Umeå Hangprinter



The Hangprinter technology was created by Torbjörn Ludvigsen at the Sliperiet. This is on the grounds of Umeå University in Sweden, located in proximity to the Architecture and Design campus.

Hangprinter is of the delta type. However, instead of the rods that connect to three evenly spaced columns in a typical delta 3d printer, this printer literally hangs from wires connected to adjacent supports. These three sets of wires secure the position of the central moving unit, and they can be anchored on any nearby available surface.

One of the strong points of this type of 3d printer, besides its adaptability to basically any print site - that can accomodate vertical supports - is the scalability. The fact that it's not prebuilt with fixed restpoints means that these can be placed anywhere, and the printer will be able to build within the volume defined by these, after being calibrated.

The largest structure realized with the Hangprinter is The Tower of Babel - a thin tapered structure which measures 4.5 meters in height.

Project & development	Year of establishment	2014								
	Year of entering into construction 3D-Printing	2016								
	Number of employees	**Less than 10**	Less than 25	Less than 50	Less than 100	Less than 500	Less than 1000	More than 1000	Unknown/ Undefined	
	Targeted market	**Printers**	Printer parts	Materials	Furniture/ Sculptures	Building components	Building projects	Other	Unknown/ Undefined	
	Development stage of printers	Conceptual	**Protoypes**	Working products	Commercial products	Other	Unknown/ Undefined			
	Development stage of printed materials	**Conceptual**	Prototypes/ Test prints	Usable products	Commercial products	Other	Unknown/ Undefined			
	Patent(s) status	**Not patented**	Patent pending	Patent granted	Other	Unknown/ Undefined				
	Patent coverage	Printer design	Printing technology	Material	Nozzle/ Deposition system	Material feeding system	Movement system	Software/ Firmware	Other	**Unknown / Undefined**
	Largest print up to date (size)	**Less than 1m3**	Less than 5m3	Less than 10m3	Less than 25m3	Less than 50m3	Less than 100m3	More than 100m3	Unknown/ Undefined	
	Largest print up to date (category)	Minor test prints	**Furniture/ Sculptures**	Building elements	Less than 50m2 buildings	Less than 100m2 buildings	More than 100m2 buildings	Multiple storey building	Other	Unknown / Undefined
Technolo	Additive Manufacturing technology type	**Material Extrusion (Layered)**	Material Extrusion (Suspended)	Binder Jetting	Other	Unknown/ Undefined				
	Form Freedom	2D freedom	2.5D freedom	**3D freedom**	Full 3D freedom	Other	Unknown/ Undefined			

gy	**Fabrication location**	**In situ**	On-site prefabrication	Off-site prefabrication	Partial prefabrication	Other	Unknown/ Undefined			
	Fabrication approach	**Direct fabrication**	Direct fabrication	Component fabrication	Formwork fabrication	Stay-in-place formwork fabrication	Cover/ Engulfing fabrication	Other	Unknown/ Undefined	
Printer	**Movement system**	Cartesian gantry	Delta gantry	Robotic arm	Mobile robotic vehicle	**Cable suspension**	Other	Unknown/ Undefined		
	Maximum printable volume	Less than 1m3	Less than 5m3	Less than 10m3	Less than 25m3	Less than 50m3	Less than 100m3	**More than 100m3**	Unknown/ Undefined	
	Maximum printable area	Less than 1m2	Less than 2m2	Less than 5m2	Less than 10m2	Less than 25m2	Less than 50m2	**More than 50m2**	Unknown/ Undefined	
	Deposition method	Jetting	Pressure extrusion	**Mechanical extrusion**	Mechanical movement	Gravity deposition	Sintering/ Welding	Other	Unknown/ Undefined	
	Number of print heads	**Single**	Multiple	Array	Other	Unknown/ Undefined				
	Print Head/ Nozzle diameter	Less than 1mm	Less than 5mm	Less than 10mm	Less than 25mm	Less than 50mm	Less than 100mm	More than 100mm	**Unknown / Undefined**	
	Print head/ Nozzle features	**Three axis motion**	Rotational / Tangential motion	Omni-directional motion	Troweling mechanism	Other	Unknown/ Undefined			
	Material feeding system	Manual	**Included, semi-automated**	Included, fully automated	Separate, semi-automated	Separate, fully automated	Other	Unknown/ Undefined		
	Theoretical printing speed	Less than 0.1m3/h	Less than 0.5m3/h	Less than 0.1m3/h	Less than 2m3/h	Less than 5m3/h	Less than 10m3/h	Less than 20m3/h	More than 20m3/h	**Unknown / Undefined**

	Actual printing speed	Less than 0.1m3/h	Less than 0.3m3/h	Less than 0.5m3/h	Less than 1m3/h	Less than 2m3/h	Less than 5m3/h	Less than 10m3/h	More than 10m3/h	**Unknown / Undefined**
	Accuracy	**Less than 5mm**	Less than 10mm	Less than 50mm	Less than 100mm	More than 100mm	Unknown/Undefined			
	Printer (diss)assembly speed	Less than 1 hour	Less than 10 hours	Less than 24 hours	Less than 2 days	More than 2 days	Other	**Unknown/ Undefined**		
	Price per printer unit	**Less than 10.000$**	Less than 50.000$	Less than 100.000$	Less than 250.000$	Less than 500.000$	More than 500.000$	Unknown/ Undefined		
Material	**Material possibilities**	**Single material**	Multiple materials	Structure/ Support material	Other	Unknown/ Undefined				
	Material type	Traditional concrete	Alternative concrete	Clay	Soil	**Plastic**	Metal	Resin	Other	Unknown / Undefined
	Price	Less than 50$/m3	Less than 100$/m3	Less than 150$/m3	Less than 300$/m3	Less than 500$/m3	Less than 1000$/m3	Less than 2000$/m3	More than 2000$/m3	**Unknown / Undefined**
	Compression strength	Less than 5MPa	Less than 15MPa	Less than 25MPa	Less than 50MPa	Less than 100MPa	Less than 200MPa	More than 200MPa	**Unknown / Undefined**	
	Tensile strength	Less than 1MPa	Less than 3MPa	Less than 5MPa	Less than 10MPa	More than 10MPa	**Unknown/ Undefined**			
	Aggregate size	No aggregates (Paste)	**Up to 2mm (Fine mortar)**	Up to 4mm (Rough mortar)	Up to 6mm (Fine concrete)	Up to 16mm (Concrete)	Up to 40mm (Rough concrete)	Over 40mm (Rough concrete)	Other	Unknown / Undefined
	Aggregate weight (kg/m3)	Ultralightwt. (<500)	Lightweight (500-1000)	Normal weight (1000-2000)	Normal weight (1000-2000)	Heavyweight (<2000)	**Unknown/ Undefined**			
	Material verification	Conceptual	**Prototype**	Partially tested	Extensively tested	Certified	Other	Unknown/ Undefined		

	Material hardening time	**Less than 1 hour**	Less than 10 hours	Less than 24 hours	Less than 2 days	Lees than 5 days	Less than 10 days	More than 10 days	Other	Unknown / Undefined
	Material usability time	Less than 15 minutes	Less than 60 minutes	Less than 2 hours	Less than 5 hours	Less than 10 hours	More than 10 hours	Other	**Unknown / Undefined**	
	Raw material price	Less than 50$/m3	Less than 100$/m3	Less than 150$/m3	Less than 300$/m3	Less than 500$/m3	Less than 1000$/m3	Less than 2000$/m3	**More than 2000$/m3**	Unknown / Undefined
	Raw material availability (in construction)	Industry standard	Extensively used	Partially used	Niche usage	**Not used**	Other	Unknown/ Undefined		