	?	?
Reduce consumables, improve reliability, enhance crew performance	Regenerable CO2, humidity	Test / integrate	Y	Y	Y
	Capture CO2, humidity & regen off back without mass penalty	New sorbents, test / integrate	??	?	Y?
	More robust cooling against microbes and contaminants	Mature, flight design, test, integrate	Y	Y	Y
	Non-venting heat rejection	Develop, test, integrate	?	?	Y
	Variable set-point pressure control	Test / integrate	Y	?	?
	Optimize vent architecture	design, test integrate	?	?	Y
		Integrated PLSS Tests - Chamber, ISS	Y?	?	Y
Increase system performance capabilities / autonomy	Increase comm bandwidth, network radio		Y	Y	Y
	Off head crew audio interface		Y?	Y	Y
	Suit info display		?	?	Y
	Network CWS		Y	Y	Y
	Integrated sensor suite		Y?	Y?	Y
	~3X storage specific energy	????	?	?	Y

A Few Possible Gaps

- Oxygen storage and recharge technology – high pressure or cryogenic
  - Cryogen or high pressure O_2 generation
- Regenerable trace contaminant control compatible with emergent CO_2 and humidity solutions
- Rapid self-donning crew position and load interfaces within PGA
- On-back mass reduction is a critical need and warrants more emphasis
  - Though needed only in out years, it will not be achievable if not integrated into early technology efforts

The Elephants in the Room

- The roadmap envisions a lot of EVA and (implicitly) EVA durations comparable to historic practice.
- Current knowledge of radiation environments and effects indicates high risk that EVA may be severely constrained.
- This could dramatically change the roadmap!
- Emphasis on more fully understanding radiation environments and GCR Q factors early is a crucial need.