Product test drive

By **Geoff Young** of BPO.

I thought, wouldn't it be cool if there was an independent review of water and wastewater technology in this magazine, which looked at available technology, similar to car reviews in car magazines?

Well, I am not offering quite that yet, but what I am proposing to do is a couple of reviews each year to help you make decisions about instrumentation. As many of you may already know, I am a bit of a geek when it comes to open channel flow measurement, so it is appropriate that the first 'test drive' is on an open channel flow device.

The product

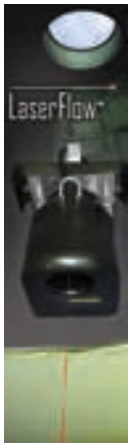
First up is the Teledyne ISCO LaserFlow unit for open channel flow. I first became aware of this technology about four years ago and, like a child with the latest toy in the toy shop, I wanted one. When I found out the price was between $25,000 and $30,000 depending on the add-ons, I was a little less enthusiastic.

Most would recognise ISCO as manufacturers of auto samplers and, speaking as someone who has used ISCO gear for over 25 years, it's got a well-earned reputation for reliability.

It has taken four years for the LaserFlow technology to reach the Antipodes and John Morris Scientific was generous enough to loan me a unit to have a play with. Whanganui District Council was then kind enough to let us install the unit upstream of a 12-inch Parshall flume that scored highly on compliance with the ASTM D1941 standard. (Sadly, the flume is not one that we installed but, when it is the first of these test-drives, beggars can't be choosers.)

The LaserFlow unit differs from most in the market place for the following reasons:

- It offers multiple point velocity measurement across the flow cross-section
- It is non-intrusive, so you are mounting it over the flow, not in the bottom of the flow (so there is no need to stop the flow and no need to get limbs and tools covered in the unmentionables found in the bottom of drains)
- It uses laser technology, and
- Post installation – no ragging.



Those unfortunate individuals who have worked in this field would have had experience with bottom-mounted area velocity devices. The one I have had the most experience with is the little brother of the LaserFlow, the ISCO 2150 device.

These units are pretty good pieces of kit except for the requirement to mount them in or near the bottom of the flow. The units have a transducer that seems to snag every piece of toilet paper or suchlike that passes through the pipeline. What doesn't get snagged on the transducer invariably gets caught up in the cable. Left unattended for too long, either the line will block or, as we have experienced sometimes, the transducer will become dislodged and torn away. This is not a criticism specifically of the 2150 – we have had three different makes of this type of device and they have all suffered the same problem. So, you either have to go down and clean them with a toilet brush on an extendable pole every couple of days or wait for the failure. The good news is, there is light at the end of the tunnel, laser light! Don't stare straight into it; it will probably blind you!

Our demo unit didn't have the ISCO mounting kit, so we had to make our own. No sweat, after all, we are Kiwis. Quick chat to the stainless steel workers next door and a mounting frame was fabricated. The LaserFlow transducer has quite a cool mounting method that enables you to extract it from the frame without getting down to it for situations like mounting it in a manhole. Downside: "Would you like fries with that?" – you have to buy the special ISCO recovery tool.

The physical mounting of the instrument in the flume chamber went relatively well. Battery-powered concrete drill and a Chemset gun and we were in business.

Levelling the instrument was done using a chain back to a vertical leg on the frame. Not being totally happy with that, we made a quick trip to the local hardware store and procured some additional chain and a turnbuckle and secured it to the roof of the flume chamber. Don't judge me – it's worth over $25K and it wasn't ours!

We are probably a bit paranoid about this after purchasing an $11,000 area velocity meter and

installing it at Franz Josef only to have it washed away to the Tasman Sea a couple of weeks later when the river decided it quite liked the land the Waste Water Treatment Plant was on. Admittedly, no chain would have saved that unit, but in this situation, it seemed prudent.

The controller for the unit was an ISCO 2160, very similar to the 2150, with configuration and download via the ISCO FlowLink software.

I would have preferred the signature controller for permanent installation as you don't have the problem with constantly replacing batteries. Configuration allows you to switch on or switch off up to 15 velocity measurement points – really useful when you have mounted it offset to the channel and don't want it measuring the velocity of the wall.

Also, if you did try and measure the wall, it returned a null value which was excluded from the average velocity measurement. Adjusting the level measurement was a case of physically measuring the level and entering the correct level in the adjustment box. The level measurement method was ultrasonic, which is not my favourite technology and, from my perspective, a bit of a let-down for what should otherwise be a nice piece of kit.

We would have liked to have done regular downloads during the test time, but the unit was five hours' drive from our office, so we waited patiently for the end of the trial.

Our results

I had great expectations for this to be an instrument that would be easy to set up and usable in a multitude of applications.

On this front the LaserFlow came up short. Just looking at the daily totals from the flume versus the LaserFlow, the LaserFlow results came back at a whopping 50 percent greater than the flume results.

Now remember that this is a flume that had a very good compliance score with the ASTM standard. So to better understand what was going on, I did a direct comparison of the level data, and although there was some differential between the local radar and the ISCO ultrasonic, there was nowhere near enough to explain the massive deviation in the daily totals, so I couldn't just blame the ultrasonic level.

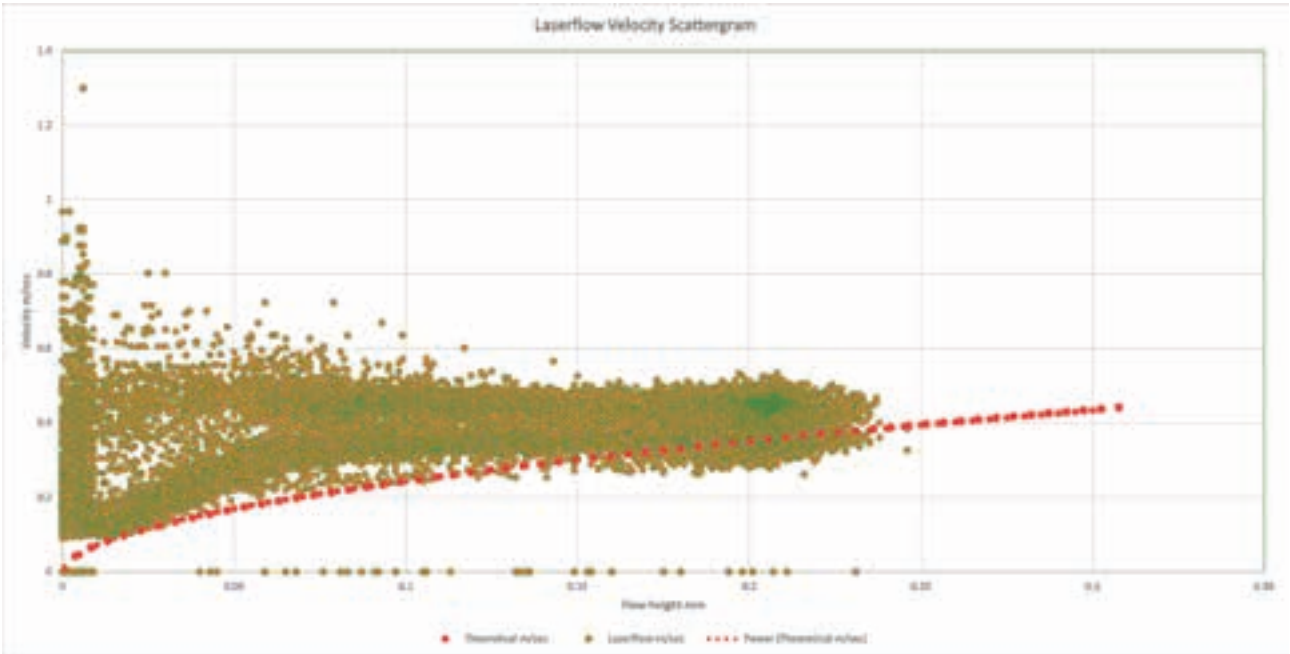
The next job was to look at the velocity measurement versus theoretical with a scattergram chart, and the issue revealed itself. There were a number of anomalies with the velocity data – the lower the flow got and, theoretically, the slower the flow got, the more inaccurate it became.

The chart with this review doesn't show the multiple points at greater than 2m/sec when there was no water in the channel. Conversely, as the level came up, the velocity stabilised and reflected a much closer relationship with the theoretical.

At velocities greater than 0.4m/sec and liquid levels higher than 200mm, the instrument appears to function pretty well, although the accumulation of zero velocity readings on the bottom of the scattergram is definitely not real and cause for concern.

The good points

- Non-intrusive measurement: No ragging, no tools covered in unmentionables, no retention bands and no standing in a live sewer. On this point alone, this instrument is a winner.
- Multipoint velocity measurement for average across the cross-section of the flow should enhance accuracy, providing there is adequate liquid depth and the average flowrate is above 0.4m/sec.
- Capable of remote transducer removal, to avoid confined space entry.
- If the unit becomes submerged, it has a traditional area velocity transducer on it that allows it to continue to measure depth and velocity.
- A good-sized memory that will collect a lot of data over a long period of time.



The not-so-good

- The 2160 controller takes Dolphin 6v alkaline lantern batteries. These last a bit over three days and cost a fortune. After the initial bench trial, we procured some lead acid rechargeable lantern batteries and managed to find a way to hook up a charge circuit to the unit to keep it running for the duration.
- FlowLink software: FlowLink software and I go back about 25 years. The original version I had was DOS-based and came on two floppy disks. It hasn't been a wonderful relationship. It's a bit like doing a Rubik's Cube with a blindfold on, only not as easy to solve (even blindfolded I can normally find a hammer). The version I was running this time was the Lite version which I still felt was overly complex. The reporting function on it is really quite powerful, once you figure out how to get the data out of it. For those of us old fashioned types who like to download it to Excel and then play with the data, it is an exercise almost as frustrating as trying to get hold of a real person from a telco when you have a line fault!
- Calibrating the level. It took me about 20 minutes and five or six goes before I was satisfied that the level was reading correctly. Although I was happy with the result I was getting after that, I still couldn't figure out why the first four goes failed. I did nothing different on the last go! Well, it turns out that when you set the level, it pays to turn all but one of the velocity points off, as it works its way through all of these before doing the level. This means that by the time the unit gets to setting the level, there is a good chance that the actual level has changed.
- Ultrasonic level measurement. Where do I start? I have never managed to get the accuracy from ultrasonics that I can get from submersible pressure, the old fashioned bubbler or the modern unguided radar. The other big bugbear I have with ultrasonics is use in steam and foam. Coming from an industrial background, these are major issues: There would be no way I would recommend one of these for use in a dairy factory!

Communication with the 2160

Let's start with the proprietary plugs: Nothing like it in the market place. The only supplier? ISCO! This thing is like Auckland Nouvelle Cuisine – you order a steak, that's all you are going to get.

I wanted to pick up a data feed from the unit to send to a telemetry system. That will require another module – $2800, thank you. How about a pulse output? That will require another module – mortgage your house. Want to interface with a sampler? For that you will require another special module. Even the download cable is not much short of $1000. When I spend this sort of coin on an instrument, I expect to be able to talk to or interrogate it in multiple ways without purchasing extra modules

Accuracy of velocity below 0.4m/sec

I was really excited when John Morris Scientific let me take this instrument away on the last day of the Water New Zealand conference in Rotorua. I set it up in our workshop

Juliet Browning, Environmental Division Manager, John Morris Group with reviewer Geoff Young.

to familiarise myself with the instrument, I messed around with level, but I didn't really have any means to check the velocity measurement. So I needed to test it in situ. The test site was chosen for its regularity, which should have produced a very stable level versus velocity relationship. Now of course I understand that at velocities of less than 0.4m/sec this instrument is going to give you some pretty hairy data.

What really disappointed me was that I hoped that this instrument was going to be easy to set up and use without the normal detailed study of the installation site. I was sadly mistaken. My theodolite, survey staff and Mannings spreadsheet can't be retired quite yet.

The price

Between $25,000 and $30,000 depending on options and add-ons. I know this is a revolutionary piece of kit, and I know that it is probably a low volume market, but one of this technology's biggest limitations is going to be affordability.

Conclusion and scoring

Overall, despite, my issue with the ultrasonics, the cost of any peripherals, the velocity accuracy issues and the accursed FlowLink software, this is actually a nice piece of kit. I am not going to rush out and replace our inventory of bottom lurking area velocity units with one, but it is certainly a piece of kit that I would happily have in our armoury and which has its place doing what I believe few other instruments are currently capable of doing adequately. I believe that in time, we would understand some of the velocity issues a lot better, and either data sort or install/configure to eliminate this error. The reputation of the bottom dwelling area velocity devices when it comes to accuracy is not exactly fantastic to begin with, so let's make sure we are comparing apples with apples.

The reliability of this kit is yet to be seen, but, given how robust most of ISCO's other gear is, it's probably a good bet. This instrument is definitely not for learner drivers; technicians who install and operate this piece of kit need to have significant experience in this field, no exceptions.

BPO score is 6 out of 10.

So here is a challenge for ISCO's opposition: let me test your unit if you think it is a match for (or better than) the LaserFlow.

If there is a water or wastewater instrument that you would like to see test driven, drop me a line on geoff.young@bpoltd.co.nz. Suppliers permitting, I will see what I can do. **WNZ**