Environmental Systems

James Johnson

<NASA - James> Well, I suppose my area of expertise is environmental systems

<NASA - James> life support and thermal control systems...specifically for the shuttle

<liliana> sorry uts a silly? but what do u mean thermak

<liliana> thermal

<NASA - James> Good question - the space shuttle and station generate a lot of heat that needs to be rejected to keep equipment from overheating

<NASA - James> since there is no atmosphere in space, heat rejection is a little tricky

<NASA - James> you can reject heat either through radiation or a processes called sublimation

<janet nieto> what happen if i do not have any proteccion on the space

<NASA - James> on Earth, you mostly reject heat through conduction or convection

<liliana> what does that do?

<NASA - James> let me explain some of those processes

<NASA - James> conduction is transferring heat via direct touch...if you hold a bowl of ice cream, you warm it up directly by your body heat and cause it to melt

<NASA - James> convection is transferring heat by air...that's how a fan keeps you cool in summer

<liliana> that is good to know

<NASA - James> sublimation is a process where a liquid immediately becomes a gas and carries heat away with it. Kind of like using rubbing alcohol to cool a fever

<liliana> so like all other speakers how did u get interested

<NASA - James> on the shuttle, we do the same with water

<Nathan Carey> wait, then what's the difference between sublimation and evaporation?

<NASA - James> Well Liliana, I was first interested in aviation

<Shea Snider> are you able to recycle this water used in the cooling process?

<NASA - James> then in high school that moved to space

<NASA - James> Excellent question Nathan

<NASA - James> sublimation is a form of evaporation

<liliana> is it healthy

<Nathan Carey> I learned some about sublimation of ice on Mars, but I thought it was from solid to gas

<NASA - James> you're right...what happens on the orbiter is we spray water on our cooling loops

<NASA - James> the water freezes almost instantly and then sublimates by going straight to gaseous state

<Nathan Carey> oh wow

<liliana> wow

<NASA - James> that process carries away the heat

<NASA - James> we also use radiation via the silver lining on the payload bay doors

<Shea Snider> is the direct sublimination caused my the extremely low pressure?

<NASA - James> Yes Shea

<Shea Snider> I'm picturing the phase-change chart of H2O.

<NASA - James> perhaps a better example of sublimation would have been dry ice

<Nathan Carey> yeah...

<Shea Snider> Is space truly a 0 atm environment?

<liliana> i agreee

<Nathan Carey> I don't think so...not quite

<NASA - James> true space is...but the shuttle actually operates in extremely high atmosphere

<NASA - James> For most of our calculations though, we can consider it near 0

<Nathan Carey> so does it gain more heat from sunlight or from friction?

<NASA - James> The orbiter and space station gets most of its heat from all of the equipment operating

<Nathan Carey> wow!

<NASA - James> but the sun and reflection from the earth add to it to a much smaller degree

<Shea Snider> As long as the pressure is below .006 atm I guess sublimination works. Do you have problems once the pressure returns to near 1atm as you near earth?

<NASA - James> If we have problems cooling the vehicle, one of the first steps is to start powering things down

<NASA - James> Yes Shea, then we have to use a different system for cooling. On entry, we can use sublimation until ~100,000 feet in altitude

<janet nieto> i am already here

<janet nieto> what are you talking about

<Shea Snider> What system takes control of the cooling below 100,000 ft?

<NASA - James> From there, we usually use a 'coldsoak' which is when we made those shiny radiator panels really cold by pointing them towards deep space

<NASA - James> Once the 'coldsoak' is used up (usually just after touchdown), we use ammonia to cool the orbiter

<NASA - James> and that system uses evaporation by spraying ammonia on our cooling loops

<NASA - James> once the ammonia is gone, we have to either power down the shuttle or make sure techs have connected a refrigeration system to cool things

<NASA - James> that's shuttle cooling in a nutshell I suppose

<Nathan Carey> so coldsoak is roughly like using an icepack in a boxed lunch?

<NASA - James> yup Nathan. Our radiators hold freon, which we try to get really cold before entry, but not cold enough to freeze

<liliana> so what subjects did u take for thia

<liliana> this

<NASA - James> I got a degree in Mechanical engineering

<NASA - James> most of my coworkers have similar engineering degrees

<janet nieto> i want to be an enginer

<liliana> any minors

<janet nieto> a chemical enginer

<NASA - James> no minors for me. We have a few chemical engineers in mission control

<janet nieto> realy

<Nathan Carey> so are thermal concerns the reason why everything NASA uses is white? (EVA suits, robotic arms, the shuttle, etc.)

<NASA - James> most are mechanical, aerospace, or electrical, but it doesn't really matter

<janet nieto> so i can have an oportunity

<janet nieto> there

<liliana> what subjects did have to take to get ur degree

<NASA - James> yup, anyone with just about any engineering, math, or physics degree can work in the control center...its the engineering thought process we look for.

<NASA - James> Well Nathan, white helps and is definitely a large part of why so many things are that way

<janet nieto> i want to have a menor in phisics and math and my mayor in chemical enginer

<NASA - James> Some of it is just that's what the materials happen to be colored though!

<janet nieto> did you are talking about the cooling and heating on the space or...???

<janet nieto> i am lost

<NASA - James> Well Janet, you'd have more math/science background than most of my immediate co-workers! It would make you very well prepared!

<NASA - James> Yes Janet, we were talking about cooling things in space.

<liliana> so u enjoy ur job?

<NASA - James> I am responsible for shuttle cooling as well as the life support systems

<NASA - James> It definitely has some exciting challenges...the missions are really fun to work!

<janet nieto> but if the space is cool what did you need to cool the shuttle

<janet nieto> ??

<janet nieto> or is not?

<NASA - James> Its the lack of atmosphere that makes cooling the shuttle a challenge, and we need to cool the shuttle due to the heat generated from all of the equipment running on the shuttle

<liliana> have u ever helped anybody with ur field

<janet nieto> when i do my essay back to the moon i was reading in some part of the internet that the minimum temperature in the moon is like two thousand something

<NASA - James> I've helped a few folks in engineering along...I help train some of the flight controllers in mission control now while I work there myself

<Nathan Carey> so, life support...does the shuttle use chemical systems to recycle oxygen, or do you mostly have to carry an onboard supply?

<NASA - James> The shuttle carries all of the oxygen it uses with it

<NASA - James> The space station uses stored oxygen it gets from the shuttle and other spacecraft as well as generates it

<janet nieto> what if the oxigen is finish

<janet nieto> ??

<Nathan Carey> so do you know much about the systems that are being considered for Mars missions that would eliminate the need for carrying extra oxygen?

<Nathan Carey> so you could recycle it completely