

Comparison of design principles applicable for green sand moulding and direct production of mould by additive manufacturing

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Outline

1. Background
2. State of the art of 3D printing in foundry
3. Design principles for AM and Conventional Manufacturing
4. Conclusions
5. Discussions & Questions



1. Background

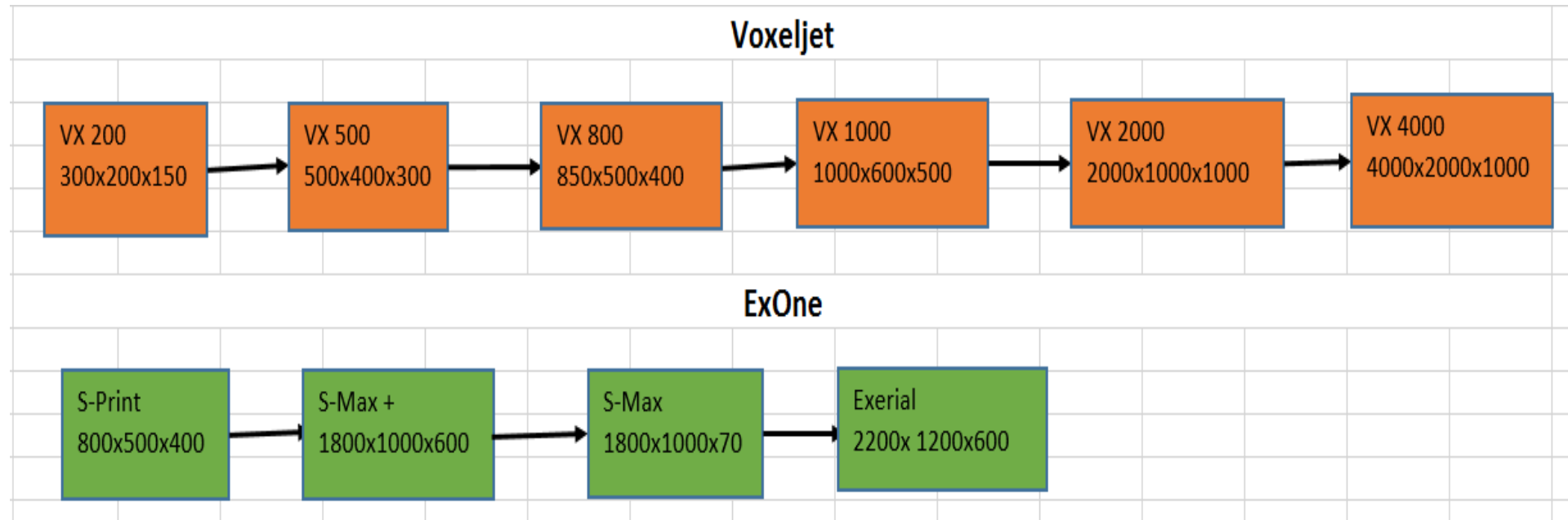
- Comparison of design principles for AM and traditional sand casting
- Design process is the most crucial part of product development
- A wide variety of shapes can be produced by pouring molten metals into moulds produced by either AM processes or conventional processes

2. State of the art of 3D Printing in foundry

- Manufacturing of moulds and cores through selective binder deposition
- Different sands used (silica, fireclay,chromite)
- Several kinds of binders (Furan, phenolic, inorganic)
- The main sand 3D printers manufacturers are ExOne and Voxeljet

2. State of the art of 3D Printing in foundry

- Current manufacturers of 3D printers



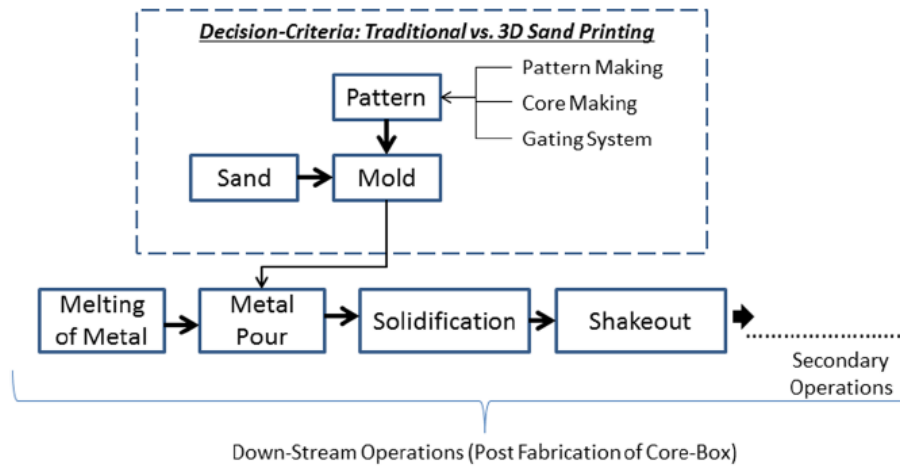
- Voxeljet only offers 3D printing in 2 different types of plastic and one type of sand
- ExOne offers 3D printing in 2 different of sand, 5 types of metals with 7 different finishes and a soda lime glass that is found in 3 different finishes

3. Case Study: Design for a cast Iron valve: Conventional design vs. AM design

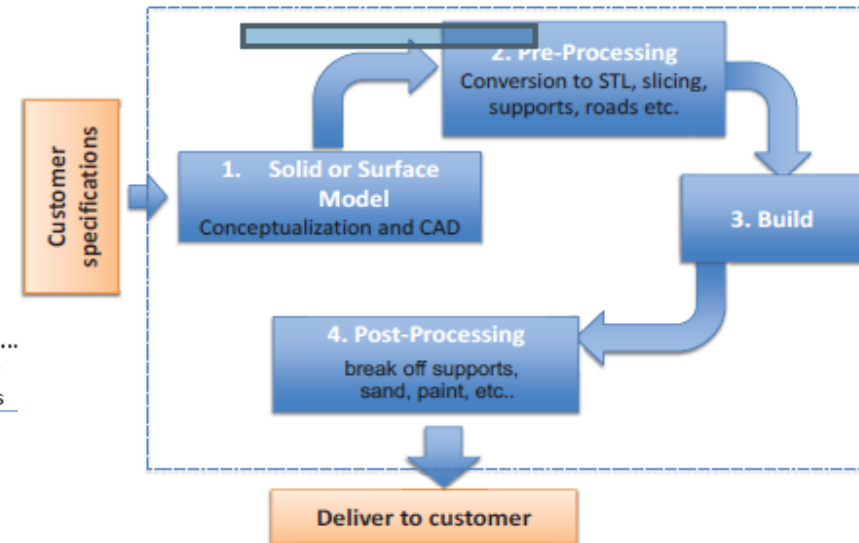


Design principles: AM vs. Conventional

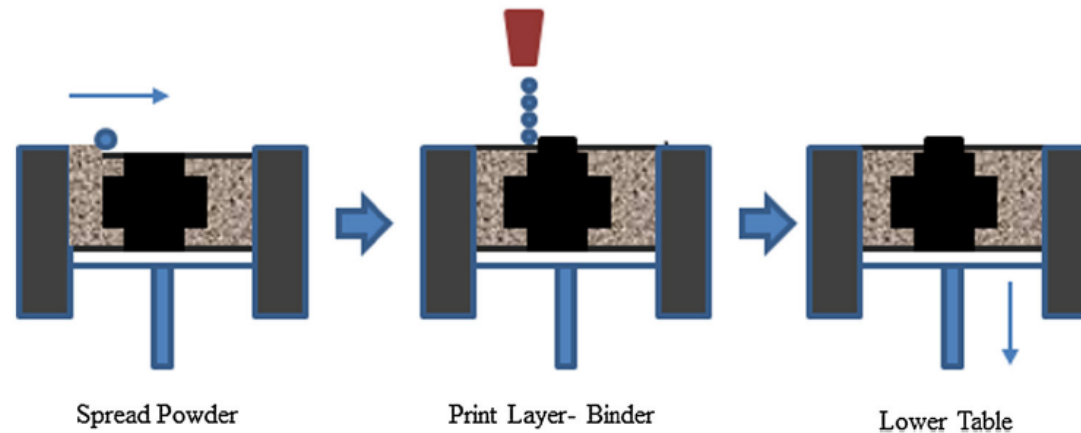
Process map for traditional sand casting



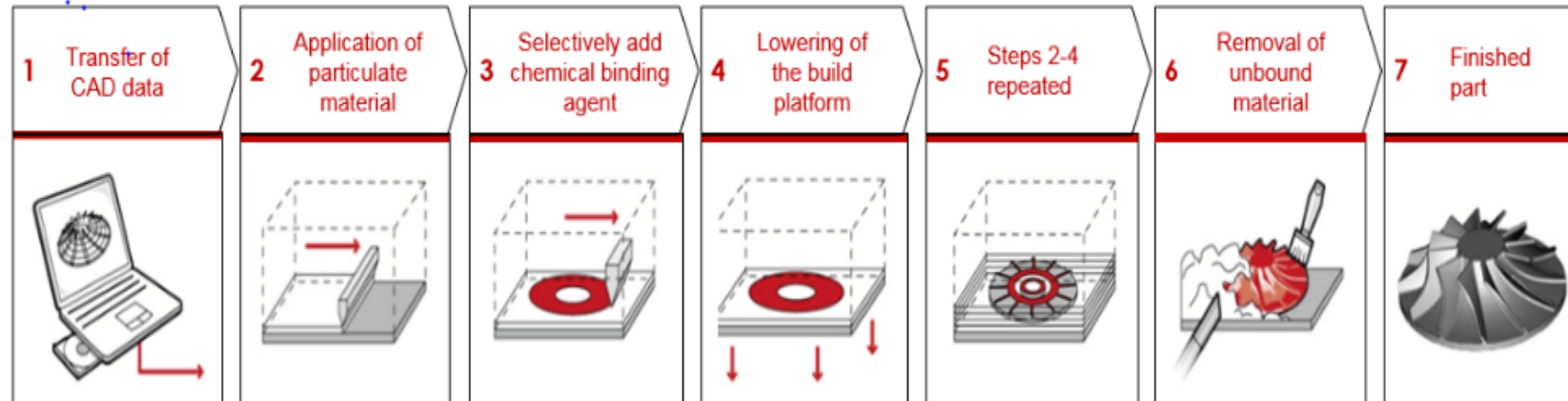
Process Map for AM



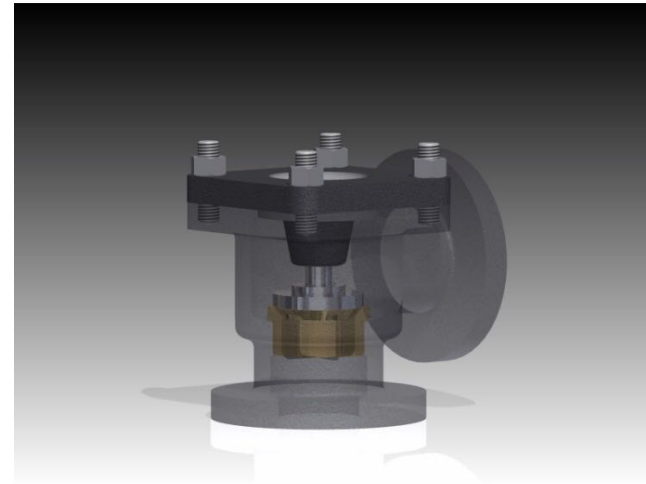
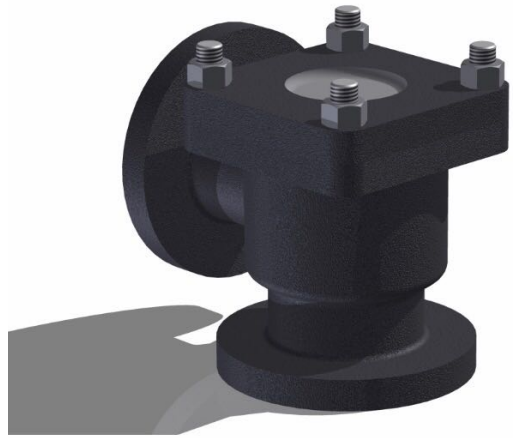
Step 3 for AM



Schematic of 3D Printing process



Cast iron valve casting



Design principles: AM vs. Conventional Manufacturing

| | Additive Manufacturing | Conventional Manufacturing |
|--|------------------------------|---------------------------------|
| Draft angle allowance | Not required | Required |
| Undercuts | Made directly in the mould | Created by cores |
| Tooling requirements | Not required | Required |
| Shape complexity | Design freedom | Limitation on design complexity |
| Customisation of product geometry | Enabled | Not enabled |
| Consolidating parts | Avoidance of assembly issues | Difficulties during assembly |

Conclusions

- 3D printing is introducing new design possibilities that cannot be achieved through conventional manufacturing design
- Additive manufacturing design eliminates the restrictions of conventional casting methods

Thank you!

Questions