Pigging Automation Without Complexity:
Practical Look at Automatic Pig Valve Launchers

Pigging is a foundational integrity operating practice used to remove debris, support flow assurance, and enable gauging and inline inspection on pipelines [1, 2]. Oftentimes, these operations are conducted using launcher/receiver stations that require direct intervention for each operation [1]. In many cases, these stations are fully capable of maintaining the operator's integrity programs. However, in situations where the line requires frequent pigging to ensure its integrity, in locations with tricky access, or when various safety and emissions targets need to be met, direct human intervention for every operation can become a significant burden [3]. In these situations, automatic launchers become a viable solution supporting operators by addressing the logistical, cost, and regulatory challenges associated with these operating conditions [4]

Summary Concept:

- **What it is:** A pigging valve integrated with a vertical storage barrel that holds multiple pigs.
- **What it solves:** Line challenges with sustaining effective pigging operations due to access, distance, or high-frequency operational requirements, causing high cost, emissions, and safety hazards.
- **Difference from Others:** pig staging in a 90° chamber connected to pigging valve, reducing complexity and increasing structural soundness and reliability.

Automated launcher systems enable operators to preload multiple pigs and launch them at defined intervals using remote actuation [5]. These features reduce the number of site visits required for a pigging program [5]. However, many automated launcher concepts (including carousel, sphere, and subsea launchers), can have very complex designs and functional requirements [3-5]. The increase in complexity may leave systems open to more opportunities for failure [6].

Now, while many automated systems are complex, that is not universal. One of the simplest, most reliable, yet perhaps lesser-known concepts for automating pigging is the automatic pigging valve launcher (APV) also known as multi-pig launchers [6]. In the following article, we will review the design concept of APVs, how they operate, their strengths and weaknesses, and the applications in which they can provide the most value to operators.

Design and Operation Concept

To oversimplify, the automatic pig valve launcher is a pigging valve with a vertical cylindrical chamber mounted on top [6]. The chamber houses multiple pigs (sometimes up to eleven) and, unlike many inland automatic launchers that are horizontal or inclined, the APV is perfectly vertical [6] [3]. The pig valve portion is directly connected to the line, and an actuation unit is typically connected to its front face [7]. For simplicity, the following components are key to the concept of the launchers' design.

1. **Pigging valve:** A trunnion-mounted quarter-turn ball valve configured for top entry pig loading [7]. Pigs drop down from the barrel into its cavity when the valve is turned to its closed position and then released into the line when turned again to its open position [7].
2. **Vertical barrel/chamber:** A vessel that rests on top of the pig valve and stores the pigs and follower weight [7].
3. **Follower Weight:** A weight that rests above the pig stack. The follower weight supports staging by placing downward force on the pigs [7].
4. **Actuation:** While not an inherently essential component to the general station's function, an actuator usually also accompanies the design and provides it with automation [6] [7].

In addition to these elements, platforms, scaffolds, etc., are commonly incorporated into the design to allow operators to access the entry point at the top of the barrel.

Operating Concept

The conceptual process of how an APV launcher works is to move pigs down the barrel and into the valve cavity, one by one, using gravity and the pressure from the follower weight [6]. Each time the valve rotates from the open to the closed position against the flow of the mainline, a pig will fall into the valve's empty cavity [6]. When the valve rotates back to the open position, the pig will be pushed out of the launcher and into the pipeline from the mainlines' flow, emptying the ball valve's cavity [6]. This repeats until all pigs stored in the barrel have been launched [6]. Exact procedures will vary based on station design, safety features, and other requirements; however, the sequence can generally be summarized as follows.

1. **Isolation and depressurization (for reload):** the valve is rotated to the closed position, and the barrel is depressurized to a verified safe condition for opening. Drain posts are used to remove residual liquids as required by the service's condition [7].
2. **Load and secure:** The entry cap is opened, the pig weight is removed, and pigs are loaded nose-first. The weight is placed back on top of the pig stack, and the entry cap is closed and secured [7].
3. **Pressurize and Launch:** Vents and drain ports are closed, the barrel cavity is pressure equalized to line conditions, and the actuator cycles the valve to release the pig into the pipeline [7].
4. **Relaunch (no loading required):** To launch the next pig, the actuator returns the valve to the closed/staging position, where the next pig will advance by moving into the valve’s

cavity. The actuator then opens the valve again to launch the pig, and the system repeats until the barrel is exhausted and requires reloading [7].

Why Vertical?

By being perfectly vertical, APVs do not fight gravity; they use it to support the movement of pigs through the launch process. Other launchers often use indexing pins or rotating carousels to position the next pig [9]. These approaches often rely on hydraulic or pneumatic controls and substantial additional support systems to move the pigs into position [3-5]. Higher complexity creates more areas where the launcher can fail and a greater maintenance burden to keep the station running as intended [8]. By using gravity rather than fighting it, the automatic pig valve launcher does not require a complex mechanism; it only requires a weight and a valve, lowering these risks and potential failure points [7].

As Argus (a manufacturer of these launchers) VP of Innovation and Technology, Jason Weiss, stated in an internal interview, "we want to keep the operation of multiple pig launchers simple… use gravity to our advantage … (so) we do not need complex mechanisms prone to failure [9].

Practical Limitations

There are limitations to the launcher primarily related to its pig-type capabilities. Automatic pig valve launchers require the pigs they send to be sized so they fit into the cavity of the valve's ball [7]. That can limit the launcher's ability to use certain pigging tools, such as ILI equipment. As such, APVs are usually limited to maintenance pigs [6]. There are, however, some common workarounds to this limitation.

Commonly, operators will use an automatic pig valve with a barrel trap downstream [10]. This hybrid approach uses the APVs for the maintenance operations. When other operations, such as inspections, are required, the barrel is used. Because APVs are hollow balls, the launcher won't cause any obstruction between the barrel trap and the rest of the line [7]. By combining these traps, operators gain the benefits of automation without sacrificing the versatility in tool use.

Frequent Applications

APVs are usually used in operating situations that involve significant logistical, cost, emissions, or safety concerns associated with pigging [4]. In these situations, APVs provide the greatest value by helping operating companies consolidate multiple loading operations into a single operation. This reduces the number of direct interventions needed at the site by workers, lowering OPEX, GHG emissions, safety, and schedule risk [11] [4]. The following section outlines some of the most common operations where we see these challenges arise.

High-Frequent Sweeping and Debris Control:

One of the most common applications of APVs is on lines that require high-frequency pigging [4]. Some pipelines, such as lines carrying hydrocarbon-rich gas or waxy crudes, are prone to rapid wax and liquid build-up [12] [13]. These lines require frequent and consistent pigging to maintain flow assurance and integrity [12] [13]. With manual launchers, operators must mobilize crews to the site each time pigging is needed to meet the integrity program's schedule [12] [13]. The more frequently these lines need sweeping and debris removal, the more the operating expenses begin to mount from these repeated crew mobilizations [11].

In these circumstances, an automatic pig valve launcher can be a more practical solution than repeated crew operations [4]. The consolidation of operations automation allows operators to significantly reduce the cost burden of maintaining these pipelines while ensuring better integrity program schedule assurance [11].

Remote and Challenging Access:

Some stations can be very challenging to access. Sometimes this is due to the line's remoteness; other times, it is simply due to the terrain and the difficulty of accessing it [3] [4]. In both situations, this leads to similar challenges that pipelines requiring high-frequency pigging face when using manual launchers. The cost of crew mobilization can quickly get out of hand, and maintaining the integrity of the program's schedule can become difficult [3].

As such, in these circumstances, you may find automatic pig valve launchers in place of manual traps. Remote launch capabilities with their automation reduce the frequency operators need to make the trip to the site [4]. This can help ease the burden of the cost and logistical constraints of reaching the site by reducing how often they need to go there [11].

Lines with Emissions and Safety Concerns:

The last common application we find APVs in is sites where operators are working under tight emissions and/or heavy safety expectations. Automatic launchers reduce the number of times personnel must physically interact with the equipment, lowering travel requirements and exposure associated with repeated site visits [6]. In addition, because reload cycles occur less frequently, automatic launching reduces the number of venting events during depressurization, supporting emission-reduction initiatives [6]. Why is this significant to the emissions and safety considerations?

Safety-wise, traveling and depressurization are consistently cited as two of the highest-risk parts of an operator's job. Energy Safe Canada reports that 40% of occupational fatalities in oil and gas are due to transportation accidents [14], while the National Energy Board notes that depressurization events pose significant hazards to operators due to the threat of projectiles and potentially toxic or flammable gases [15]. Emissions-wise, decompression and travel also contribute to GHG emissions, with the degree depending on the distance, launcher cavity volume, line pressure, and other operational circumstances [16]. As the design of the automatic

pig launchers directly addresses both these concerns, when safety risk and/or emission reduction are prioritized by operations, these tools are often implemented.

Conclusion

Automated launchers solve a specific but recurring operational problem: how can we sustain our pipeline integrity program with pigging when the required frequency or line accessibility creates unsustainable logistical, emissions, safety, and/or operating costs. By using actuation and housing multiple pigs, automated launchers enable multiple pigging runs to be consolidated into one loading and allow remote launching. Among automated launchers, the automatic pig valve is a simple, reliable approach that uses gravity to support the launching mechanism. While the design is not intended to replace conventional barrel traps in all cases, for remote assets, programs under emissions and safety scrutiny, and lines with build-up that require high-frequency pigging to maintain, the automated pig valve launcher offers a pragmatic pathway to operational excellence.

References

[1] J. Cordell and H. Vanzant, Pipeline Pigging Handbook, Houston; Louisianna: Clarion Technical Publishers, 2003.

[2] T. Clark and B. Nestleroth, "Gas Pipeline Piggability," Battelle, Columbus, 2004.

[3] D. Bacon and J. Carter, "Automatic Multiple Pig Launcher Systems," *Pipeline Products and Services Association,* 2006.

[4] A. Blackley, J. Weiss and B. McNabb, "Pigging Previously Unpiggable Pipelines," *Clarion Technical Conferences,* 12 February 2025.

[5] R. C. Sander, D. D. Wint, T. K. Sale, R. R. Riggs, D. A. Sahm and G. J. Drzewieck, "AUTOMATED PIG LAUNCHING SYSTEM". United States Patent US20160169436A1, 16 June 2016.

[6] Argus Machine Co, "Multi-Pig Launcher: Production Optimization & Corrosion Mitigation for High Frequency & Remote Pigging Applications," Argus Machine Co. Ltd., Edmonton, 2024.

[7] Argus Machine Co, "MN-ML-001 – Multi-Pig Launcher – 6.000 & Larger Model D – Installation, Operation & Maintenance Manual," Argus Machine Co. Ltd., Edmonton, 2022.

[8] P. D. T. O'CONNOR and A. KLEYNER, Practical Reliability Engineering, vol. 5, Chicherster: John Wiley & Sons, Ltd., Publication, 2012.

[9] J. Weiss, Interviewee, *Gravity Fed: Innovation in Pipeline Maintenance.* [Interview]. 13 April 2023.

[10] Argus Machine Co, "Multi-Pig Launcher Typical Installation P&ID," Argus Machine Co, Edmonton, 2024.

[11] Argus Machine Co, "Cost and Emissions Calculator: Argus Mutli-Pig Launcher," Argus Machine Co. Ltd, Edmonton, 2022.

[12] L. Weidong, H. Qiyu, W. Wenda and G. Xuedong, "Advances and Future Challenges of Wax Removal in Pipeline Pigging Operations on Crude Oil Transportation systems," *Energy Challenges,* 2020.

[13] A. Sousa, M. Pereira and H. Matos, "Planning Pipeline Pigging Operations with Predictive Maintenance," *EDP Sciences,* 2021.

[14] Energy Safe Canada, "Occupational Fatalities in the Oil & Gas Industry in Western Canada," WCB Alberta and Saskatchewan WCB data as of Q4 2020, WorkSafeBC data as of Q3 2020, 2021.

[15] National Energy Board, "Pipeline Pigging Operations: Open to Injury," National Energy Board, Calgary, 2007.

[16] United States Environmental Protection Agency, "EPA Observes Air Emissions from Natural Gas Gathering," *Office of Enforcement and Compliance Assurance ,* 2019.

[17] C. Freedman, "A tale of three pigs," *Institution of Chemical Engineers,* 2006.

[18] h. M. Uzoma and T. B. M. Ojaoah, "Design and Analysis and Cost Imperative of A Prototype Pig Launcher for Upstream Oil Sector," *International Journal of Engineering Research & Science,* vol. 10, no. 3, 2024.

[19] Roto-Launcher Inc., "The Pig Caddy," [Online]. Available: http://roto-launch.com/pdf/Pig_Caddy_Brochure_FINAL_Feb2010.pdf. [Accessed 9 February 2026].

[20] O. D. Tarlton, "Multiple pig subsea pig launcher". United States Patent US6336238B1, 8 January 2002.

[21] M. M. Disher and R. G. Chernuka, "Rotating pig launcher". Canada Patent CA2391846A1, 27 December 2003.