

HVLP spray systems

What if you could cut your finishing time by more than half, and get a super-smooth finish, to boot? You can! Stow that brush and enter the spray age with a low-overspray system.

If you've never tried your hand at spray finishing, it's never been easier, cleaner, or safer, thanks to high-volume, low-pressure (HVLP) sprayers. Why spray? You complete more work in less time; benefit from fast-drying finishes that are far less susceptible to nibs from settling dust, such as water-base, lacquer, and shellac; and consistently produce smooth results. And, as your spraying skills improve, you can use techniques like toning and shading (adding color between finish coats) that bring depth and sophistication to your finishes.

You could get those results using a conventional spray gun powered by an air compressor. But they operate at high pressure and create a hazardous fog of overspray. As much as 80 percent of the finish that leaves a conventional spray gun bounces back off your workpiece, and winds up on every exposed surface, including the shop floor, walls, shelves, and tools.



GOT HVLP?

If you already own an HVLP spray system, check out professional finisher Paul Snyder's tips for getting the most from it on *page 78*.

HVLP sprayers, on the other hand, use a large volume of air at low pressure to break up, or *atomize*, the stream of finish leaving the nozzle into a fine mist. This method greatly reduces finish bounce-back, saving you both money and time cleaning up.

To earn the HVLP designation, a spray gun must transfer at least 65 percent of the finish to the surface, but transfer rates upward of 80 percent are possible. That's far more efficient than a conventional sprayer, but it still leaves plenty of finish fogging the air. So wear a respirator approved for the material you're spraying and work in an area where overspray won't cause problems. Always supply adequate fresh air when spraying, and of course, don't spray flammable, solvent-based materials where a spark or pilot light could ignite the volatile vapors.

Turbines trump conversion guns in the HVLP game

HVLP sprayers come in two forms: Conversion guns and turbine-powered sprayers. Like conventional spray guns, conversion guns atomize finish with air supplied by a compressor, and that air must be filtered of both water and oil to avoid contaminating the finish. Conversion guns require 5–25 CFM (cubic feet per minute) of air to work well. To put that demand into perspective, a 30-gallon compressor typically can power a lower CFM gun adequately, but it takes an

80-plus-gallon model to supply enough air for the hungriest guns. That makes conversion guns better suited for large-scale spraying operations.

Turbine systems, on the other hand, provide a complete, self-contained, portable package that includes the gun, air supply (the turbine unit), and hose. The air from the turbine is dry and clean so it doesn't require water or oil filters. For those reasons, and because they nicely simplify the spray-finishing operation, we prefer the turbine systems to conversion guns.

Our test includes ten HVLP turbine spray systems ranging in price from \$100 to \$800. With that much difference in price, you might expect huge differences in performance. Actually, every system we tested will spray a smooth, consistent coating—a few systems could spray any woodworking finish we poured into the cup without thinning—but most require thinning the heaviest-bodied finishes.

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HVLP's holy trinity: Gun, turbine, and hose

These three parts of the system, as shown and described *below*, work in concert to produce a smooth, level film on your project. Naturally, the gun and turbine impact

performance the most. A powerful turbine can't compensate for a poorly performing gun, nor can the best gun effectively atomize finish with an anemic turbine, but a restrictive or easily crushed hose can render the whole system ineffective. Let's examine each key component, one at a time.

The spray gun: Finesse comes at a cost

To best atomize a finish, three spray-gun adjustments must be balanced: *fluid flow* (the amount of finish leaving the gun), *air-flow* (the amount of air exiting the spray cap), and *fan width* (how broad or narrow a pattern the gun can spray). All of the tested spray guns use the same method to adjust the fluid flow: A knob on the gun controls how far the needle can retract into the nozzle when the trigger is pulled. The deeper the needle goes, the more fluid flows into the air stream, and the more the airflow required to atomize it.

Too much airflow, though, leads to excessive bounce-back and overspray. So, to control airflow, most HVLP turbine systems use a valve either in the air line, as shown at *far left*, or on the gun. Instead of an air valve, the Turbinaire 1235GT has a knob on the turbine unit that changes the speed of the motor to vary air output. Although basically a nice feature, we like having the air control at the gun end of the hose: It saves walking back to the turbine, which should be placed as far as possible from the spraying operation.

Low-cost systems usually don't have an air-control valve, so atomization is controlled only by fluid flow and fan width (which we'll cover shortly). Give credit to Campbell Hausfeld here: CH's \$200 model HV2002 is the only system under \$600 we tested that includes an air control.

HOW A TURBINE-POWERED SPRAYER WORKS: A powerful fan (1) inside the turbine unit draws room air through the filter (2), removing dust and airborne overspray. That air travels via the hose (3), in some cases through an in-line air-control valve (4), and then to the gun (5). Some of that airflow is diverted to pressurize the cup (6), which contains finish. Pulling the trigger retracts the needle (7) in the nozzle (8), flowing the pressurized finish up through the pickup tube (9) and into the path of the airflow from the turbine, which leaves the gun through the horns (10) in the spray cap. The rushing air performs three tasks: It siphons finish from the cup, atomizes the finish into tiny droplets, and delivers the finish to your workpiece.



YOUR BIGGEST AND SMALLEST FAN



The best HVLP spray guns allow you to adjust the fan width from a maximum of 12" (top photo) down to about 1" (bottom photo), or anywhere in between (center photo), by simply rotating a knob at the rear of the gun.

Fan width makes up the third part of the atomization equation. Spraying a 12"-wide swath (see photos, *above*) uses more finish than a 5"-wide stripe, so narrowing the spray pattern while reducing the fluid flow helps a weak turbine better atomize a heavy-bodied finish without thinning.

All of the tested guns can spray about a 1" round pattern by simply rotating the air cap to a 45° angle. That's fine for small projects, but you wouldn't want to spray a large one, such as an entertainment center, in 1" swaths. So most guns also provide another method

of narrowing the flat fan: either turning a knob at the rear of the gun, or loosening the air cap. (You can also narrow the fan width by moving the gun closer to the surface being sprayed.)

We like the knob adjustment, found on the Accuspray 23i-T and the Turbinaire, best. By turning the knob in small increments ($\frac{1}{4}$ – $\frac{1}{2}$ turn) and doing a test spray, we found we could quickly and easily adjust the fan from its widest setting all the way down to about 1" wide.

Loosening the air cap to change the fan width proved less effective in our tests. As the air cap moves away from the nozzle, air flows more freely, resulting in a drop in both air pressure and fluid flow. That means the finish will need to be thinned so it can spray at the lower pressure. The Capspray CS8100 and Wagner 2900 did a better job of controlling the fan width, with less thinning, than the ApolloSpray 800, Fuji Q3, or Campbell Hausfeld HV3500. Once again, lower-cost systems lack here. The Campbell Hausfeld HV2002, Rockler 61577, and Wagner 2400 don't have a fan width adjustment feature other than rotating the air cap 45° or changing the distance from the surface.

Four more things to look for in great guns

•**Nonbleeder.** In a bleeder-style gun, air from the turbine flows (or "bleeds") through the gun all the time, whether or not the trigger is pulled. This constant airflow helps keep the turbine motor cooler, extending its life, but also can stir up dust or blow across a sprayed surface and distort the film surface. We prefer non-bleeder guns, where the air only flows when the trigger is pulled. With these models, an opening in the air line or the turbine unit relieves air pressure to keep the turbine from overheating.

•**Check valve.** All of the tested systems come with a siphon-feed gun, which uses some of the air from the turbine to pressurize the cup and help deliver fluid to the nozzle. If you tilt the gun too far while spraying, finish can block this small air supply, stopping the spray. The Accuspray, Apollo, CapSpray, Fuji, Turbinaire, and Wagner 2900 use a one-way check valve in the tube between the gun and the cup to prevent finish from getting inside the gun body, where it is difficult to clean out.

•**Multiple air ports.** A bottom-mounted hose keeps the gun better balanced in-hand, but a rear-mounted

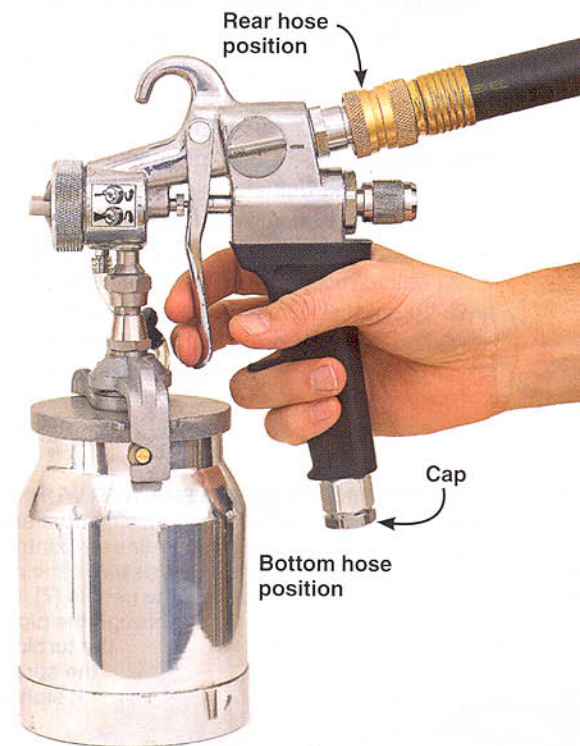
hose lets you get the gun into tighter spaces, such as inside cabinets. To keep options open, we like a gun with air ports in both places—the unused port is capped, and moving the hose mount takes only a few seconds and a wrench.

•**Easy air cap adjustments.** To change the fan pattern from vertical (the setting for spraying a wide or long project) to horizontal (for tall projects, such as a bookcase or hutch), to round (for small parts or narrow areas), you must rotate the air cap. (See photos, at *right*.) The best air caps adjust without having to loosen the retaining ring—remember, that changes the fan width on some guns—and we found the best caps on the ApolloSpray, Capspray, Fuji, and Campbell Hausfeld HV3500.

The turbine: HVLP's power plant

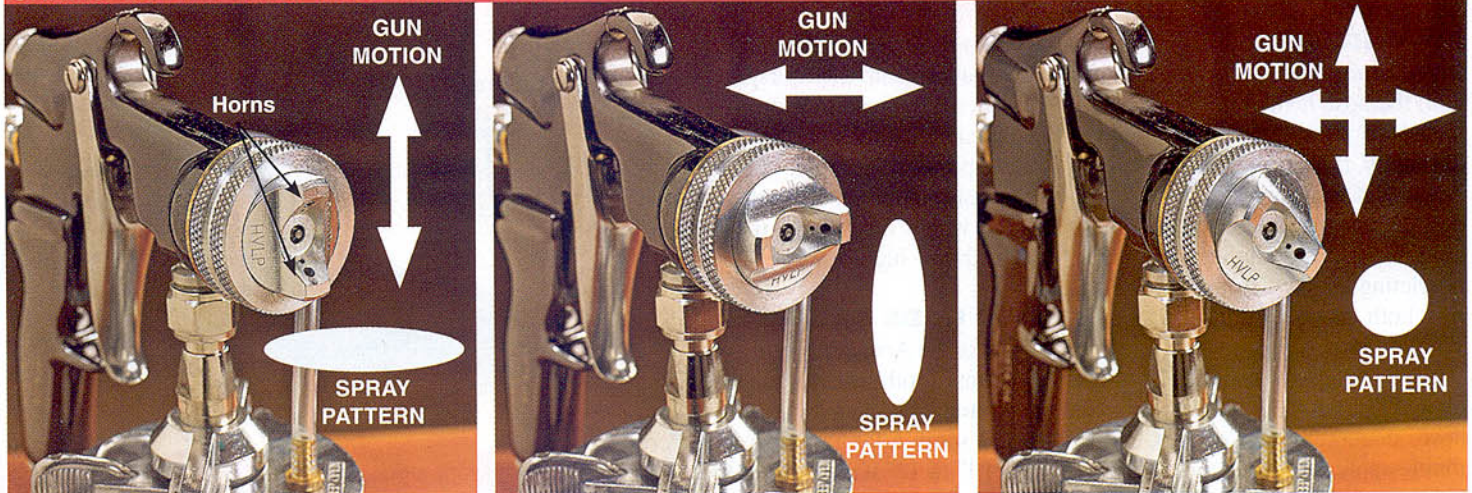
An HVLP turbine is really a vacuum cleaner motor, only in reverse. A series of fans, called stages, move a lot of air at low pressure, and more stages equal greater air output (rated in cubic feet per minute, or CFM), which means better atomization. However, a number of other factors, including motor speed and the size of the turbine blades, also affect the air volume and pressure, so you can't judge a turbine only by its number of stages.

TWO AIR PORTS ADD VERSATILITY



You can install the air hose at either the rear or bottom of some guns. Choose the bottom position for the best gun balance and the rear port for better tight-quarters access.

CHANGE SPRAY PATTERNS WITH A TWIST



Rotating the air cap changes the fan pattern from horizontal (left) to vertical (center) to round (right). Although it can be hard to remember, here's a simple trick: The horns on the spray cap indicate the direction you move the gun when spraying. Top-to-bottom for a horizontal fan; left-to-right for a vertical fan; and a round pattern can be sprayed in any direction.

Any dust or particles in the air supply would end up in the finish, so there's a range of filtering approaches among the brands. Some opt for a single filter, others for dual filters (one for the motor-cooling air and a

finer filter for air going to the spray gun). One model (the ApolloSpray) uses high-quality filters for both air supplies.

One complaint we often hear from HVLP users is that the turbine units are noisy, and

we agree completely. True to their roots, most sound about like a shop vacuum. Fuji's Q3 is a notable exception: We found it easy to have a conversation standing right next to the turbine while it ran.

The best systems spray through thick and thin

Finishes can range in thickness from water-thin dyes to paints that are as thick as honey. The thickness of the finish is called its *viscosity* and it is a primary consideration in achieving quality results. The higher the viscosity, the more airflow needed to atomize the finish. The HVLP systems we tested vary in their ability to spray heavy-bodied finishes without thinning.

To measure the viscosity of a finish, most spray systems come with a viscosity cup similar to the one shown at *right*. (The Campbell Hausfeld models come with a less-precise viscosity stick, and the Accuspray didn't come with any viscosity tool.) Viscosity changes with temperature (the warmer the fluid, the less thinning needed), so we conducted all of our tests with the room and fluid temperature at 70°F.

Although all of the systems we tested sprayed stain and oil-based varnish unthinned, only three models—the Accuspray, Fuji, and Turbinaire—could spray higher-viscosity finishes without thinning. The thinning percentage listed in the chart reflects the amount needed to achieve optimal atomization across the gun's full range of fan-width settings.



HOW THICK IS TOO THICK?

To see if a finish is light-bodied enough to spray, dip the viscosity cup into the finish and time how long it takes for the cup to drain through the hole in its bottom. If it takes longer than the time listed in the system's manual, you'll need to thin before spraying.

Note: We tested each system with the needle and nozzle that came with it. Most manufacturers offer optional needle/nozzle sets that can spray thicker materials without thinning. If you routinely spray heavier materials than a system can spray with its standard set, these optional sets make good sense.

THE BEST SYSTEMS REQUIRE LESS THINNING OF FINISHES

BRAND	MODEL	THINNING REQUIRED		
		Oil-based poly (1)	Lacquer (2)	Water-based varnish (3)
ACCUSPRAY	23i-T	0%	0%	0%
APOLLOSPRAY	800	15%	20%	20%
CAMPBELL HAUSFELD	HV2002	15%	20%	20%
	HV3500	10%	10%	15%
CAPSPRAY	CS8100	15%	20%	20%
FUJI	Q3	0%	0%	0%
ROCKLER	61577	50%	50%	50%*
TURBINAIRE	1235GT	0%	0%	0%
WAGNER	2400	20%	30%	30%
	2900	15%	20%	20%

A Excellent
B Good
C Fair

Notes: 1. Minwax Fast-Drying Polyurethane
2. Sherwin Williams Sher-Wood Lacquer
3. Oxford Ultima Varnish

(*) Could only spray this material with a narrow round spray pattern.

The hose: important but underrated

Routing air from the turbine to the gun, the hose is the final big piece of the HVLP puzzle, and a good hose has durability, flexibility, and low weight. A too-stiff hose tends to steer the gun during spraying; a more flexible hose may not return to its original shape, restricting airflow. To make this vital link both crush-resistant and maneuverable, two manufacturers supply a flexible “whip” hose with their systems. This short length of extra-pliable hose, connected between the heavy main-supply hose and the gun, provides flexibility where you need it and durability where the hose can get underfoot.

All of the hoses became more flexible as they softened from the turbine-warmed air passing through, although the Turbinaire hose felt heavier and stiffer than the others: The optional whip hose is a must with this system. We also found that hoses reinforced with a mesh resisted crushing better than the more typical coil construction. (See photo, *below*.)

Hose length may not seem like an important consideration, but placing

the turbine as far as possible from the spray area extends filter life by keeping it away from the overspray. It also reduces turbine noise. However, a long hose can hinder the performance of an underpowered system, so the less-expensive units come with a shorter hose, which helps keep the pressure and airflow higher.

Top guns and turbines

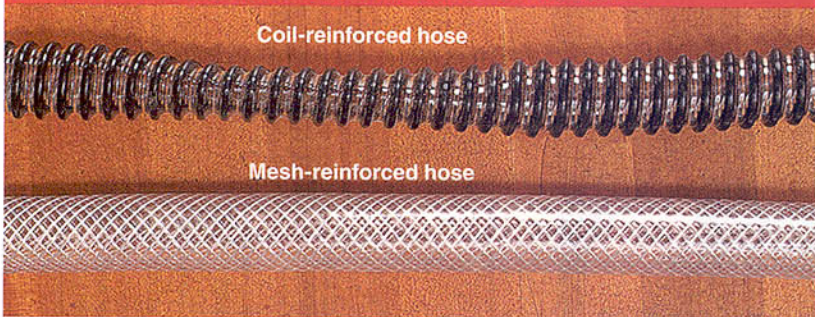
We like the AccuSpray and Turbinaire systems: Both use top-quality guns that atomized clear finishes well and could spray a fan of finish anywhere from 1" to 12" wide without thinning. We also gave high marks to the quiet Fuji Q3, so if noise level is more important to you than the ability to spray a fan narrower than 5", it, too, would be a very good choice.

Those systems all run from \$750 to \$800. If you don't have that much dough to blow, the Campbell Hausfeld HV2002 atomized clear finishes nearly as well as some units that cost more than twice as much. You sacrifice gun quality and fan-width adjustability for the savings, though, and the 15-foot hose keeps the turbine unit closer to the spray area than we like. 🌿

AccuSpray 23i-T



STRONGER-LOOKING ISN'T ALWAYS STRONGER



Coil-reinforced hose

Mesh-reinforced hose

Coil-reinforced hoses tended to not spring back if accidentally stepped upon. The mesh-reinforced hoses by Accuspray and Fuji flattened when stepped upon, but recovered their shape—and airflow—quickly.

The man behind the mask

Paul Snyder, “The Finish Wiz,” is a finishing and restoration professional from Fredericksburg, Virginia. Paul teaches finishing techniques ranging from basic to master level skills, and contributed to the spray-finishing technique article on *page 78*. Paul's Web site, finishwiz.com, aids finishers of all skill levels.



Written by Dave Campbell with Paul Snyder

BRAND	GUN MODEL	TURBINE MODEL	SPRAY-GUN STYLE: (S) BLEEDER OR (N) NON-BLEEDER (1)	MINIMUM, MAXIMUM FAN WIDTH (2)	GUN				
					HOSE MOUNTING LOCATION (3)	VISCOSITY GAUGE INCLUDED (4)	NUMBER OF STAGES	AIR FILTERING (5)	
ACCUSPRAY	10	23i-T	N	1", 12"	B	N	3	D	
APOLLOSPRAY	A5510	800	B	6", 12"	B/R	C	3	D	
CAMPBELL HAUSFELD		HV2002	B	N/A	R	S	2	S	
		HV3500	B	5", 12"	B/R	S	3	D	
CAPSPRAY	Maxum II	CS8100	N*	3", 12"	B/R	C	3	D	
FUJI	XT	Q3	N	5", 12"	B/R	C	3	C	
ROCKLER		61577	B	N/A	R	C	1	S	
TURBINAIRE	BNB	1235GT	N*	1", 12"	B	C	3	D	
WAGNER		FineSpray 2400	B	N/A	R	C	1	S	
		NB Soft-Spray 2900	N*	3", 12"	R	C	4	D	

NOTES:

- As shipped from factory.
(*) Can be converted to bleeder.
- With finish thinned for best atomization over full range of widths.
(N/A) No fan-width control. Sprays 9–10" fan, or turn air cap to 45° for a narrow, round pattern.
- (B) Bottom of gun
(R) Rear of gun
(B/R) Both bottom and rear of gun

Turbinaire 1235GT



Campbell Hausfeld HV2002



TEN HVLP SYSTEMS UNDER THE GUN

TURBINE	HOSE	PERFORMANCE GRADES (6)													COMMENTS	MORE INFO:
		LENGTH (FEET)	WHIP HOSE: (I) INCLUDED (O) OPTIONAL, OR (U) UNAVAILABLE	EASE OF ADJUSTING AIRFLOW	EASE OF ADJUSTING FAN WIDTH	QUALITY OF GUN CONSTRUCTION	STAIN, OIL-BASED VARNISH (8)	OIL-BASED POLYURETHANE (9)	LACQUER (10)	WATER-BASED VARNISH (11)	AIR FILTRATION	TURBINE NOISE LEVEL (12)	HOSE: RESISTANCE TO CRUSHING	WARRANTY (YEARS)		
30	I														A	A
24	I	A	B	A	A	B	B-	B-	A	C	B	2	U	745	A good system with high-quality filters for both spraying and cooling air. Whip hose and dual mounting locations make the gun maneuverable. The Teflon-lined cup eases clean-up.	888/900-4857 hvlp.com
15	O	A	N/A	C	A	B	B-	B-	C	C	B	3	U	200	Good spray performance from an economical system, but the viscosity stick gave inconsistent readings when thinning. Short hose keeps turbine close to spray area, where filter can foul.	800/626-4401 chpower.com
25	O	A	B	B-	A	B+	B+	B	C+	C	B	5	U	600	Sprayed as well as more expensive units, and shares such features as rear or bottom hose mounting and in-line airflow valve. We'd toss the viscosity stick and get a cup for reliability.	
30	U	A	A-	A	A	B	B-	B-	B	B	B	1	U	825	This system sports unique features, such as external adjustment for the pickup tube and a light that warns when the turbine filter is clogged. Middle-of-the-pack spray performance.	800/292-4637 spraytechinc.com
25	I	A	B-	A	A	A	A	A	B-	A	A	2	C	750	We didn't need to thin any tested finish to spray it well with this super-quiet system. The turbine's filter can be difficult to replace (it fits inside the unit). Hose was somewhat stiff until it warmed.	800/650-0930 fujispray.com
15	U	N/A	N/A	C-	A	C-	C-	C-	C	B	B	1	T	100	Except for stain and oil-based varnish, we had to thin every finish 50 percent before this low-dough unit could spray it. Short hose keeps turbine close to spray area, where air filter can foul.	800/279-4441 rockler.com
25	O	B	A	A	A	A	A	A	B-	C*	B	3	C	800*	No thinning was needed to spray any finish we tried. Hose felt stiffer than others (get the optional whip), and airflow adjustments are back at the variable-speed turbine, which could be 25' away.	800/866-4857 turbinaire.com
20	U	N/A	N/A	D	A	B-	C+	C+	C	C	B	1	U	100	Bare-bones, all-plastic gun and a lightweight turbine unit. Sprayed a little better than the \$100 Rockler. The hose "press-fits" onto both the turbine and the gun, and could pop loose.	800/328-8251 wagnerspraytech.com
25	U	A	B	B	A	B	B-	B-	B-	C	B	1	U	580	Similar in performance to the ApolloSpray for less money. But you'll forfeit the whip hose, and Apollo's filter is superior.	

4. (C) Cup
(N) None
(S) Stick

5. (C) Combination filter: Single filter for spray air and cooling air
(D) Dual filters: Separate filters for spray air and cooling air
(S) Only spray air filtered

6. **A** Excellent
B Good
C Fair
D Poor
N/A No adjustment on this gun

7. The amount of thinning required to get good fluid flow and atomization over the full range of fan widths using the needle/nozzle set provided.

A No thinning required
B 10-20% thinning required
C 30-50% required

8. Minwax Stain, Waterlox Varnish

9. Minwax Fast-Drying Polyurethane

10. Sherwin Williams Sher-Wood Lacquer

11. Oxford Ultima Varnish

12. (*) Noise level improves at lower turbine speeds.

13. (C) Canada
(T) Taiwan
(U) United States

14. Prices current at time of article production, and do not include shipping, where applicable.
(*) Available with single-speed turbine (Model 1135GT) for \$700.