

Photo Bioreactors on the Moon

John Landers: 2037

John Landers was a little uncomfortable about being asked to give a practical lecture on Photo Bioreactors for Regrav Technology 101 at Sydney University. But, he had to agree with James that the lecturers would not have the experience to do justice to this particular practical session, and life had to go on as normal. So, on his first full day to himself since returning with the Crystal Tablets of Ra Hark he found himself on final approach into Sydney University.

Landers glided the DD7 silently in from the north. Over the old sandstone and slate Anatomy Building and gently past the rugby field, millimeters above the tree line. With only manual control, Landers toggled the DD7 with beautiful precision. The entire three hundred and twenty metres of steel hull sat hovering one hundred millimetres above the old cricket field. The huge steel bow, intimidating all who walked through the car park of St Johns dormitory.

‘Not too shabby for an old bloke,’ he smirked as he lowered the forward belly plank and looked out across the car park to shocked expressions.

‘No need to be concerned Earth Citizens, I, Klartu, come in peace,’ said Landers laughing at his own joke which not one student thought was funny.

‘Looks like the Earth really *has* stood still, ah ... OK. My name is John Landers and this very fine ship is the DD7. You may be familiar with the DD7’s work on Mars if you watch Foxlite. As you can see, the DD7 is a converted oil tanker for atmospheric mining work on the Moon and Mars. She, and I will be giving today’s practical. We will be working on the Moon, cleaning and scrubbing a photo bioreactor used in the production of protein and bio fuels. So let’s go and get dirty.’

But the confused faces still stood their ground mystified by Landers’s approach.

‘OK, let’s try that again. Today’s practical is simply that. We have a photo-bio-reactor that needs flushing and re-culturing on Moon Base M17, located in the Sea of Tranquillity. If you guys and girls would like

to participate in a real practical come on-board and be seated and we will lift off for the Moon, ETA docking in seventeen minutes. M17 is a dome-protected site so you need bring nothing special. The practical will be three hours and you should be back here in less than four hours as per the prac allowance.'

'Are we good to go?' said one of the female students as none had been outside the atmosphere before and Landers standard clown and humour approach didn't really inspire enthusiasm. Seven were adamant about staying behind until Landers casually sat on the belly plank and spoke softly about how space travel was an essential part of their training and that this first time excursion would be an experience to remember for the rest of their lives. Exposing his gentle and confident tone created an intrigued sense of passion and inspiration in their uncertain young lives.

Suddenly, and quite excitedly, sixty intrepid off-worlders were ready to set sail for the Moon.

Awed a little by the sheer size and height of the DD7 the entire class made their way back through the old diesel engine room, humming and glowing from the large Regrav II engine. Up they climbed through the seven stories of super structure to the Command Bridge, to gaze back down over the University grounds. Young minds of science now filled with the excited anticipation of some new and fantastic carnival ride.

Landers requested automatic helm and the monster lifted off, casually turning and slowly accelerating north back over Sydney Harbour while stunned students looked out the many side-view portholes, speechless and now a little freaked out again.

With Sydney being such a beautiful view from the air, Landers decided to linger and slow the escape trajectory. Allowing for an entertaining and relaxing trip into space. Once clear of atmos traffic he again requested auto helm and began discussing and outlining their practical session. He was quietly checking for flight stress.

Everyone stayed focused on the view and no one was speaking much. So he just talked in the background while also looking down at his favourite surfing spots. As the sky turned to darkness, sixty young minds experienced that strange feeling of rapture, like coming home after months away. They gazed out in silence at their future.

Landers understood their feelings and once they were clear of Earth orbit, he finally spoke softly describing how the DD7 would make course

corrections and move the Earth into a semi-Sun-eclipsed position on final approach.

‘We’ll adjust for a final inbound path across the Moon’s night. Low Moon orbit always makes for a stunning view of home. And, as we approach M17, you will see the lights of massive mining cities and manufacturing sites, now harvesting the Moons rich resources.’

Once he had their calm attention he explained the prac session and settled their nerves saying they would only be assisting the shift crew in their routine maintenance of a bacterial protein bioreactor.

‘All maintenance work on bioreactor silos is carried out in the twilight of the lunar cycle. Because the Earth sequences the Moons rotation, its day/night length is locked into its orbital rotation of twenty-eight days.

Therefore, our reactor culture day equals fourteen Earth days. We rest the cultures in the lunar twilight for three days. Then artificially light them up for eight days and then rest them again before the long natural lunar day starts again.

This particular reactor plant produces oxygen for all mining and exploration sites. It also cultures a high protein food substitute for Moon workers. We found, to work in low gravity space for long periods, we need to eat foods grown in space. There is a subtle change in the protein structures that support a similar bone structure variation and also stops muscle deterioration. So you see the code knows and low gravity food manufacture must always be an important part of space exploration.’

Landers continued with background information saying, ‘These bioreactors culture Australian freshwater algae in water harvested from below the Moon’s surface. There is still an abundance of water trapped on the Moon below the surface and huge tunnel drilling machines constantly mine it for conversion to oxygen, hydrogen and breathable air. Enough air to make a complete lunar atmosphere supported under a Regrav dome.’

The DD7 glided in slowly with a tourist-like fly-by of the acne-covered surface retracing the flight path of the Apollo 11 mission. They came up on the famous landing site and looked down in wonderment before locking onto final approach M17.

The DD7 slowed down to twenty kilometers per hour as they entered through the M17 dome field screen and proceeded to touch down in, the crow park.

The forward belly plank, located where the old propellers and rudder use to be, came down and sixty faces peered out not quite able to walk the last six hundred metres. Landers was last down from the Command Bridge and stood back as two young women were the first to step forth onto the dusty old Moon.

‘Come on you guys,’ Landers said as he walked through the group and down the plank, ‘and please no, one small step for man jokes. Orr, OK then ... if you must. Come on, we’ll sample some of the local tucker before we start. Fancy a Moon Macca’s?’

After the meal they massed into a disorganised group and walked over toward the silo stacks, still a little apprehensive.

The silos stood in a mass similar to massive concrete wheat silos, over two hundred metres high, semi-transparent and all varying slightly in colour with a weird phosphorescent glow in the lunar evening.

Landers said, ‘You can check the health of a silo just by the colour. The bacteria silos start to go a dark brownie colour if the culture is too thick and if over fed they go a light fawny-brown colour.’

The algae silos stop glowing and begin to clump and turn a blue-black colour if not fed correctly. That excess dies off turning into a bio-fuel base very similar to crude oil. When they start to lose their glow, you know they’re hungry. You can also do a full bio-scan or microscopic examination for numbers and nutrient levels if you really wanted to get technical in day light.’

He opened a plastic door that sealed off the silos work and maintenance area and ushered the students inside the moon-dust free zone. There he greeted two of the shift staff and introduced them as Will and Steve. Steve took on the job of instructing the group as to what was about to happen and said they would require ten teams to record and activate the different procedures.

‘The silo for today’s prac has become clogged with bacteria used to consume frozen toxic power plant emission slabs. It will be our job to remove fifty per cent of the culture. We will be containing the waste and transporting it to another silo for further reduction consumption by another species of bacteria. Five groups of six students can use the Regrav hover suits. It is your job to look after the upper openings two hundred metres off the ground. You will be adjusting carbon dioxide and airflow, water flow and flush nozzles and supervised by young Will.’

‘These silos are sealed and have a constant flow of carbon dioxide and carbon monoxide to feed these anaerobic bacteria. The gasses are blown down one silo and back up the next,’ Will yelled as his crew floated two hundred metres off the ground, looking down into the big dark hole filled with black plastic mesh. Ok, let’s begin the flush,’ he said as thirty faces peered down into the black hole.

‘We bypass the flow to any silos needing maintenance so we need to be fairly quick, or they die. And, anaerobic means the bacteria would die in the presence of oxygen. So our flush has to be carefully administered not to get air in the mix. We wash a percentage of the brown sludge off the internal mesh screens. Then capture it in bins down the bottom of the silo and that’s where your fellow students take over,’ Will explained, softly, now properly adjusted on his voice com. ‘So be careful it looks bad and it smells worse.’

From the capture bins on the bottom, the ‘on ground’ groups transported the bacteria sludge to another silo. There it was loaded into an airless container, pumped to the top, and gently sprayed into a new silo. The falling brown mist of living bacteria easily settling on clean screens and begin the process anew.

‘Careful,’ Steve said to the first ‘on ground’ group. ‘The sludge smells like really thick dog farts once it is taken away from the carbon dioxide. So do not get any on your skin. You won’t be able to get the smell out. It’s so chunky you can carve it,’ he joked laughing at the pursed looks on their faces. ‘Some bacteria start eating themselves and give off sulphide gas so we put high carbon dioxide levels in the water spray and it works like an anaesthetic but it still won’t stop the smell.’

‘And you turn this crap into food! That’s disgusting.’ Said a bewildered student on the verge of dry reaching.

‘Makes a damn fine Mother’s Meat Pie with sauce. Also churns out a pretty mean McMoon with cheese. Big hit with the miners hereabouts. One hundred per cent protein don’t you know,’ said Steve straight faced as a few student began to hurl an unsightly yellow liquid. A McMoon with cheese had been the preferred breakfast.

After several flush and feed transfers, the groups reassembled and changed jobs so everyone experienced the excitement of Regrav hover suits.

Just on three hours had passed when the final shipment made its way to the new silo. Landers gathered up his young troops and they all gave a hearty thank you and excited goodbye to the two humanoids, Steve and Will. The opportunity to participate in actual atmos reactor work had been more fun than work. Not to mention, the chance to fly like a bird ... inside a reactor dome while looking out across the beautiful old dusty Moon.

‘I would appreciate a summary of today’s efforts noting sizes, species, gases and flow rates please. Consumption and output calculations will get you a D or maybe a High D. If you need assistance you can always get me on the Earth Net.’

Twenty-two minutes later, the new space explorers were still as excited but a little stunned by the days practical session. It had ended all too quick as they wandered off across the old cricket fields of Sydney University.

Landers thought to himself, *‘Regrav Technologies really needs a LZ on the roof of the University of Technology Building. This green area is too hard to park all three hundred and twenty metres of the hull’*, and then he smiled as he thought of the Dean and what he might say when he found out about a dirty old DD7 oil tanker being parked on the lawn.

‘Computer, set a course for AASI Base if you would please.’

‘Copy that Commander. ASSI Base in seven minutes,’ confirmed the newly installed Flight Systems Command.

