Developments in wireline packer testing – IPI field trials its new STX-60 product

Perth based Inflatable Packers International ["IPI"] has launched its new STX-60 packer system. Initially designed for CBM exploration work it is proving to be a very cost effective and versatile addition to the IPI range for mineral mining systems. This article focuses primarily on the much improved straddle testing economics. In addition STX-60 enables more advanced hydrological testing capability with its shut in valve and can be readily upgraded for testing PQ wireline or to run or rods for, eg, up to 6" RC hole testing. It can also be deployed on large/remote projects as redundant system back up for HQ SWiPS due to the commonality of the packers. IPI's Senior Engineer, Francis Ford, takes up the story:

Coring operations in mineral exploration may include a packer testing regime. The data from these tests is used for mine design and hydrogeological analysis. IPI has been providing drilling contractors, consultancies and mining companies' standard packer equipment over the last decade for this very purpose. Traditionally carried out with what is known in the industry as 'Wireline Gas Packers'. The gas set up is cumbersome due to the wireline and inflation line required and has limited depth applications due to limited pressure rating and gas pressure supply.

Francis Ford, IPI Engineer, in Ghana – STX -60 Training

Knowing the limitations, IPI developed and released what is now known as the SWiPS (Standard Wireline Packer System). This system is a hydraulic packer system, using fresh water to inflate the system. This packer system is a single shot system perfectly suited for 'testing while drilling'. Simply retrieve the inner tube, flush the hole, deploy the SWiPS and begin testing. This type of testing is what is commonly known as single packer testing or bottom hole testing, essentially using one packer to create a seal and injecting in between the packer and the bottom of the hole. Once the test is complete, the SWiPS is deflated, retrieved and an inner tube is deployed for drilling operations to continue. In this application, a single shot system does not result in much down time, purely because the drilling is only on standby for the duration of the packer test. The tool can be reset offline while drilling operations continue and deployment and retrieval of the SWiPS for each test must be included in the test duration hence are not considered down time. However, the same cannot be said when conducting straddle packer testing - especially when using wireline packers.

When it comes to multiple straddle packer testing, traditionally the hole is drilled to TD and the testing is carried out on the way out of the hole. It is easy to see that having to retrieve and deploy a single shot system for every test can start to add up to a considerable amount of time - obviously depending on the number of tests. Ideally a multi set wireline packer system which only has to be deployed at the beginning of the test and retrieved at the completion of the test could easily save hours of standby time. **It also minimizes the time needed on site for specialist staff and equipment.**

Initially developed as a 'big brother' to the SWiPS, the STX60 is a wireline packer system developed with more complex testing in mind. It has been designed as a multi set wireline or tubing conveyed packer system, which features a down hole shut in valve, a circulating stage and a balanced piston which prevents volume displacement into the test zone to ensure accurate shut in pressures.

The field trial below was carried out at a mineral exploration site in Ghana. The program detailed 5 primary holes each with 5 or more zones to test and a straddle HQ SWiPS system was initially scheduled for the work . An IPI representative was present on site to train the hydro geologist and the drill crew on the servicing and operations of both the SWiPS and the STX60. The testing program called for previously drilled and logged holes to be reopened, the upper [RC Section] cased and multiple straddle testing carried out.

Time associated with running SWiPS and STX in straddle format:

Some points to observe:

- Testing times will vary between each test program.
- Deflation times were kept standard at 5minutes for both SWiPS and STX. However, when using the STX60 in unsaturated boreholes, the deflation times will increase by 3-5mins. This extra time is due to the fact the tool has to be staged into Circulating mode in order to equalise the fluid level in the rods and the annulus. This extra 3 minutes equalising the tubing and the annulus is still much faster than unseating the tool and having to 'land' it again.
- Landing issues can cause unexpected delays and the timings will vary from situation to situation. This is especially true when deploying in holes angled less than 45degrees from horizontal.

  NOTE: IPI has developed a prototype pump down head to assist in landing the tool when being deployed in shallow angles (not used in this comparison). This does not require an underground compatible core barrel assembly. It is quite hard to quantify the time it takes to land. Solutions to deflation or landing issues can vary depending on the severity of the hole angle and the crews experience with landing methods.

- All deployments were done without swimming the tool. The system was lowered into the barrel on the wireline with the dry release installed. While filling the string to check for correct landing, we were able to use the overshot as a hammer if the system hadn't landed correctly.
- All 'Q' series rod joints were taped while running in hole to assist in sealing.
  All times below represent the time from when the packers are first deployed to when the packers are retrieved and the drill pipe tripped out. There are other factors that contribute to total time on any well. For example, in this instance the rig was mobilised to site, re-aligned with the well, the RC section of the hole cased off, the diamond cored section then re-entered and flushed (any bridges reamed) and run to test depth prior to the packers being deployed. Each situation will vary, however, the time savings based on tool operation will be transferable when

comparing the SWiPS and STX. The real savings are in not having to retrieve and re-deploy the STX so in essence the comparison should only really focus on these times. However, to give a holistic view of the testing duration, we have included the times from the first packer deployment right through to the last rod trip just before the rig demobilizes.

SWiPS Multiple Straddle Test

Testing Depth (m)	Deployment Time (mins)	Landing Time (mins)	Test Duration (mins)	Deflation Time (mins)	Retrieval Time (mins)	Pull rods (mins)
250-253	15	24	65	5	6	8
205-208	13	29	65	5	6	1.5
196-199	12	40	65	5	6	3.2
180-183	10	28	65	5	5	6
140-143	5	15	65	5	4	35 (rod trip)
TOTAL TIME	55	136	325	25	27	53.7

TOTAL TESTING TIME: 621.7mins (10.36hrs)

STX Multiple Straddle Test

Testing Depth (m)	Deployment Time (mins)	Landing Time (mins)	Test Duration (mins)	Deflation Time (mins)	Retrieval Time (mins)	Pull rods (mins)
198-201	13	16	65	5	0	1.5
188-191	0	0	65	5	0	1.5
175-178	0	0	65	5	0	8
110-113	0	0	65	5	0	1.2
104-107	0	0	65	5	4	25
TOTAL TIME	13	16	325	25	4	37.2

TOTAL TESTING TIME: 420.2mins (7hrs)

The STX clearly shows a time saving when compared to the SWiPS, especially when doing consecutive straddle testing. The savings are even more significant when there are a multitude of holes each with multiple straddle tests. In this particular testing program there were 5 priority holes each with multiple test zones. With a total of 8 holes there were potentially 40 tests, most of which were run. You can quite easily save a significant amount of time simply by using an STX. **Probably enough to quickly pay for the complete tool!**

After having done some tests with both the SWiPS and STX, it was decided that the remainder of the tests be carried out with the STX. The reason being it had the advantage of being able to stay latched inside the barrel after the first test zone, which can translates into time savings as can be seen in the tables above.

This time saving comes from not having to deploy, land and retrieve the STX after each test. Clearly if unexpected events occur, both the STX or SWiPS may have to be retrieved, redeployed and re-landed beyond the number of times otherwise required with a fault free operation. Possible issues could be leaks, malfunctions of IVA or setting tool valve. Even with this in mind, neither system is anymore robust than the other and choosing between the SWiPS and the STX will still come down to the type of testing, methodology and costs.

The STX and SWiPS run in single test format will not have any considerable time difference as both tools will need to be deployed and retrieved after each test. The only consideration in this case comes down to the type of testing. As previously mentioned, the STX tool enables more complex testing such as DST and IFO tests, so whether or not the test requires the ability to shut in, etc, becomes a determining factor.

Since the above operations took place the tool has had several other runs at various projects internationally. For major / remote projects STX-60 now features as follows:

1. HQ or PQ straddle testing – as the primary system with a HQ and/or PQ SWiPS as redundant back up with common packer elements.
2. NQ, HQ or PQ single packer testing – an STX-60 available for additional straddle testing [if required] and as redundant back up for all 3 sizes [NQ run on rods with 60mm packers – not wireline]

IPI's Commercial Director, Howard Kenworthy comments: "STX is probably IPI's most versatile and cost effective tool yet. It also illustrates that when sourcing equipment for major / remote projects the lowest cost equipment is rarely the right option when you look at both reliability and the total operating costs"