

Mid-Range UV Combo Printer



Dilli Neo Titan UV

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Dilli Neo Titan UV UV Flatbed combined with Roll-fed

Virtually no outside reports exist on UV printers other than “Success Stories” in trade magazines. The Success Stories that leave the most impact on me include one on a Chinese-made printer. This Success Story was featured in a major US trade magazine. It was written about the same time as more than 35% of this same brand of printer were being rejected by owners, at a time when probably a quarter of the dealers who had sold this printer gave up because the printer broke down too often, and in a year that several lawsuits were filed by print shop owners to get their money back.

Another Success Story (in the same major trade magazine) lauded a printer without mentioning its downsides. I visited the owner of the identical brand and model of printer. The owner told me that this printer broke down repeatedly and that he felt like a guinea pig with an unfinished beta-stage printer.

So, sorry, but Success Stories are not realistic, indeed they may be misleading, and potentially seriously so.

This FLAAR Report is not intended to lure you into buying this or any other brand of UV printer. FLAAR is a research institute at a university. Our interest is to learn which UV printer we should consider to acquire for our own printing needs. As expected of a research professor, I go out and work hard at learning about as many of the over 101 printers from more than 45 different manufacturers. Since we do all this research anyway, we issue the FLAAR Reports so we can share our findings with printshop owners, managers, printer operators, and with other university departments of print management.

People sometimes ask why some of our Reports are more comprehensive than others: it's very simple:

- when we can inspect the printer in the factory,
- when we can undertake tests in their demo room,
- when all manuals are available

then it is more realistic to have a complete and comprehensive FLAAR Report on a specific brand and model.

This is an ample report because it has been possible to spend two days inside the factory and demo room at the world headquarters of Dilli north of Seoul, Korea. Dilli provided access to all their manuals including their design and parts descriptions.

THE BASICS

1. Brand name, model?

The full name is Dilli Neo Titan UVT-1606.

2. If there are two or three (or more) widths of this printer, what differences exist other than the width?

Of this platform here is only one size. It's the Dilli Neo Plus that has two different sizes; these are a different Dilli platform that we discuss in a separate FLAAR Report, one on the Dilli original series.

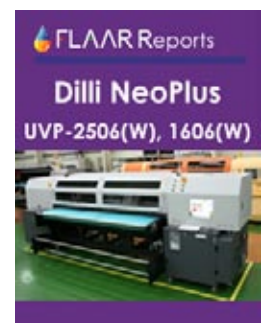
3. What is the nature of the company? Is this company the manufacturer, distributor, or rebranding a machine made by someone else?

Dilli is the manufacturer of all of these printers in Korea. Dilli and D.G.I. are owned by two brothers: D.G.I. makes the solvent printers; Dilli makes the UV printers.

4. Is this same model(s) rebranded and sold under other names?

Dilli has supplied some portion of Neo Titan under other name on OEM basis.

Since the two printers are essentially identical, the FLAAR Report on each are similar. One difference is that we have spent two days inspecting the Titan in Korea. So the report on the Titan is longer than the report on the other version.





Dilli has

- 2,768 m² assembly space,
- 231 m² R&D space ,
- 165 m² for sales and marketing

Total square meters of the entire building, all floors, including assembly, R&D, and sales & marketing space

- At the address of 542-2 :: (6,424 m²)
- At the address of 542-3 :: (4,958 m²)

Dill presently has > 25 workers working on the assembly line but there are plenty of capable new people in the area that could be hired to increase manufacturing capability.

Dilli has > 12 research workers in R&D.

> 6 Sales Representatives work in marketing & sales (keep in mind presently probably 75% of their production is OEMed, so the company for which they OEM has their own worldwide.

> 27 workers are elsewhere in the Dilli company.

I spent several days in their factory, have visited their R&D facilities and seen their sales and marketing areas.



Dilli Neo Titan UV
Combo Printer

5. What other printers of other brands are comparable?

The IP&I 1606 is the closest other brand of combo-style printer. The Flora F1 180uv is another combo style but it is Chinese, is unproven and needs to be evaluated before we would consider it.

All other entry level printers are hybrids, meaning they have pinch rollers pressing on grit rollers. A hybrid system has no moving transport belt.



Dilli Neo Titan 1606 at ISA 07.

6. When and where was this model first introduced?

First shown to the public at Kосign 2006 (November, Seoul). First introduced internationally at ISA '07 in April.

7. Is this printer mature or still in alpha-stage or beta-stage?

This printer is out of beta stage and is fully functioning.

8. List price?

List price for Dilli Titan is \$120,000. In Europe and other parts of the world the price will vary by currency and the local distributor.

9. What accessories are extra charge? Are these same or similar accessories included with other printers at no extra cost?

The printer comes complete from Dilli; what you see is what you pay for and is what you receive.

10. Does a complete set of full-sized ink cartridges come with the new printer, or merely a "starter set" that is not as full as a regular set?

Minimum amount of ink that comes with the printer when it is installed is 1 liter per color.

11. Is an air suction system needed to be installed as a separate item, or is all the vacuum table or other vacuum requirements already included in the printer itself?

The printer comes with a separate vacuum motor that sits on the floor, alongside the printer. But you need to provide compressed air for the negative vacuum in the printhead.

12. Is it recommended, or required, to buy a spare parts kit? Or extra printheads?

The spare parts kit is neatly packed into two suitcase-like containers. But these are for the dealer or distributor and are not generally bought by the end-user.

13. Or do the dealers prefer that customers not try to make their own repairs?

The end-user is not encouraged to take the printer apart and do repairs on their own.

This policy varies by manufacturer. Interest in doing their own repairs varies by the end-user and by the printer operator. A few operators like the opportunity to take service training at the factory and thereby to be able to do basic repairs on their own. Most manufacturers discourage this, but some manufacturers do allow end-users to take advanced service training.



Dilli NeoTitan 1606 at SGIA 07

14. How does the total cost compare with other UV printers?

	Dilli version
Base price, chassis and print engine	\$120,000
installation	included
training	At distributor (this is an advantage, less chance to be disturbed by e-mail, etc)
ink	1 liter each color
warranty	1 year
spare parts kit	Not required to be bought by the end-user
table(s)	included



Spare parts kit container. Dilli factory visit, 2007.



PURCHASING

15. Are dealers national (most companies) or regional (Roland allows a dealer to operate only within a limited regional area)? Does a buyer have any choice in dealers?

Dilli dealers in the US are about six in number. The dealer we know the most is ACCI; they have many years experience selling the Zund 215 and the Zund 250. Not many other dealers have this level of experience specifically with UV printers.

STRUCTURE OF THE PRINTER: Vacuum

16. Is there a vacuum function?

Yes. There is a vacuum.

17. Is the vacuum created by simple fans, or by an air pump?

Lower priced printers use simple fans to create a light vacuum, so the GCC StellarJet 183uv uses fans. To generate a better vacuum requires an air pump; this is what the Dilli printer uses: a pump.

18. In how many sections?

The entire bed is one section. Printers that cost twice as much (quarter-million dollar range) have their vacuum in more than one section.

19. Just Off and On? Or variable?

Just off and on. Printers that are expensive have variable capability.



STRUCTURE OF THE PRINTER: Media Transport Mechanism & Media Path

20. Was this printer made originally as a UV-curable ink printer, or is it retrofitted with UV-curing? If retrofitted, what was the original brand or model?

This is not a retrofitted Chinese solvent printer. This printer was made from the ground up to handle UV-curing. Plus, Dilli has many years prior experience designing and building UV printers.

21. Is there a moving transport belt (combo style) or a stationary platen (hybrid style)?

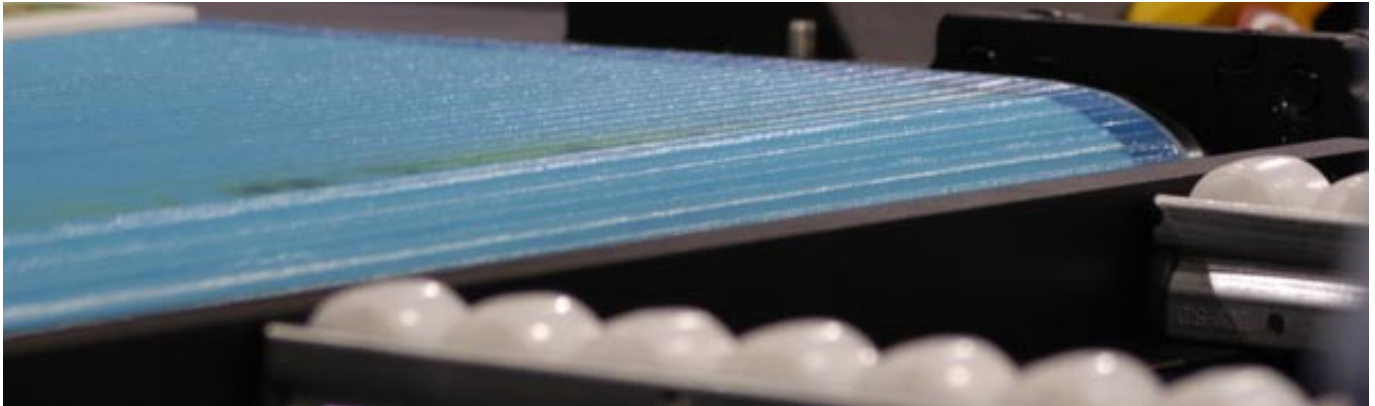
This is a combo style printer with a conveyor belt.

As in most cases, the conveyor belt of the 1606 UV is continuous and has a rough surface to transport whatever material that is put on top.



STRUCTURE OF THE PRINTER: Transport Belt**22. Describe the transport belt? What material? What manufacturer?**

The transport belt is made of a PVC-like plastic material.

**23. Size, does it stick out?**

The conveyor belt sticks out both front and back on the larger Dilli printer but on this model it does not stick out appreciably at the front and only a bit at the back.

24. How well does this belt hold up to heavy use? Does it skew?

You can check this yourself to some degree by looking at the transport belt from either side. Have the lighting shine on the belt so that you can see the horizontal sections. What you want to see is whether the woven aspect of the belt remains straight, or whether it has shifted from stress and strain.

There is a belt tension adjustment procedure listed in the manual. To see if there is any skew, "place a piece of tape on the vacuum table along and slightly under the edge of the belt. Mark this tape vertically along the edge of the belt and mark the belt with a horizontal line as a rotational reference. Then run the belt for 2-3 minutes while looking to see if the belt gradually drifts to one side or the other. The belt would move toward the side that was more loose. Then adjust the belt rotational (tension regulating bolt," etc,

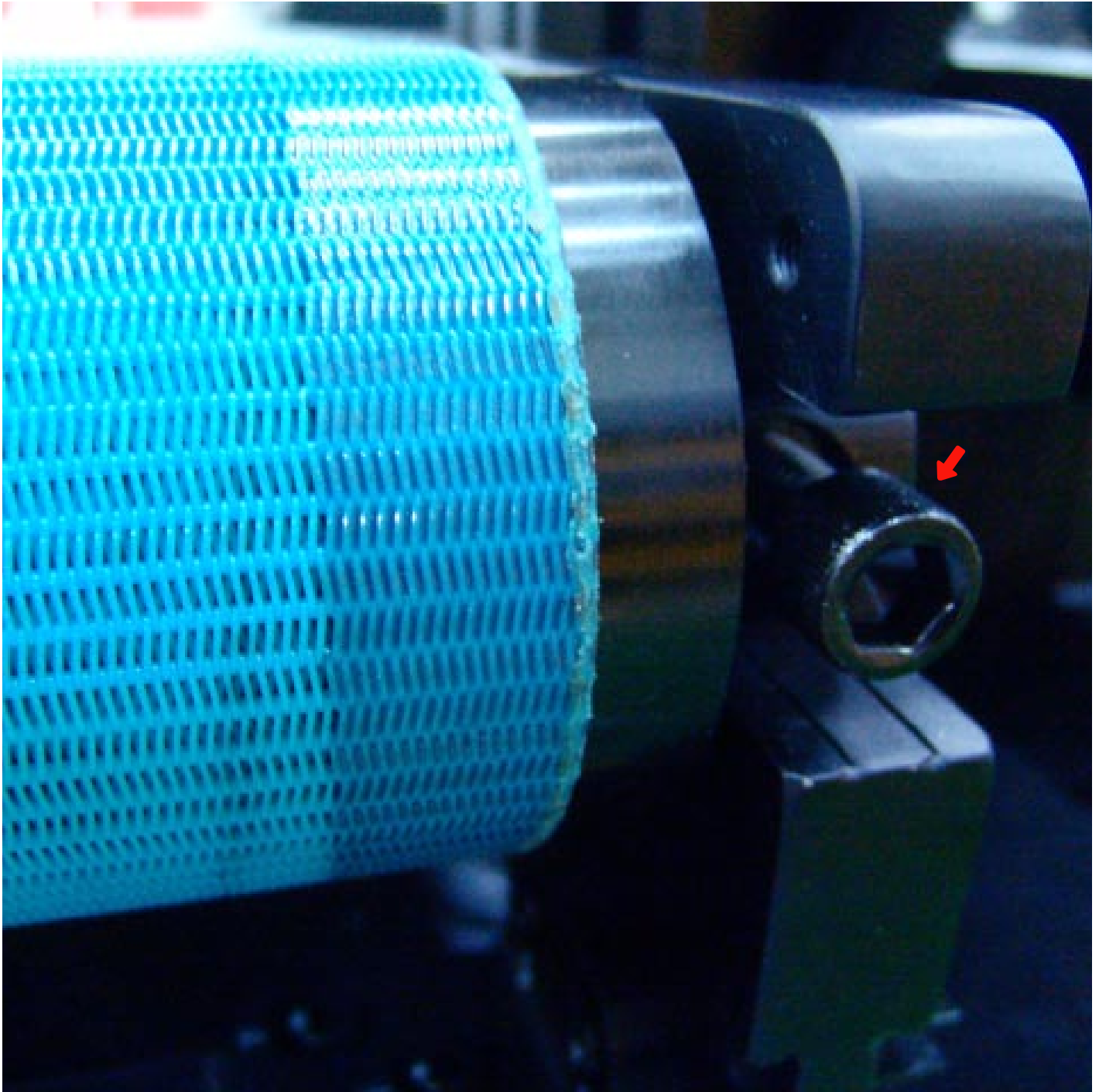


Rear view of the conveyor belt. It sticks out a little bit.

25. How often does the main flatbed transport belt need to be replaced? At whose expense?

All conveyor belts are consumables. You might need to replace it twice a year at most. You wrap it around and then slide one piano-wire through the ends to attach it to itself. This is typical also of the belts for the quarter-million dollar VUTEk combo style UV flatbeds.

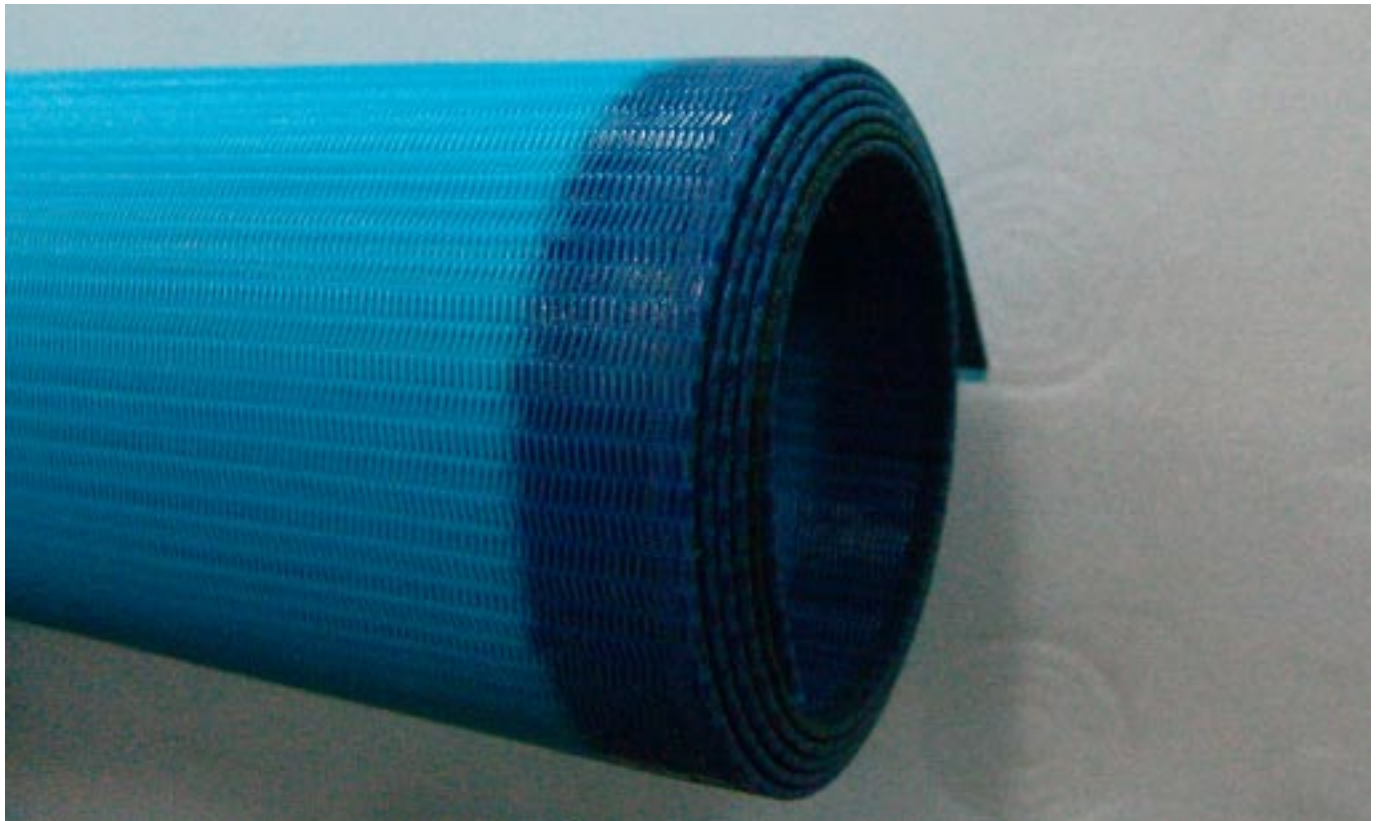
Compared with other manufacturers, Dilli has supplied its new belt at a lower price to market.



Transport belt. A wrench is used to regulate tension through this bolt.



Transport belt adjustment system, Dilli factory, 2007.



Transport belt, Dilli factory, 2007.

26. What does the transport belt area of the printer look like under the belt?

The belt is completely flat under the printer; there are no auxiliary rollers to create a tri-angular arrangement (see the next question-and-answer).

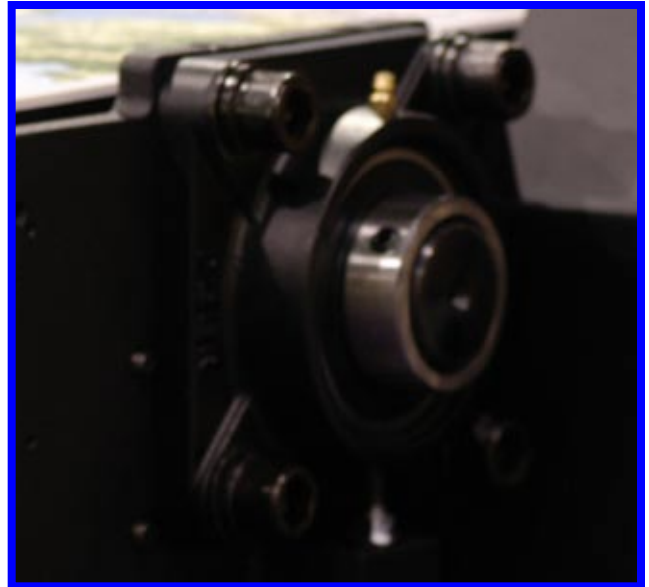
27. How many rollers control the belt: is the path of the belt horizontal, or triangular?

You should expect at least one drive roller and one driven roller, one at the front the other at the back. In between is a rectangular horizontal vacuum bed, essentially the same kind of bed you get on a dedicated flatbed printer.

The IP&I Revo has three rollers; the IP&I Cube260uv has four rollers that control the transport belt. I have not yet seen inside the DYSS printer, but reportedly it may have more than two rollers. 95% of all other UV combo style printers have only a front drive roller and a back driven roller, so two rollers is standard.

28. Which is the drive roller for the transport belt (where is the motor and what kind of motor turns the transport belt?)

The front roller is the drive roller. The motor is at the left end of the roller.



Drive roller is the one at front.

LINING UP FLAT MATERIAL (to help it feed straight)**29. What kinds of raised guide bars along the side of the table exist? Left or right? How long?**

There are no raised bars along either side.

30. Is there a registration gate that is lowered across the back printing area?

Most printshops report that most rigid media is crudely cut and rarely are the edges really at 90° to each other. So you don't really want to align a corner, you want to align one side (or one end). Thus not having an alignment feature on the side is not necessarily a plus or minus.

The summer 2007 version of the Dilli had a registration ruler; you place it manually into slots so that it goes across the width of the table. You align your material's end against this. When you are not using this measurement/alignment bar it rests into a slot set into the table.

The current winter 2007 version of the Dilli has a motorized registration gate. In other words, this system is improved over what was offered previously.

31. Where is the registration gate located? At the back? Under the carriage? Or in the front?

The registration/alignment gate is not at the back; is not under the carriage area; instead the gate is up front. The reason for placing it here is so that you don't have to walk around to the back of the printer every time you load a 1 x 1 meter board or comparable intermediate size.

32. Does the drop-down gate have moveable features to assist in registering materials?

Yes, there are two moveable adjusters. They offer about 1 cm of alignment surface. They do not have any side arm.

33. Does the drop-down gate have features to facilitate placement of multiple small materials against it?

No, this you only get on the very expensive Durst Rho 800 or ColorSpan 9840uv.

ROLL-FED

34. How is media held flat? Vacuum table? Pinch rollers?

Roll-fed media is held flat by vacuum table. Every hole in the table is tested by Dilli by sticking a pin through the hole.

35. If there are no pinch/grit rollers, is the media held by tension?

Although the media is moved by the transport belt, roll-fed media does have two single-roller tension bars, one at the feeding side; the other at the take-up side.

36. How is the roll held at the feeding position? On a spindle? On a saddle?

This printer uses a spindle.

A saddle is formed of two rolls with a slight space between them. You rest your roll of substrate on the saddle created by the two adjacent rolls. You don't need to run a spindle through the roll. You don't need to fumble loading the end of the spindle into two holders (one at each end). Loading a saddle is quicker as a result. But a saddle is primarily used on heavy-duty industrial printers 3.2 meters or wider where the weight of a roll may cause a spindle to sag. Plus, it's a headache to thread a spindle through a 5-meter long core.

37. Is there an air (pressure) core system?

Air core spindles tend to be used only on grand-format printers costing over a quarter of a million dollars.



Rear view. Spindle (a) and tension bar (b)

38. How is the roll media handled at feeding position? For example, is there a dancer bar?

There is a tension bar at the output side but not both. This tension bar goes up and down, but it is not a dancer bar (which goes diagonally).

39. Is the feeding area for roll-fed material physically attached to the printer or is it out in front and not attached (as on the GRAPO Octopus).

The roll-feeding attachment is physically attached.



Rear view. Spindle (c) and tension bar (d)

40. If a combo system, does the media feed directly onto the transport belt or is there an intermediate roller bar out in front?

Intermediate bars tend to be found only on cheap Chinese printers, and generally for hybrid designs. There is no intermediate bar for the Dilli printer.

41. At the front, is there an extra roller bar(s) near the platen or transport belt? Is it a bar to roll under the media, or over the media, or are there both (in addition to pinch roller/grit roller arrangement).

No.

42. How is the roll media handled at take-up position? For example, is there a dancer bar?

There is a tension bar that can move up and down but not a full dancer bar.

43. Describe the overall path of the media through the system?

In general, the roll-feeding and handling system on this printer is relatively sophisticated, as you would or should expect from a company with many years experience designing and manufacturing roll-fed solvent-based inkjet printers.

44. How much media is wasted during loading and feeding?

With some brands of printers you suspect that they are deliberately designed to waste ink and media since this is how those companies get their profits. Media is moved too far out before you can cut it, resulting in media being wasted before and after cutting, etc.

There is less waste on a dedicated flatbed printer because there is no material used in loading or feeding up to the point it is printed upon.

45. Can you print on more than one roll of substrate simultaneously?

Being able to print on several different rolls of material simultaneously is common on grand format solvent-based printers but almost unknown (and unavailable) on printers less than 104 inches. The Durst Rho 351R offers an option to allow printing on two different rolls simultaneously. This feature is not expected on any printer costing less than \$250,000.



Front view. Spindle (e) and tension bar (f)

46. For handling ink that passes through the weave of fabrics or mesh, is there a trough? Or other mechanism to catch the ink?

A trough is possible only on a printer with a fixed platen; there is no easy way to put a trough on a combo style printer. If you need to print on fabric or mesh with a UV combo printer you need a liner or you need to put an intermediate sheet onto the surface of the conveyor belt (or clean up the ink that passes through the weave).

47. Is there a cutter? Is it manual or automatic.

Most combo-style printers have no on-board cutters. The Durst Rho 351R has a manual cutter since this is a dedicated roll-to-roll printer (meaning it has no moving conveyor belt). So roll-to-roll systems are more likely to have an appropriate location for a cutting element and even potentially a cutting slot.

48. Is there a "knife guide," a slot where you can draw your knife down and across the width of the substrate?

Most combo-style printers have no area to put such a knife slot.

STRUCTURE: Miscellaneous***49. Does the printer have levels built into the structure of the printer?***

Yes, what appears to be a carpenter's type level is built into the middle of the gantry structure. An actual built-in level is rare, and is a nice added feature.

There are also two other built-in levels; one on each side of the media exit area.

50. Does the printer have leveling supports? How many, and how strong?

Leveling any UV printer is crucial. Indeed at the NUR factory, once the structure is leveled in the assembly room, rather than roll it from stage to stage, all construction stages take place with the printer not moving from stall to stall.

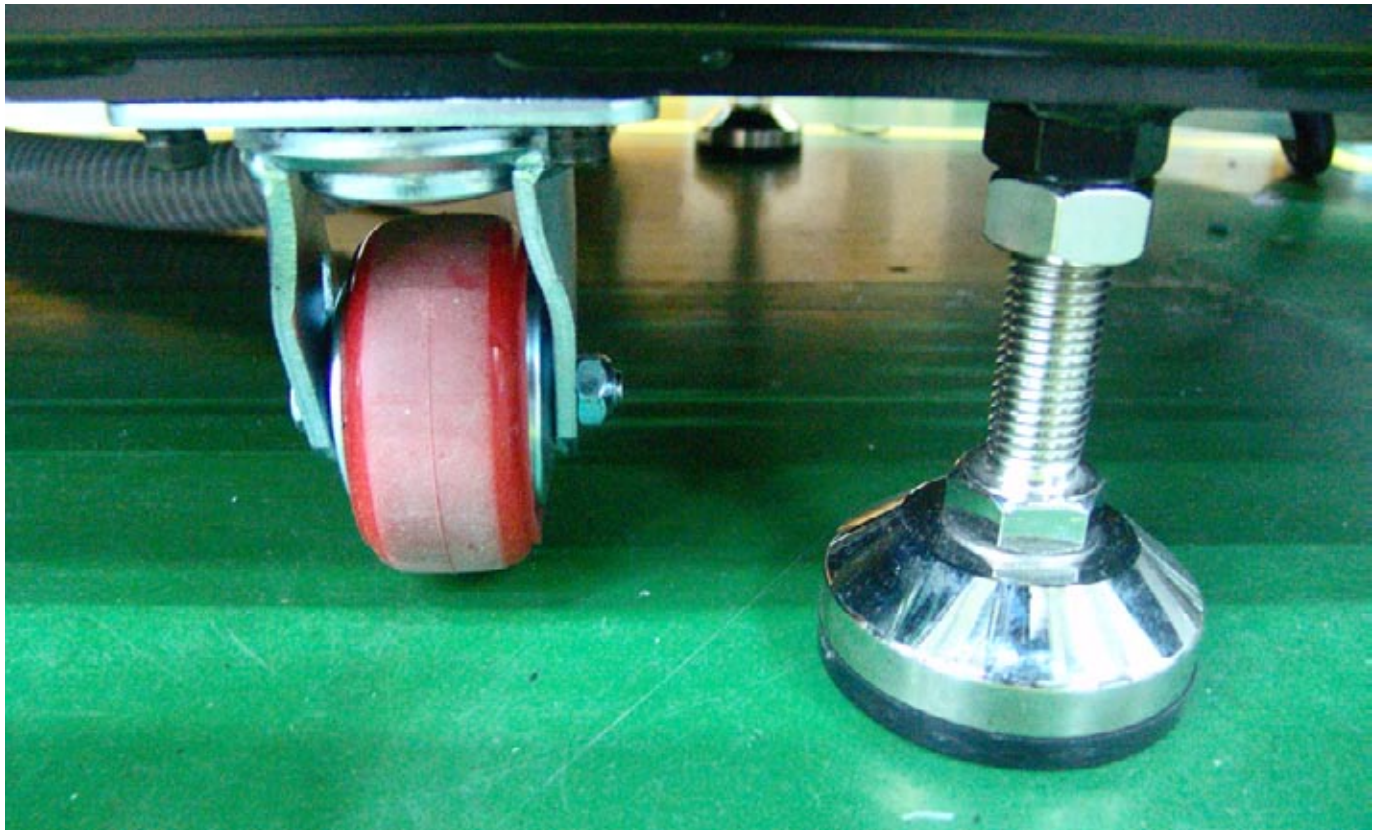
The Dilli has four silver-colored leveling screws on the main body.

51. Does the printer have wheels? How many, and how strong?

Four red wheels are separate from the four levelers. The printer also has two extra wheels for the ink station at the right end.

52. Is the motor a linear motor or a stepper motor?

Both the carriage motor and the feed motor are AC servo motors.



A total of 4 leveling supports and 6 wheels can be found in the printer.

TABLES for Combo or Hybrid Flatbed**53. What is the approximate size of the table?**

The main table is quite short, barely 2', but it has a novel flip-up extension of about 16", so the overall table is more than a yard (over a meter).

54. What is the design of the take-up table?

- **Horizontal roller bars the full width of the table?**
- **Horizontal roller bars with rigid supports in the middle and/or elsewhere too?**
- **Separate flat bars with rows of tiny rollers?**
- **Solid flat table with small roller bars?**
- **Solid flat table with ball bearings?**
- **Another design?**

The table has 5 widely spaced vertical bars, each with 16 closely packed white rigid plastic rollers per bar.

55. If there is a row of rollers set into a bar, can you slide the individual bar to a new position?

Not really.

56. Does the table stick out with cantilever support only? Or does the front have legs for added support?

The front of the table has legs for added support.

57. Are there only two legs (at the front) or are there four supports?

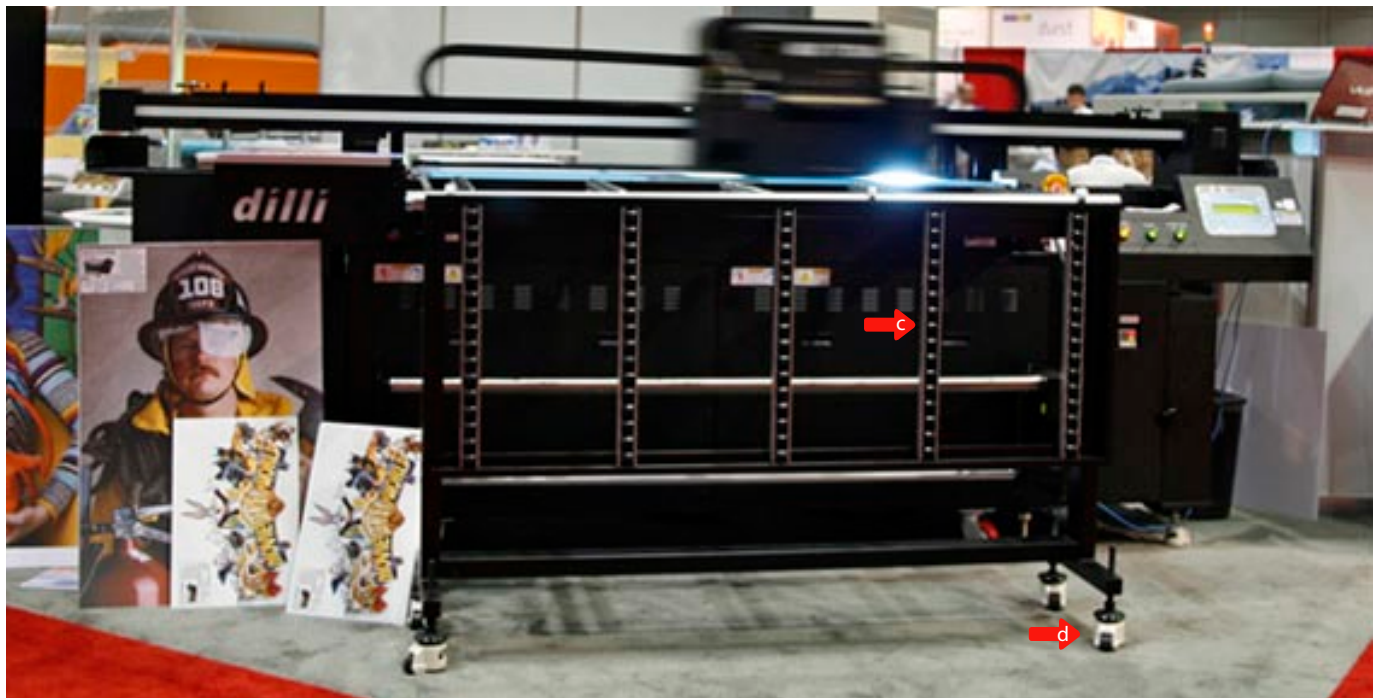
There are four supports on the floor, but they are under the front of the table; the back of the table is supported by being attached to the printer.

58. Is the table physically attached to the printer? Or just rolled up close to the printer?

There is a good latching system to attach the table firmly to the printer.

59. Does the table fold up and wheel away folded up?

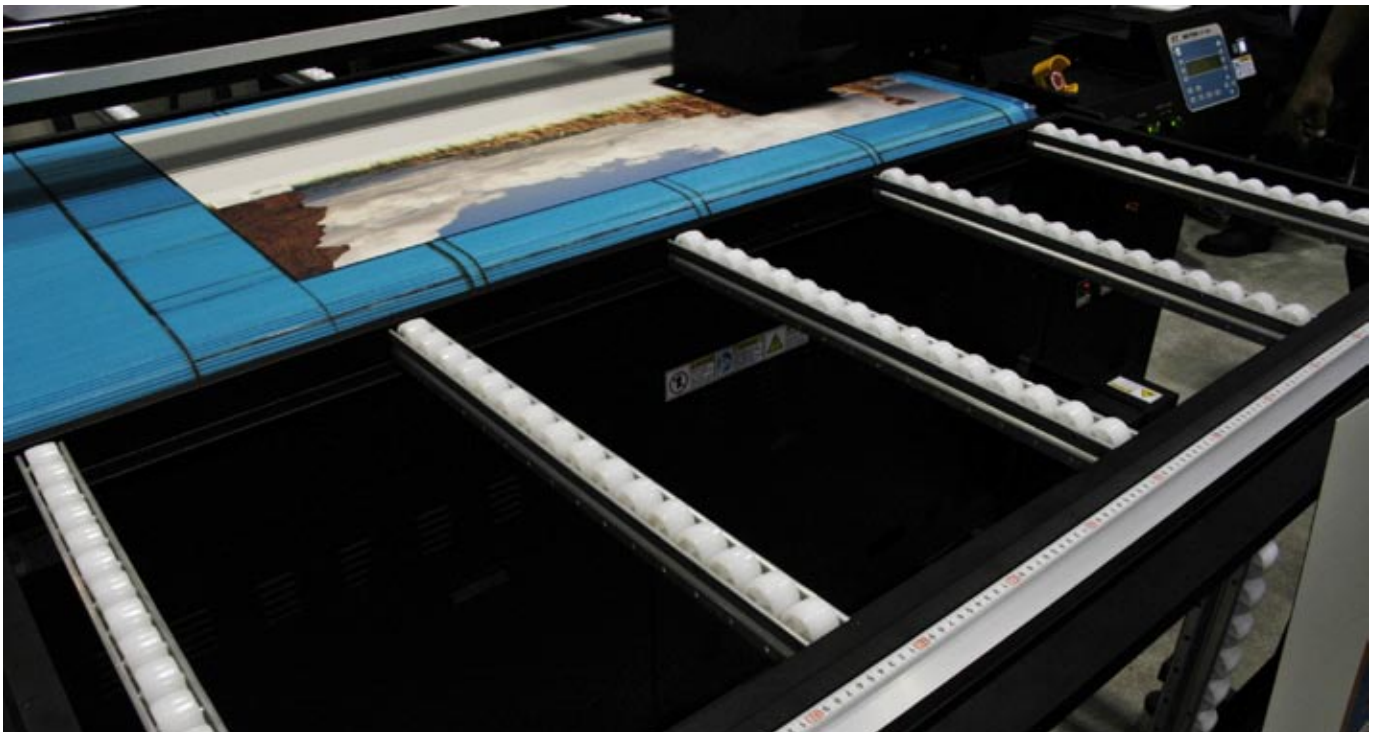
Yes, the table has two sections at the top; one folds down to the right, the other folds down to the left.



The table is composed by five bars containing a set of rigid plastic rollers (c). Four supports are placed at the front of the table (d).



Table folding structure, GraphExpo 07.



The bars contain 16 rollers tightly placed, GraphExpo 07.



Table attachment system, GraphExpo 07.



Table supports, GraphExpo 07.

Miscellaneous

60. What moves:

- the flatbed platform,
- the printhead area,
- only the material (fed by roller table; then gripped and fed by the printhead area mechanism as on a regular printer; or both?

For example, on the Inca Columbia the flatbed itself moves in and out for every line of print. The 3M (Leggett & Platt) machine is unique in that it has two options for movement, both the material and the head assembly in X,Y directions.

61. If the objects you are printing are not as wide as the full width of the printer, does the printing carriage still have to cross the entire space, or can the printing assembly hover just over the area of what has to be printed (and thereby be a bit faster)?

Yes, most sophisticated printers can hover. But this may cause too much heat build up over one part of the printer. So your software also needs to be able to modify the hovering position if so desired.

OPERATING THE PRINTER

62. In the main area for operation, is the machine software based (touch screen), or with physical control buttons? Or both?

There are both physical control buttons as well as a small LCD panel with function buttons.

63. Do you get an LCD screen in the printer or a real computer monitor? How big is the screen or monitor?

You don't get an actual keyboard; there is no computer monitor either. You only get a small LCD panel. This kind of small LCD panel is also the tradition on the Mimaki flatbed printers, and is a feature that we prefer to be replaced by an actual LCD with a normal computer keyboard.

64. Is the position of the LCD screen or monitor user-adaptable?

Not adjustable.

65. Where does the computer keyboard sit?

There is no keyboard for the printer itself.

66. Where does the operator stand or sit?

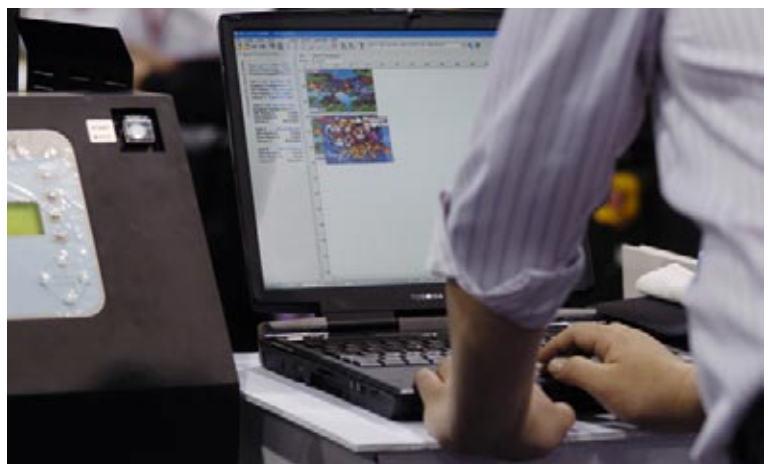
Front right.

67. What aspects of the printer can you operate from behind (the loading area)?

At the back left you find the main Off/On switch, vacuum switch, and media set switch. Otherwise most of the switches are on the front.



You get a small LCD screen in the control area. It is fixed to the printer, therefore, not user-adaptable.



Because a computer is not included, laptops have been used to operate the printer at tradeshows.

68. What controls are on either end?

There are no controls at the left end (this means none on the outside door of the cabinet). At the right end is the ink cabinet and ink level indicator (Full or Empty).

**69. Is a foot pedal included (for operating aspects of the printer)?**

I have not yet noticed any foot pedal.

70. Is there a pole with beacon lights?

Dilli was among the first to use a vertical pole with beacon lights. Most other printers do not have such a beacon. Presence of a beacon is not a major plus point; absence of a beacon is not a significant minus point.

CONSTRUCTION (BUILD QUALITY)**71. What kind of testing is done in the factory of the incoming parts?**

Yes, parts are tested, indeed I would rank Dilli as one of the better Asian manufacturers in this respect. Actually this Korean company is so sophisticated they make their own testing equipment. Their sister company, D.G.I., also makes wide format inkjet printer testing equipment.

I doubt you would find anything like this with any Chinese printer manufacturer, or at least not at this level of expertise or dedication.

72. What is the solid-ness of the construction of the outer body? Is it plastic? Metal? Heavy gauge?

All Korean UV printers from all Korean manufacturers are solidly made.

73. Describe the design and construction of the carriage area?

The carriage area has dual rails to keep the carriage movement even: one on top, the other on the front.

74. Is there both a front hood and a back hood?

This is an open design so there is no protective hood whatsoever.

75. How would you describe the overall workmanship of visible parts? Clean (Swiss made), or flimsy and uneven (several Chinese-made printers)?

Workmanship is what you would expect in a European manufacturing plant.

76. Does the printer wobble back and forth when printing?

There is no noticeable wobble.

AESTHETICS

77. How would you describe the design of the printer?

Well designed.

78. Can you easily distinguish which is the “front” and which is the “back”?

Yes, you can distinguish the front from the back. I call the front the area where the LCD and operator panel(s) are situated. This usually means that the other side is where you feed the material in. I call that the back. But many printer companies call the feeding area the front. It makes no difference as long as you define what you mean in advance.



FLAAR calls “the back” the area where you load the material.

SET-UP OF THE PRINTER: PRACTICAL CONSIDERATIONS

79. What are the electrical requirements of this printer? This means, will the building have to be rewired.

Single phase 220, 50/60 Hz. Larger printers such as those of Gandinnovations require a three-phase electrical system, which in many printshops would require rewiring.

80. Do you need to budget installing a ventilation or room exhaust system?

All UV printers need room ventilation, for everything from ozone to misting ink to general odor. Increasingly ozone production is surprised; this has led some companies to claim that “no ventilation is needed.” Such a claim is dangerous, especially in a country like the US where litigation is so common.

81. Are there any special temperature or humidity requirements or preferences of this printing system?

Temperature and humidity are indeed crucial.

This printer prefers temperature between 18 and 28 degrees C, at 25-75% relative humidity. But based on interviewing end-users with other brands, even more important is that whatever temperature and humidity is present, that it not vary during the day: cool in morning, hot by 11 am, hotter by 2 pm.

The new Dilli manual from ACCI recommends 69 to 85 degrees F and 20 to 80% humidity.

82. What about dust and cleanliness of the air?

Dust in the printing environment is an aspect that is often neglected. It is crucial that if a sign shop, that no sanding, sawing, or grinding operations be nearby. The dust and debris from sawing and comparable operations are extremely unhealthy for a UV printer.

In other words, you need to ventilate away more than ozone and ink odors; you need to ventilate away everything else that is already in the printshop environment.

83. What is the connectivity? Network, SCSI, FireWire, USB, or other?

TCP/IP.

84. What air pressure is required to be provided to the printer? Is this for a vacuum table, or other purposes (such as ventilation)?

You must provide a source of pressurized air. This is for vacuum table and other systems.

85. What is the size and weight of the printer?

3.5 x 1.52 x 1.6 meters, approximately 136 x 60 x 63 inches. The printer weighs 620 kg.

86. How many boxes arrive?

Two boxes arrive: the main box with the printer; then a second box with the tables, etc.



The printer comes in one piece. The only features that come detached from the main body are the tables.

INSTALLATION OF THE PRINTER

87. Is there a glossary in the User's Manual?

No, and as in most printer literature, there is use of the word “hybrid” to describe the fact that it can do both flatbed and roll-fed material. A hybrid can do this via pinch rollers with grit rollers; a printer with a moving transport belt is a combo, not a hybrid. So this Dilli Titan printer (and all current models of Dilli printers) are all combo printers, not hybrids.



Manuals, at Dilli headquarters, December 2007.

88. What is the native language of these guides? Is the translation acceptable?

The original language of the User's Guide is Korean. The translation is acceptable but has some words that are translated in a literal manner. Literal translations are common for manuals translated from Korean, Chinese, and Japanese. There are at least two typographical errors (spelling) but this is about the average even for manuals written in native English.

89. How hard, or easy, are the manuals to obtain BEFORE you buy the printer?

I was shown all manuals at the Dilli headquarters; every single manual, including the master part's list (that the engineers use to construct the printer). I was allowed to have the User's Guide. Service manuals are very technical and FLAAR does not tend to keep these in our library since there are over 101 models of UV printer and the service manuals change every time one part of the printer is changed. But we do have a reference library of as many user's manuals as possible. Our reference library of user's manual is one of the largest in the world. This reference library is for our use in evaluating the printers. Since these manuals belong to the manufacturer, we do not reproduce them, share them, or in any other way provide access to them. However a few user's manuals are totally available from the manufacturers (this was the policy of MacDermid ColorSpan for many years).

90. Is installation included in the purchase price?

Installation is included in the purchase price in the US and in most parts of the world.

TRAINING

91. Is training included in the purchase price? If so, what kind of training is offered?

When you purchase this printer from ACCI the training is in their facilities in Minneapolis. This is an easy city to reach since it's a hub for Northwest Airlines, as well as being served by many other airlines. Getting around the city is easy and hotels are a reasonable cost. The training itself is included in the purchase price.

ACCI says that training is more effective when the operator(s) is away from his desk, away from the distractions of his place of work.

92. Is factory training available?

Yes, if you wish to visit the factory north of Seoul you would be welcome. Normally, however, training is done by the distributor.

93. What on-line training is available?

No on-line training is available for most inkjet printers



Dr Nicholas Hellmuth and the CEO of Dilli, Dr Geun-Soo Choi, outside the new D.G.I. factory and headquarters.

TECH SUPPORT & WARRANTY

94. What is the original warranty period?

One year warranty.

95. Does it include parts, labor, printheads?

Printheads have a warranty for six months.

96. What are the hours of tech support? If support is from eastern time zone, hours should be at least 8 am through 8 pm to cover users on the West Coast.

ACCI provides tech support from 8:30 am to 5 pm, Central time zone.

97. What happens if the tech support from your local distributor is uninspired or inadequate? Can you telephone the manufacturer directly? If so, will be manufacturer actively assist you, or only begrudgingly?

MacDermid ColorSpan was good at providing direct manufacturer's tech support. Whether this will continue under HP ownership is not yet known. Dilli also can provide manufacturer's tech support if absolutely needed.

Some other manufacturers simply don't provide tech support themselves, or only begrudgingly: they expect their dealers to provide support. We have several instances in Australia of poor tech support for GRAPO printers and the printshop owner rated the backup from the manufacturer in the Czech Republic as unsatisfactory (that's putting it about as politely as I can; the situation was quite unbearable for two UV printer owners in Australia).

98. Can the manufacturer remotely diagnose the printer?

No.

99. What is the native language of the tech support person?

English if you buy your printer in the US. Other languages if you buy your printer elsewhere.

100. Who does repairs? Dealer, manufacturer, distributor, or third-party?

Distributor.

CLEANING & MAINTENANCE NEEDS**101. How is head cleaning accomplished? purge, suction, manual, other?**

The heads are cleaned by sucking ink out of them, hoping that the movement of the ink will dislodge any obstructions in the nozzle channels.

But then you can also do a nozzle test, which makes the nozzles jet ink for three seconds. In other words, there are two manners of purging.

102. To what degree is purging automatic (once you press a button), and to what degree is it manual?

Purging and suction are done by the printer once you tell it to by pressing the square blue purge button.

103. To initiate a purge, where is the control or button? Is it software generated or do you have to press a button? Is the button on the outside of the printer, or inside on the carriage?

Purging with ink is easy; just purge with ink. But if you need to purge with flush liquid, you have to fill the line with flush liquid first.

- Manually turn the valve on each ink line to "S" for cleaning by forcing a solution through the system.
- Then the solution valve itself.
- Push the purge button; this flushes the heads with cleaning solution.

104. Is purging done with ink, or with a flush solution?

If you wish to purge with flush solution you have to first open the main flush control; then turn the toggle switch to the flush position on each printhead one by one.

105. The ink that is purged, where does it go? Into a drain/waste bottle, or into a drip tray?

Purging is done at the right. Ink goes into a drip tray and from the tray into its tube down to a waste bottle.

106. Is there a capping station?

Yes, the capping/suction station is at the left; it is protected by a cover. There is a "capping cover switch" to have the cover slide away to expose the capping station.

A capping station can be used to cap the printhead nozzle plate area when the printer is not in use. Or a capping station can be used as a sucking station to purge the inks.



Capping station.

107. Where is the parking area, “home?”

Home is at the right. This is clearly indicated in an annotated view of the printer (provided by ACCI).

108. Is the service area the same as the parking area?

No, they are on different sides of the printer.

109. Does this printer spit, or “weep” (“flash”) at regular intervals?

No, Dilli printers do not weep (spit). Printers that are retrofitted solvent printers, especially those from China, such as those by Flora, tend to still have a spitting function remaining.



Parking area at right.



Capping station is at left.

MAINTENANCE

110. What daily procedure is required at start up in the morning?

Clean out the caps in the capping station, then purge and wipe.

111. What daily maintenance is required at night?

Quick purge, wipe, cap. You can elect whether to fill the caps with cleaning solution or not. Takes about 3 minutes all together.

112. How do you clean the transport belt?

You can remove wet uncured ink with alcohol.

113. How complex is it to align the printheads?

There are two head alignment adjustment bolts on the carriage. This is a manual procedure. The instructions are helpful and provide details even that you need to use an insulated screwdriver to prevent causing an electrical short-out.

114. Is there a sleep mode? Should the machine ever be turned off? Does this entail having a UPS unit to guarantee it is on all the time?

You can turn the printer off completely.

SAFETY & HEALTH CONCERNS**115. How many emergency stop buttons are there? Where are they located?**

Only two: one in the front operator's area; one on the back (feeding area).

116. Is the machine enclosed, or exposed?

Since there is no hood at all, the printing area is completely exposed.



Both stop buttons are easily accessible.

117. Does the hood close down completely to seal the system, or are there a few inches open at the bottom?

The hood on any hybrid or combo system must allow space for boards to pass through, so its hood can never close down tightly onto the platen area. The design must allow space; this space should be closed off with a skirt. Some printers use flaps or rubber like material; other printers use skirts of brush-like material.

118. What kind of "skirt" exists along the bottom of the hood to prevent light leakage?

There is a skirt to prevent light leakage.

119. What system of ventilation or exhaust system is built into the printer? Or if not required, what would common sense dictate? Is it adequate to clear the work area of gasses and fumes?

The Dilli manual provided by ACCI states clearly "For the comfort and health of the operators, a ventilation system may be used to exhaust ink fumes and heat from the working area." I would recommend changing "may be used" to "should be used."

120. What is the noise level, primarily of the fans for the vacuum?

I never heard any unacceptable noise level.

121. How easy is it to obtain the MSDS of the ink?

It is rare that the MSDS of the ink is easy to obtain. If the MSDS is an auto-download from the company website, this is how it should be. But most companies do not wish the end user to know which brand of ink is being used, so hiding the MSDS is not necessarily an attempt to hide the dangers, but may be to hide the source of the ink.

PRINTHEAD TECHNOLOGY

122. Which brand printhead is used?

KonicaMinolta printheads are used. The same brand is used in the IP&I UV printers.

123. Which model of printhead is used

Dilli clearly states that the heads are KM512.

124. How many other printers utilize the same printhead? Have they shown any problems?

Several other UV-curable inkjet printers use KonicaMinolta printheads. They are considered a good printhead, albeit not very fast.

125. How many printheads per color?

One.

126. How many total number of printheads?

Six.

PRINTHEAD DPI & Features

127. What is the drop size in picoliters?

14 pl. This is roughly the drop size of an HP Designjet 5000 or HP 5500.

128. Is there variable droplet capability?

No variable droplet sizes.

129. How many passes can this printer achieve?

2 to 8 passes are possible. "Most people use 4 passes for 720dpi or 8 passes for 1440dpi."

130. Does the software use passes or modes to describe quality levels?

Increasingly most printer companies are not listing the passes that their printers run back and forth. The definition of a pass is not consistent in any event: FLAAR defines a single pass as the movement of the printer carriage, while jetting ink, from one side to the other. There is a difference between "single pass" and "one pass" but that needs an entire article (one pass means a page-width row of non-moving printheads).

Mutoh describes one pass as a complete back-and-forth movement (FLAAR defines that as two passes).

Most printer manufacturers would rather avoid having to state clearly how many actual passes it takes to achieve specific quality levels. So they create "modes" that are a combination of passes and possibly other features that result in a specific quality level.

131. How does the resolution of this printer compare with other brands or other models of the same brand?

Many UV-curable printers nowadays use essentially the same KonicaMinolta printheads, so the resolution they achieve is roughly comparable.

Bi-DIRECTIONAL VS Uni-DIRECTIONAL PRINTING

132. What is the direction of uni-directional printing? From right to left, or left to right; or both?

From right to left.

133. Is printing bi-directional or uni-directional? What are the different results in speed; in quality?

At the trade show ACCI was printing primarily in uni-directional mode. In the Mimaki booth they were trying with bi-directional; their result was excessive lawn-mower banding problems.

PRINthead Positioning

134. Are the printheads in a straight row, or staggered?

The printheads are staggered in a triangular wedge shape (you can see the layout of the printheads by looking at the positions of the capping station).

Show photo of the capping station to show layout of the printheads.

135. Do you raise the heads manually, with click stops, or motorized?

Motorized.



Dilli Neo Titan UV 1606. Capping station.

PRINthead: Associated Features

136. What is the firing frequency (voltage) of the printheads (in KHz)?

Yes. Each head has its own voltage recommended by printhead manufacturer. Using the Function keys on the LCD screen you can increase or decrease the head voltage. But be aware that you need to understand the pros and cons of this before you try it.

PRINthead Life Expectancy

137. What does each printhead cost to replace?

Price of the printhead, and especially the service cost to install it, vary by the local distributor.

SUBSTRATES

138. What sizes of material can be printed on?

Max width is 62.875 inches.

139. What is the difference between media width and actual print width?

We have this entry because some printers are called "3.2" because they accept substrates that are 3.2 wide, but the printer can actually print only 3.1 meters. In such a case the model name is misleading (and incorrect in a sense). I have even seen some model designations claiming 3.3 when they only hold media 3.2 meters. So there is a bit of misleading advertising out there.

	Print width	Material width	Claimed by how the model is named
Dilli	1.58 m, 62 inches	1.6 m, 63 inches	1606 model designation means 1.6 meter material with 6 printheads.



140. What about edge-to-edge printing (borderless)?

It claims borderless printing, but not at full media width, since there is half an inch border on both sides since the printer can actually print only 62 inches across.



Dr. Nicholas Hellmuth and Dilli personnel showing borderless samples.



141. How about maximum roll diameter or weight?

36 cm, 14.17 inches, appears to be the maximum roll diameter.

142. Can you adjust the rate of media feed?

You need to adjust the rate of feed to remove banding lines caused by media feed that is slightly off. This is not the fault of the printer but a result of the fact that each different kind of material feeds slightly differently.

143. What thickness can this printer handle?

From 1 mm up to 4.5 cm, which is 1.75 inches.

144. Can you measure the height of the material with a sensor, or is it manual?

A small sensor sticks out from a lift; as you lower it, when the sensor touches the material this registers the material's height (at this point the sensor snaps back up into its protective position).

SUBSTRATES, Issues

145. Can you print on mirrors?

In theory you can print on mirrors, but it's always a risk that the UV light may reflect back up inside the printhead nozzle and solidify the ink inside the nozzle. Usually this kind of solidified ink cannot be dislodged by purging.

146. Heat concerns: will the heat generated by the UV curing lamps cause adverse effects to some delicate forms of heat-sensitive media? Which materials might curl, distort or discolor from the heat?

Heat sensitive materials would include polyethylene, polypropylene, shrink-wrap, very thin and thermal sensitive papers, plastic coated cartons, PVC and aluminum foil (www.dotprint.com/fgen/prod1297.htm).



Oce lists several other common signage materials as sensitive to the heat of UV lamps. For these reasons we have a separate FLAAR Report on applications and materials.

Heat can build up when the printhead carriage hovers over a small area to print a narrow job. Heat can build up inside the printer as materials (especially metal) absorb heat and hold it (and then radiate it out for a long time). So heat is not only an issue from the obvious and immediate heat of the UV lamps. Residual heat can be an issue as well.

147. What about build up of static electricity? What kind of materials cause this? Do some materials generate static electricity which cause the media to attract ink in areas not supposed to be printed on. How is it manifested?

You do need to be aware of how to prevent static electricity build up:

- No carpets or rugs on the floor. Indeed you should consider anti-static tiles or carpet.
- Use a humidifier during winter months to avoid dryness
- Learn which media are susceptible to gathering a static charge.
- Consider a printer that has specific anti-static features:
 - Grounding
 - Static bar(s).

Most printer reps suggest this is more an environmental issue than a printer or ink issue. They say you can't have carpet and you must maintain a high humidity. They admit that the static electricity situation varies depending on each site's situation.

"Some media may be more affected by static charges than others."

148. What happens in very dry weather (low humidity), especially in winter with central heating?

During dry periods (with low humidity) static problems may increase. With a high static charge (such as with PVC materials), the ink is attracted to charged areas of the material. This results in overspray (ink laydown in unintended areas).

SUBSTRATES: Cleaning, Priming, Preparation

150. Do you have to brush off or otherwise clean each sheet of incoming material by hand before you print on it?

Generally yes. The need to clean incoming materials is typical of any printer. Some materials have more detritus or dust or issues than other materials. And some suppliers offer better materials than others.

151. Which substrates ought to be laminated, top-coated, or otherwise post-treated?

Realize that top-coating (a UV clearcoat) may be useful on some materials and even possibly required on some applications. This may require an additional machine, space, training, and further ventilation considerations. You are not protecting against the sun, you are protecting against the ink rubbing off slippery surfaces such as glass or marble.

Lamination can also serve to provide a glossy finish on a material that is naturally matte.

SUBSTRATES: General Concerns

152. Although this printer "prints on almost all materials," what is the adhesion rate with most materials? Does the ink easily scratch off certain materials?

Realize that all statements must be judged based on how long the ink has been on the material, and the surface nature of the material. Not all fluted plastic material is the same; and six months later the adhesion could theoretically be different (based on conditions of display and the nature of the surface of the material).



APPLICATIONS

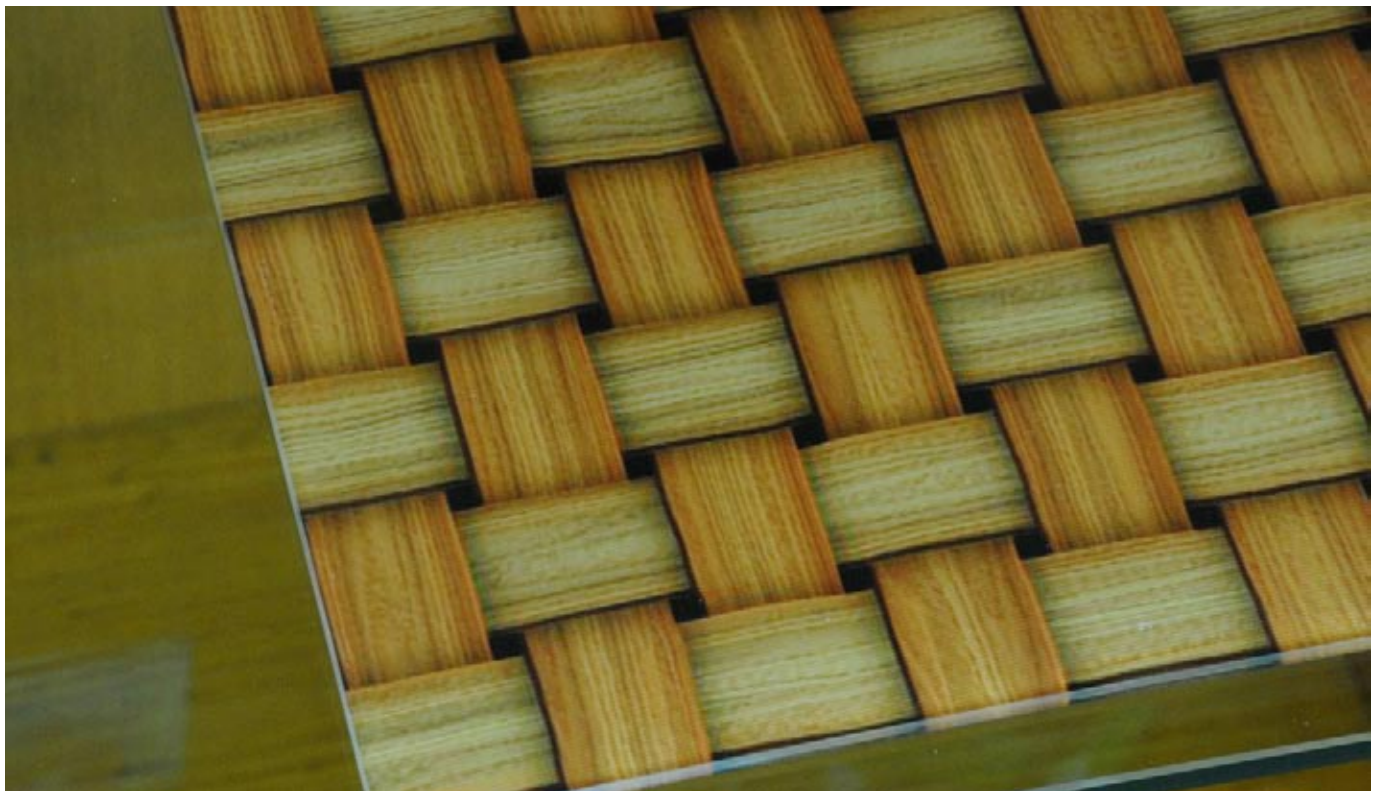
153. Can you print fine art photos, giclee, or décor?

You can definitely print décor; you can print on pre-stretched canvas.

154. Can you print on textiles or fabrics? How do you handle the ink that gets through the weave?

There are two issues with printing on fabrics: first, the ink goes through the weave and ends up on the table or transport belt or platen. Second, the fibers from fabrics or mats can get onto the printhead nozzle plate and sometimes up into the nozzles.





INK

155. Is there a special ink for flexible material, and another ink for rigid material? What other inksets are available? Is there any choice in inks?

Only one general purpose ink is offered at present.

156. Is an extrudable or thermal-formable ink available from the printer manufacturer?

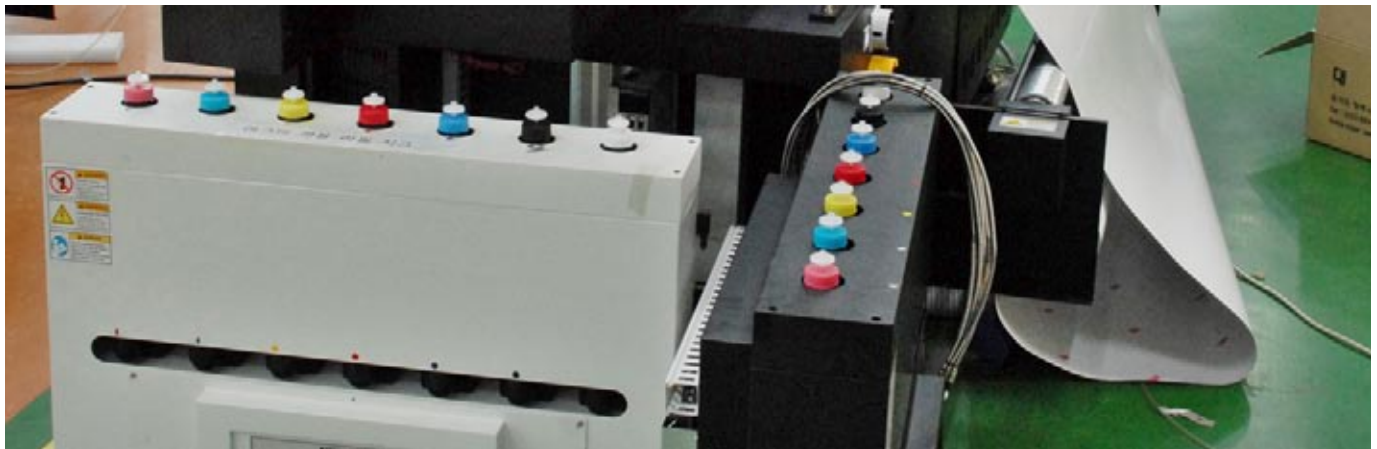
At present only Mimaki and Gandinnovations offer a special heat-formable UV-cured ink.

157. How many colors are used to produce output - four, six, or eight?

Six.

158. Where are the printer's ink containers located? Front, back, or sides?

The main ink tanks are located at the right end of the printer. They can be easily accessed without first having to open a cabinet door.



Lm, lc, Y, M, C, K

INK: White & Varnish

159. Is white ink available?

White ink is available on the larger Dilli UV printer but not on the Titan.

160. Is spot varnish available?

Not on this model.

INK Cost

161. Does the refill container of ink come in cartridge, bottles or bulk? How large are the ink containers for this replacement ink?

Ink comes in bottles.

162. How many liters of ink does the on-board ink container hold in the main tank?

1.8 liters per color.

163. What is the cost per container? What is this cost translated to liters?

Ink costs \$150 per liter.



164. How much ink does the waste ink container hold?

1.5 liters.

165. How often does the waste container need to be emptied?

About every two months, though obviously this depends on how often you use the printer and how often you purge.

166. Do you have to drain the on-board container manually? Or just remove one bottle and place an empty bottle in it's place?

You have to manually drain the container through a petcock valve into a disposal container.

167. How do you know when the waste container is full?

An alarm sounds and also a message is displayed on the LCD.

168. Is there an out-of-ink alarm? Is there a warning before actually being out of ink?

Same as with the waste container being full; when the ink is near empty, an alarm sounds and also a message is displayed on the LCD. But the sound for the ink being out is a different tone than the sound of the waste container being full.

169. Can you hot swap the ink (refill with ink while the printer is running)?

Since the operator's manual says "Make sure the printer power is OFF" before pouring in new ink, this suggests you cannot hot swap the ink. But when I asked I was told you can hot swap ink. So this needs to be double-checked.

INK: Supply System, Tubing, Filters, etc

170. How is new ink added? Pouring into the on-board container? Switching the container to the new ink container?

Use a funnel to pour ink into the main tank.

171. What is the situation with the ink gelling?

Ink gels from heat; not from UV light (since in theory the inside of the printer will have black ink lines so no UV light can reach the ink). But overall heat will cause UV ink to gel. But if you have some circulation within the tank and if the ink is far from the heat, gellation will not be as much an issue.

172. How long does it take to heat the ink in the morning at startup?

The overall start up time (from a cold start in the morning) is less than 10 minutes.

INK: Longevity

173. What about solvents such as cleaning solvents? Do they mar, dull, or wash away the ink or change the surface quality, especially on vehicle wrap?

- Ammonia (in Windex and comparable cleaning liquids)
- Acetone
- Cleaning alcohol
- Gasoline
- Soap and water with sponge
- Soap and water with a broom (frequently used to clean vehicle wraps in Latin America, for example)
- Scotch-tape pull-off test

INK Color Gamut

174. Which colors print best?

- Blue in general
- Red raspberry colors
- Purples
- Nuts
- Wood colors
- Grays

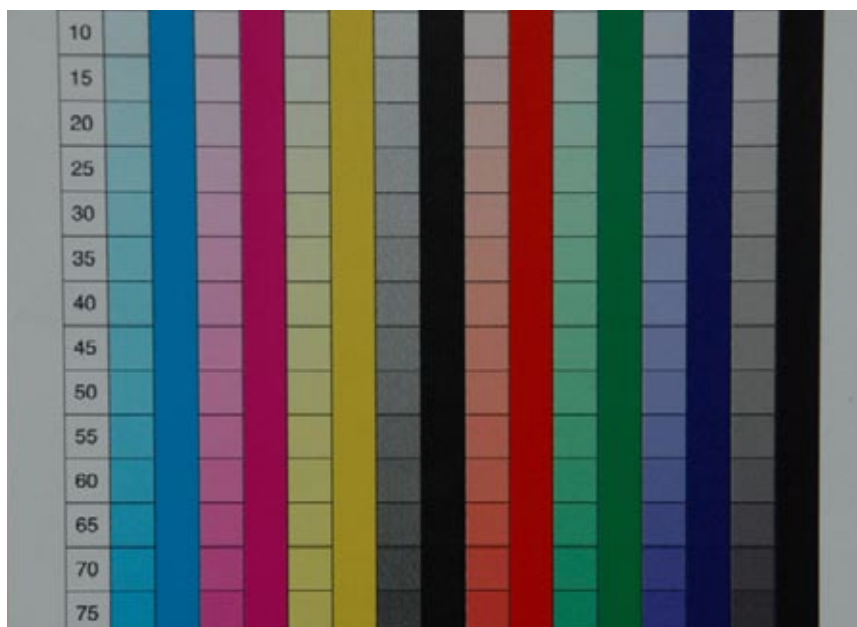
are all excellent.

175. What about silver or other metallics?

Metallic colors, such as watches, print nicely, as is typical of almost all UV-curable inkjet printers, except badly calibrated machines from China.

176. Is the color gamut what your clients need for their logos and products? How about red? Does it turn out more orange? Is red bright enough in saturation to satisfy clients? Or are the colors overall a bit dull?

Yellow and green are better than about half of the other competing UV printers.



Color gamut print sample.

THE UV CURING LAMPS

**177. How many different sets of lamps are there?
Is there pinning first and then curing later?**

This printer uses the traditional curing system of one lamp on each side of the printhead carriage.

178. What technology is used in curing lamps: microwave, continuous (mercury arc), LED, or flash (pulsed Xenon)?

This printer uses normal mercury arc UV lamps for curing.

179. How many watts are the lamps?

1020 watts each UV lamp.

180. What wave length do the lamps cover?

365 nm.

181. What is warm up time?

Six to eight minutes.



182. What brand of lamp is used?

The lamp itself is from Integration Technology, but evidently not the entire UV curing system.

183. How many lamps does the printer use?

Two is the usual number of lamps. Some cheap Chinese printers use only one lamp. Mimaki uses one lamp on several of their narrow-format UV printers to avoid the lawnmower effect that is caused by bi-directional printing (bi-directional print requires two lamps, one for each direction of ink laydown by the printer carriage).

The Luscher JetPrint, due to its über-dimensional size, may also have needed more than two lamps (whatever it had did not function fully adequately).

184. What shuts the lamps off? For example, after so many minutes of not being used; or if they overheat?

The lamp system is arranged so the lamps can stay on as long as needed. This is different than systems, such as that of ColorSpan, where the lamps turn themselves off relatively quickly in order to escape overheating.

185. Is the lamp fan filter a user-replaceable item? How often should this be cleaned or replaced?

If the filter gets clogged with dust then it is less efficient in keeping down heat. Heat build-up is not good for the overall carriage area.

186. What is the true drying (curing) time of the inks used with this set of lamps? What factors influence the true (total) drying time?

The ink does not necessarily totally cure within seconds. Some colors, depending on how thick the ink is laid down, may cure "instantly." But several factors may result in a cure that takes 24 hours, 48 hours, or weeks. If you set the print mode for "glossy" this reduces the lamp intensity. These prints will outgas for weeks.

UV LAMPS: Cooling

187. Are there shutters?

Yes, each of the UV lamps has a shutter. Shutters help control light leak and save from having to turn the lamps off. So the lamps last a bit longer and you can be more productive, not having to wait for the lamps to cool down and then warm up all over again.

188. How often do the shutters stick?

The Dilli factory and R&D department is more sophisticated than other UV printer factories in the sense of the amount of testing equipment that I saw. One item of testing equipment was for counting how many times you could open and close the shutters.

189. How are the lamps cooled? Air? Fans? Water-cooled?

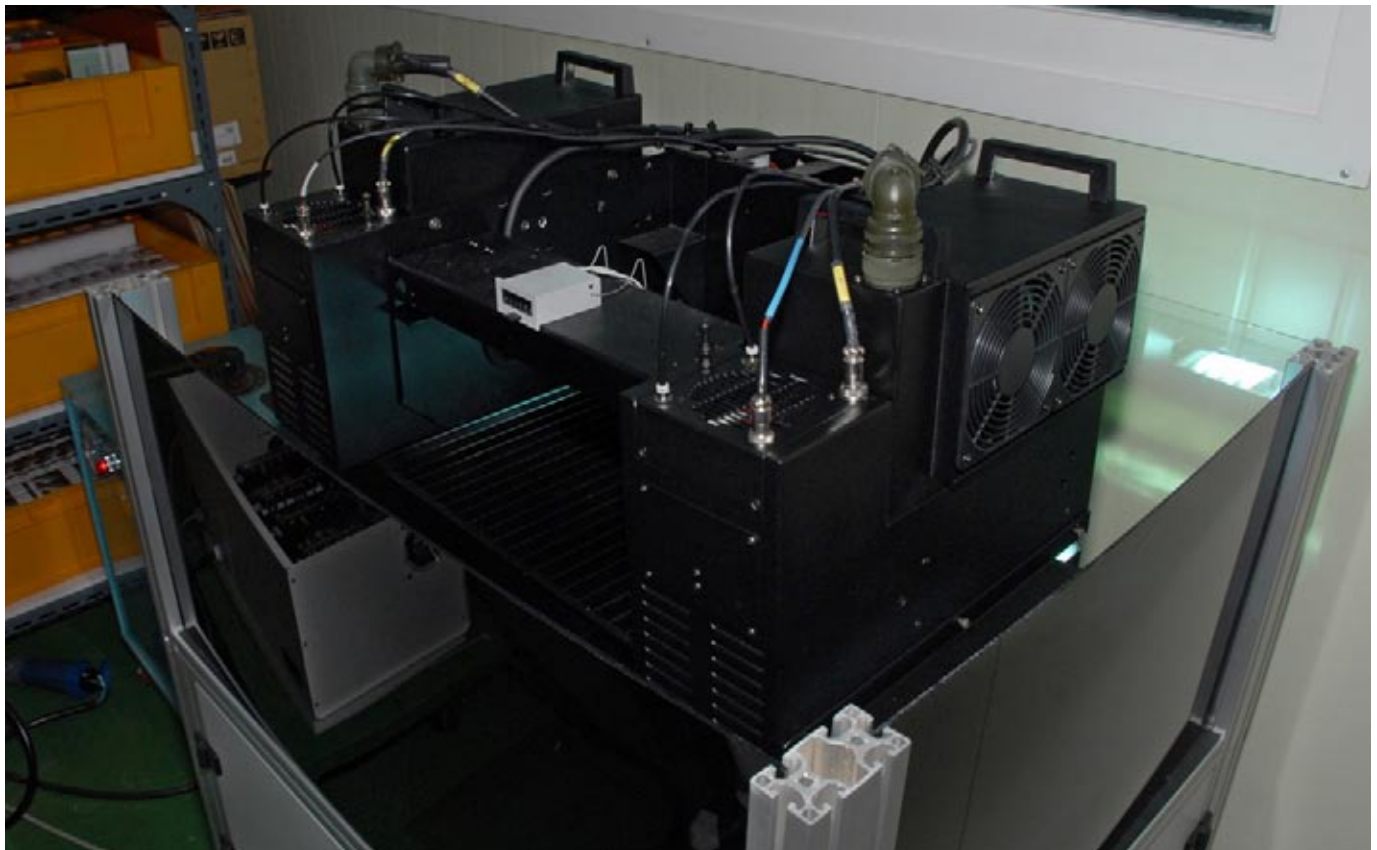
The UV curing lamps are cooled by fans.

190. How many settings do the lamps have? Or are the fans just Off and On?

High and Low (and naturally off and on).

191. In the areas at left and right of the printing area, is the surface specially protected against the extreme heat of the UV lamps when they carriage is parked?

Yes, at both the right end and also at the left end there are special open grills to help dissipate the heat from the lamps while they are parked.



Shutters test, Dilli factory, 2007.

RIP SOFTWARE & Printer Software

192. Which RIPs are featured?

Dilli features Wasatch SoftRIP and Onyx PosterShop RIPs.

COLOR MANAGEMENT FEATURES

193. What color management sensors or measuring tools are on-board?

ColorSpan has color management tools built into its UV printers, but otherwise this feature is not yet available on other brands.

PRODUCTIVITY & ROI (Return on Investment)

194. What is the level of productivity, high, medium, low?

This is not a speed demon, but then again, it does not cost a quarter of a million dollars either.



ADVERTISING CLAIMS:

195. How does the actual printer compare with what was claimed in the ads?

The Agfa brochure waffles a bit on print speed by using the word “up to...” It is unclear whether “photo/sign” quality is the highest quality; it is also unclear whether this is uni-directional or bi-directional.

Most printer ads are misleading with respect to speed and quality, which is a shame. For example, on the front page, it talks about how impressive the quality is, but then uses the speed output figures for the lower poster quality, not the actual photo quality. Again, this is the traditional manner of doing it, but end-users get upset and find this inappropriate, especially of a large and generally respected company such as Agfa. I would expect more restraint from a European company.

196. Do certain parts of the printer need to be repaired or accessed so often that you have to remove safety plates or protective plates to make access easier?

This is mainly with Chinese-made printers.

197. How often do people return this printer and say they want their money back?

This is mainly with Chinese-made printers.

COMPARISONS WITH OTHER PRINTERS

198. When people are considering buying this printer, what other printer(s) are they also looking at?

IP&I 1606 was first shown at the same SGIA '06 trade show as the Dilli Titan 1606.

The Flora F1 180uv is also a combo style, at a lower price, but comes from a factory with many years track record of producing printers that don't always work adequately: the first two generations of DuPont printers had to be recalled and junked. Most of the first generation Flora printers for Raster Printers were rejected both by dealers and end-users.

Although current Flora printers are substantially improved, they still suffer from low-bid mentality and have not yet impressed either end-users or distributors or resellers. We are considering visiting their factory to see how far they have progressed, and for 2008 their printers may be improved enough to be acceptable for low-price entry-level experimentation.



IP&I 1606 at ISA 07.



Flora 180UV at FESPA 07.

Teckwin does not make any combo-style (conveyor belt) systems at present: only hybrid and dedicated flatbeds. Our interview with one Teckwin owner indicated that he had not experienced any major breakdowns or even any continuous issues or headaches. If we can inspect such an installation in person to reconfirm this, Teckwin may be the first Chinese-made printer that might pass a FLAAR inspection. So far owners and operators of printshops with Flora, Infiniti, and DuPont printers have tended to point out the consistent and persistent breakdowns as parts wear out or simply won't hold up to being used 8 hours a day. Running most Chinese printers multiple shifts is either not possible or risky.

No printer is perfect, not even those made in Switzerland or Japan, but our antennae indicate that the Teckwin UV printers may be the first Chinese made UV flatbed printer that functions acceptably. But all Korean UV printers (Dilli, DYSS, IP&I, and Lotte) are better designed and more reliably constructed than even the best Chinese printer.

People would also consider an entry-level printer from ColorSpan. However they were recently purchased by HP and it may take a while for that take-over to be effective.

SUMMARY: Image Quality Issues: General

199. Is text sharp or fuzzy? What is the smallest text that you can easily read?

On some materials 4 pt text is legible.

200. Can the system produce glossy finish? To what degree is surface glossiness an issue? Can you select glossy or matte or do you get what the system provides and that is all? If you get only one, or the other, which is it you get?

Everyone defines glossy in a different manner. The output also varies depending on what material you print it. The Oce Arizona 250 has an ink with a nice semi-gloss (but this printer has other issues; you really need to check the FLAAR Reports first). The ColorSpan 5440 produces an attractive gloss output on some materials. The Inca Spyder 150 produces the best gloss of all—but can't print matte. So you need to decide what you and your clients prefer, since it's not recommended to switch ink to another brand. After-market ink is common with solvent printers, but not done as often with UV printers.

201. Do you need "Pantone markers" to do touch-ups?

If you use Pantone markers or other markers for touch-ups you run the risk that these areas will fade faster than the original UV ink.

Conclusions

Pros

Intelligently designed, robust engineering, competently manufactured. Most products from Korea are well built. Korean cars, and printers, are not like cheap Chinese low bid models. Chinese printers simply don't hold up; parts wear out, and the cheaper Chinese-made printers fall apart (this is based on checking two Infiniti printers and one DuPont Cromaprint 22uv). We also have reports on a Yaselan UV printer in Australia which was either broken down or being repaired more than 33% out of the 70 days that the owner reported to me.

Output of the Dilli Titan did not show much splatter (at edges of text and edges of solid color). If you use a lupe you can always see splatter, but with your own eye you don't want noticeable splatter when you are close to the image. So overall quality can be judged as good, which is what you expect from a KonicaMinolta printhead.

A major pro of the Titan is that the head of the company, Dr Geun-Soo Choi, has a PhD in piezo inkjet printhead technology. How many other printer manufacturers have a president with this experience?

Parts that arrive at the plant are actually tested. I would be surprised if this happens to parts at a Chinese factory.

Parts used by Dilli are predominantly made in Korea. Most parts are NOT from China.

The registration/alignment gate for rigid boards is up front (not at the back). Being up front means that you can load small and intermediate size materials from the front: you don't have to always walk around to the back.

Downsides

The printer itself has no full-sized monitor; in this sense it is comparable to the Mimaki JF-1631 and JF-1610.

The printer has no hood. Even ColorSpan recognized that a hood was necessary, to protect your retinas from light and to help protect from misted ink.

Comments & Suggestions

In order to evaluate the other features and capabilities of this printer I will need to spend a day testing it in a demo room. It would also be helpful to visit the factory in Korea. So far I have inspected the

Teckwin UV factory in Shanghai, one of the factories making the Infiniti UV in China, IP&I in Korea (several days), VUTEK (three times this year already), Gandinnovations, NUR (twice this year already), Zund (two days), about four times at the MacDermid ColorSpan factory, Inca Digital, Sun factory (Sun Chemical, Fast-Jet), Sun LLC (NEO LED uv printer, several days), etc.

If you need more information about Dilli, please contact:
K.H. Park
oversales@dilli.co.kr

Most recently updated January 2009.

Updated February 2008 based on spending two days in the factory and Dilli company facilities north of Seoul in December 2007. Updated January 2008.

First issued August 2007.



As soon as you have your UV-flatbed printer, your printshop will desire to have a cutter or trimmer.

First you need to trim. Simple cutting of the edges of your board so the edges are neat and clean. Then of course some clients will ask if you can do contour-cutting. This means you can offer additional services and earn additional income.

The best way to learn about trimmers is to ask a distributor who has more than one brand. This way they do not push their house brand and denigrate brands that they do not carry. Also, you want a real person that actually has experience. Otherwise you get a "box pusher" who is simply an Internet sales person, who does not know trimmer from dimmer.

The person we suggest is **Mike Lind** because his company, **Reprographic Designs**, handles all leading brands: KeenCut, Neolt, Meteor Metoschnitt, RotaTrim, etc. You can contact him at 1 281 492 2714 or malind@msn.com.

His company is also the Master Distributor for Cruse reprographic scanners in the US and adjacent countries.



XY Cutter Options

In a period of economic recession printshops will tend to ask about options that are priced lower than high-end prices. Thus we suggest a possible solution at mid-range price: Gerber M class cutters. I have inspected two huge factory complexes of Gerber Scientific in 2008 (especially their cutters for fabrics) and will be visiting their facilities again in 2009.

To contact Gerber:

Phone (US): 800-222-7446, email: cservice@gspinc.com

Fax: 800-227-6228 or 860-648-8064

Phone (Intl): 860-648-8028, email: gspinternational@gspinc.com

When you acquire a UV-curable wide-format printer you will eventually learn that an XY flatbed cutter is a useful accessory for thick rigid materials. The advantage of having an XY cutter is that you are selling not just the print, but a finished work. To stay ahead of the competing printshops in your city it helps to offer your clients a solution for every step of the printing workflow.

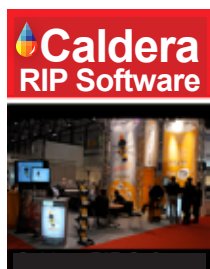
We have seen Gerber cutters at work during major trade shows, both in Europe and in the US. Gerber has dealers all across the US and Canada, and in Europe is served by Spandex.



Dr. Hellmuth shows a sample processed by the Gerber M Series cutter exhibited at GraphExpo '08.



Gerber M Series cutter at ISA '08.



These reports on RIP software and Color Management for serious UV printers are free downloads on all FLAAR web sites (follow the link to 'free downloads') http://www.wide-format-printers.net/reviews_reports_evaluations/free_download.php

RIP, COLOR MANAGEMENT, and ICC Color Profiles options

Once you have a serious UV-curable wide-format printer, you may prefer to have an equally serious RIP software and color management equipment.

The RIP software for simple water-based printers such as Canon, Epson, and HP may not be the same RIP software that could be most effective and productive on a UV-curable flat-bed or UV-cured roll-to-roll production printer.

I first noticed Caldera RIP on Gandinnovations UV printers several years ago, then I saw Caldera being used at the Mutoh Europe factory demo room in Belgium.

When I was visiting the Durst factories in Europe I again noticed that they were using Caldera RIP software.

So I requested access from Caldera so I could visit their world headquarters in Strasbourg, France, to spend several days learning more about their RIP. As a result there is now a FLAAR Report photo essay on this software.

Most recently I have seen Caldera RIP at the Shanghai printer trade show in China, at DRUPA in Germany, at FESPA Digital in Geneva, SGIA '08 and Viscom Italy '08.

When I visited a large printshop in Maribor, northern Slovenia, they were using Caldera RIP and the manager of technical services for this company said, "Caldera does a good job." This company in Slovenia has about eight UV printers (about five of them from Durst) and an equal number of large solvent printers. They originally used a GretagMacbeth color man-

agement system but switched to BARBIERI because the BARBIERI spectrophotometer can read more efficiently and can handle textiles, backlit, wood and other materials that are either awkward or difficult on other brands of color management instruments. You can learn about the BARBIERI equipment either from their headquarters in Brixen or their distributors worldwide.



Caldera also offers a highly regarded spectrophotometer from Barbieri, the leading color management company in Italy (they are headquartered in the same city as Durst, the manufacturer of Rho UV-cured printers).



For further information on Caldera

contact Joseph MERGUI
mergui@caldera.fr

If you have questions about color management, if you are in the US you can contact: ImageTech at:
www.ImageTechDigital.com
Mark Spandorf (owner and president),
mark@imagetechdigital.com
or 510 238-8905.

If you are in Europe or the rest of the world you can contact BARBIERI directly at: BARBIERI electronic snc,
info@BARBIERIElectronic.com
www.BARBIERIElectronic.com
Tel.: +39 0472 834 024
Fax: +39 0472 833 845

Reality Check

Being a university professor for many years does not mean we know everything. But intellectual curiosity often leads us to enter areas that are new to us. So we do not shirk from entering areas where we are obviously not yet expert. If in your years of wide format printing experience have encountered results different than ours, please let us know at ReaderService@FLAAR.org. We do not mind eating crow, though so far it is primarily a different philosophy we practice, because since we are not dependent on sales commissions we can openly list the glitches and defects of those printers that have an occasional problem.

FLAAR and most universities have corporate sponsors but FLAAR web sites do not accept advertising, so we don't have to kowtow to resellers or manufacturers. We respect their experience and opinion, but we prefer to utilize our own common sense, our in-house experiences, the results from site-visit case studies, and comments from the more than 53,000 of our many readers who have shared their experiences with us via e-mail (the Survey Forms).

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To distribute this report without subscription/license violates federal copyright law. To avoid such violations for you, and your company, you can easily order additional copies from www.wide-format-printers.NET.

Update Policy

Starting in 2008, updates on UV-curable wide-format inkjet printers are available for all individuals and companies which have a subscription, or to companies who are research project sponsors. If you are a Subscriber or manager in a company that is a research sponsor, you can obtain the next update by writing ReaderService@FLAAR.org. If you are neither a Subscriber or a research sponsor, simply order the newest version via the e-commerce system on www.wide-format-printers.NET. Please realize that because we have so many publications and many are updated so frequently that we have no realistic way to notify any reader of when just one particular report is actually updated.

There is a free PDF that describes the UV-curable inkjet printer Subscription system. Subscriptions are available only for UV-related wide-format printer publications.

FLAAR Reports on UV-curable roll-to-roll, flatbed, hybrid, and combo printers are updated when new information is available. We tend to update the reports on new printers, on printers that readers ask about the most, and on printers where access is facilitated (such as factory visits, demo-room visits, etc).

Reports on obsolete printers, discontinued printers, or printers that not enough people ask about, tend not to be updated.

FLAAR still publishes individual reports on solvent printers, and on giclee printers, but subscriptions on these are not yet available; these FLAAR Reports on solvent, eco-solvent, and water-based wide format printers have to be purchased one by one.

Please Note

This report has not been licensed to any printer manufacturer, distributor, dealer, sales rep, RIP company, media, or ink company to distribute. So, **if you obtained this from any company, you have a pirated copy.**

If you have received a translation, this translation is not authorized unless posted on a FLAAR web site, and may be in violation of copyright (plus if we have not approved the translation it may make claims that were not our intention).

Also, since this report is frequently updated, if you got your version from somewhere else, it may be an obsolete edition. FLAAR reports are being updated all year long, and our comment on that product may have been revised positively or negatively as we learned more about the product from end users.

If you receive any FLAAR Report from a sales rep, in addition to being violation of copyright, it is useful to know if there is a more recent version on the FLAAR web site, because every month new UV printers are being launched. So what was good technology one month, may be replaced by a much better printer elsewhere the next month.

To obtain a legitimate copy, which you know is the complete report with nothing erased or changed, and hence a report with all the original description of pros and cons, please obtain your original and full report straight from www.FLAAR.org.

Your only assurance that you have a complete and authentic evaluation which describes all aspects of the product under consideration, benefits as well as deficiencies, is to obtain these reports directly from FLAAR, via www.wide-format-printers.NET.

Citing and Crediting

A license from FLAAR is required to use any material whatsoever from our reports in any commercial advertisement or PR Release.

If you intend to quote any portion of a FLAAR review in a PowerPoint presentation, if this is in reference to any product that your company sells or promotes, then it would be appropriate to ask us first. FLAAR reports are being updated every month sometimes, and our comment on that product may have been revised as we learned more about the product from end users. Also, we noticed that one company cited the single favorable comment we made on one nice aspect of their printer, but neglected to cite the rest of the review which pointed out the features of the printer which did not do so well. For them to correct this error after the fact is rather embarrassing. So it is safer to ask-before-you-quote a FLAAR review on your product.

The material in this report is not only copyright, it is also based on years of research. Therefore if you cite or quote a pertinent section, please provide a proper credit, which would be minimally "Nicholas Hellmuth, year, www.FLAAR.org." If the quote is more than a few

words then academic tradition would expect that a footnote or entry in your bibliography would reference the complete title. Publisher would be www.FLAAR.org.

If you intend to quote any portion of a FLAAR review in a PowerPoint presentation, if this is in reference to any product that your company sells or promotes, then it would be appropriate to license the report or otherwise notify us in advance. FLAAR reports are being updated every week sometimes, and our comment on that product may have been revised as we learned more about the product from end users. Also, we noticed that one company cited the single favorable comment we made on one nice aspect of their printer, but neglected to cite the rest of the review which pointed out the features of the printer which did not do so well. For them to correct this error after the fact is rather embarrassing. So it is safer to ask-before-you-quote a FLAAR review on your product.

Legal notice

Inclusion in this study by itself in no way endorses any printer, media, ink, RIP or other digital imaging hardware or software. Equally, exclusion from this study in no way is intended to discredit any printer.

Advisory

We do our best to obtain information which we consider reliable. But with hundreds of makes and models of printers, and sometimes when information about them is sparse, or conflicting, we can only work with what we have available. Thus you should be sure to rely also on your own research, especially asking around. Find another trustworthy end-user of the same make and model you need to know about. Do not make a decision solely on the basis of a FLAAR report because your situation may be totally different than ours. Or we may not have known about, and hence not written about, one aspect or another which is crucial before you reach your decision.

The sources and resources we may list are those we happen to have read. There may be other web pages or resources that we missed. For those pages we do list, we have no realistic way to verify the veracity of all their content. Use your own common sense plus a grain of salt for those pages which are really just PR releases or outright ads.

We are quite content with the majority of the specific printers, RIPs, media, and inks we have in the FLAAR facilities. We would obviously never ask for hardware, software, or consumables that we knew in advance would not be good. However even for us, a product which looks good at a trade show, sounds good in the ad literature, and works fine for the first few weeks, may subsequently turn out to be a lemon.

Or the product may indeed have a glitch but one that is so benign for us, or maybe we have long ago gotten used to it and have a work-around. And not all glitches manifest themselves in all situations, so our evaluator may not have been sufficiently affected that he or she made an issue of any particular situation. Yet such a glitch that we don't emphasize may turn out to be adverse for your different or special application needs.

Equally often, what at first might be blamed on a bad product, often turns out to be a need of more operator experience and training. More often than not, after learning more about the product it becomes possible to produce what it was intended to produce. For this reason it is crucial for the FLAAR team and their university colleagues to interact

with the manufacturer's training center and technicians, so we know more about a hardware or software. Our evaluations go through a process of acquiring documentation from a wide range of resources and these naturally include the manufacturer itself. Obviously we take their viewpoints with a grain of salt but often we learn tips that are worthy of being passed along.

FLAAR has no way of testing 400+ specifications of any printer, much less the over 101 different UV printers from more than 46 manufacturers. Same with hundreds of solvent printers and dozens of water-based printers. We observe as best we can, but we cannot take each printer apart to inspect each feature. And for UV printers, these are too expensive to move into our own facilities for long-range testing, so we do as best as is possible under the circumstances. And when a deficiency does become apparent, usually from word-of-mouth or from an end-user, it may take time to get this written up and issued in a new release.

Another reason why it is essential for you to ask other printshop owners and printer operators about how Brand X and Y function in the real world is that issues may exist but it may take months for these issues to be well enough known for us to know the details. Although often we know of the issues early, and work to get this information into the PDFs, access to information varies depending on brand and model. Plus with over 300 publications, the waiting time to update a specific report may be several months. Plus, once a printer is considered obsolete, it is not realistic to update it due to the costs involved.

For these reasons, every FLAAR Report tries to have its publication date on the front outside cover (if we updated everything instantly the cost would be at commercial rates and it would not be possible to cover these expenses). At the end of most FLAAR Reports there is additionally a list of how many times that report has been updated. A report with lots of updates means that we are updating that subject based on availability of new information. If there is no update that is a pretty good indication that report has not been updated! With 101 models of UV printers, several hundred solvent printers, and scores of water-based printers, we tend to give priority to getting new reports out on printers about which not much info at all is available elsewhere. So we are pretty good about reporting on advances in LED curing. But glitches in a common water-based printer will take longer to work its way through our system into an update, especially if the glitch occurs only in certain circumstances, for example, on one type of media. With several hundred media types, we may not yet have utilized the problem media. While on the subject of doing your own research, be sure to ask both the printer operator and printshop owner or manager: you will generally get two slightly different stories. A printer operator may be aware of more glitches of the printer than the owner.

If a printer is no longer a prime model then there is less interest in that printer, so unless a special budget were available to update old reports, it is not realistic to update old reports. As always, it is essential for you to visit printshops that have the printers on your short-list and see how they function in the real world.

But even when we like a product and recommend it, we still can't guarantee or certify any make or model nor its profitability in use because we don't know the conditions under which a printer system might be utilized in someone else's facility. For ink and media, especially after-market third-party ink and media, it is essential that you test it first, under your conditions. We have no way to assure that any ink or media will be acceptable for your specific needs in your specific print shop. As a result, products are described "as is" and without warranties as to performance or merchantability, or of fitness

for a particular purpose. Any such statements in our reports or on our web sites or in discussions do not constitute warranties and shall not be relied on by the buyer in deciding whether to purchase and/or use products we discuss because of the diversity of conditions, materials and/or equipment under which these products may be used. Thus please recognize that no warranty of fitness or profitability for a particular purpose is offered.

The user is advised to test products thoroughly before relying on them. We do not have any special means of analyzing chemical contents or flammability of inks, media, or laminates, nor how these need to be controlled by local laws in your community. There may well be hazardous chemicals, or outgassing that we are not aware of. Be aware that some inks have severe health hazards associated with them. Some are hazardous to breathe; others are hazardous if you get them on your skin. For example, some chemicals such as cyclohexanone do not sound like chemicals you want to breathe every day. Be sure to obtain, read, and understand the MSDS sheets for the inks, media, and laminates that you intend to use. Both solvent, eco-solvent, and UV-curable inks are substances whose full range of health and environmental hazards are not yet fully revealed. It is essential you use common sense and in general be realistic about the hazards involved, especially those which are not listed or which have not yet been described. FLAAR is not able to list all hazards since we are not necessarily aware of the chemical components of the products we discuss. Our reports are on usability, not on health hazards.

Most inks are clearly not intended to be consumed. Obviously these tend to be solvent inks and UV-curable inks. Yet other inks are edible, seriously, they are printed on birthday cakes. Indeed Sensient is a leader in a new era of edible inks. Therefore the user must assume the entire risk of ascertaining information on the chemical contents and flammability regulations relative to inks, media or laminates as well as using any described hardware, software, accessory, service, technique or products.

We have no idea of your client's expectations. What students on our campus will accept may not be the same as your Fortune 500 clients. In many cases we have not ourselves used the products but are basing our discussion on having seen them at a trade show, during visiting a print shop, or having been informed about a product via e-mail or other communication.

Results you see at trade shows may not be realistic

Be aware that trade show results may not be realistic. Trade shows are idealized situations, with full-time tech support to keep things running. The images at a trade show may be tweaked. Other images may be "faked" in the sense of slyly putting on primer without telling the people who inspect the prints. Most UV inks don't stick to all materials; many materials need to be treated.

Or the UV prints may be top-coated so that you can't do a realistic scratch test.

Booth personnel have many standard tricks that they use to make their output look gorgeous. In about half the cases you will not likely obtain these results in real life: in most cases they are printing uni-directional, which may be twice as slow as bi-directional.

Trade show examples tend to be on the absolutely best media. When you attempt to save money and use economy media you will quickly notice that you do not get anywhere near the same results as you saw in the manufacturer's trade show booth, or pictured in their glossy advertisement. Five years ago we noticed Epson was laminat-

ing prints to show glossy output because their pigmented inks could not print on actual glossy media. The same equipment, inks, media, and software may not work as well in your facility as we, or you, see it at a trade show. All the more reason to test before you buy; and keep testing before you make your final payment. Your ultimate protection is to use a gold American Express credit card so you can have leverage when you ask for your money back if the product fails.

Images printed at trade show may be in uni-directional mode: so you may not realize the printer has bi-directional (curing) banding defects until you unpack it in your printshop. Bi-directional curing banding is also known as the lawnmower effect. Many printers have this defect; sometimes certain modes can get rid of it, but are so slow that they are not productive.

You absolutely need to do print samples with your own images and the kind provided by your clients. Do not rely on the stock photos provided by the printer, ink, media, or RIP manufacturer or reseller. They may be using special images which they know in advance will look fabulous on their printer. Equally well, if you send your sample images to the dealer, don't be surprised if they come back looking awful. That is because many dealers won't make a serious effort to tweak their machine for your kind of image. They may use fast speed just to get the job done (this will result in low quality). Check with other people in your area, or in the same kind of print business that you do. Don't rely on references from the reseller or manufacturer (you will get their pet locations which may be unrealistically gushy): find someone on your own.

Factors influencing output

Heat, humidity, static, dust, experience level of your workers (whether they are new or have prior years experience): these are all factors that will differ in your place of business as compared with test results or demo room results.

Actually you may have people with even more experience than we do, since we deliberately use students to approximate newbies. FLAAR is devoted to assisting newcomers learn about digital imaging hardware and software. This is why Nicholas Hellmuth is considered the "Johnny Appleseed" of wide format inkjet printers.

Therefore this report does not warranty any product for any quality, performance or fitness for any specific task, since we do not know the situation in which you intend to use the hardware or software. Nor is there any warranty or guarantee that the output of these products will produce salable goods, since we do not know what kind of ink or media you intend to use, nor the needs of your clients. A further reason that no one can realistically speak for all aspects of any one hardware or software is that each of these products may require additional hardware or software to reach its full potential.

For example, you will most likely need a color management system which implies color measurement tools and software. To handle ICC color profiles, you may need ICC color profile generation software and a spectrophotometer since often the stock pre-packaged ICC color profiles which come with the ink, media, printers and/or RIPs may not work in your situation. Not all RIPs handle color management equally, or may work better for some printer-ink-media combinations than for others.

Be aware that some RIPs can only accept ICC color profiles: you quickly find out the hard way that you can't tweak these profiles nor generate new ones. So be sure to get a RIP which can handle all aspects of color management. Many RIPs come in different levels.

You may buy one level and be disappointed that the RIP won't do everything. That's because those features you may be lacking are available only in the next level higher of that RIP, often at considerable extra cost. Same thing in the progression of Chevy through Pontiac to Cadillac, or the new Suburbans. A Chevy Suburban simply does not have all the bells and whistles of the Cadillac Escalade version of this SUV.

Don't blame us... besides, that's why we are warning you. This is why we have a Survey Form, so we can learn when you find products that are inadequate. We let the manufacturers know when end users complain about their products so that the manufacturers can resolve the situation when they next redesign the system.

Most newer printer models tend to overcome deficiencies of earlier models. It is possible that our comparative comments point out a glitch in a particular printer that has been taken care of through an improvement in firmware or even an entirely new printer model. So if we point out a deficiency in a particular printer brand, the model you may buy may not exhibit this headache, or your kind of printing may not trigger the problem. Or you may find a work-around.

Just remember that every machine has quirks, even the ones we like. It is possible that the particular kind of images, resolution, inks, media, or other factors in your facility are sufficiently different than in ours that a printer which works just fine for us may be totally unsatisfactory for you and your clients. However it may be that the specific kind of printing you need to do may never occasion that shortcoming. Or, it may be that your printer was manufactured on a Monday and has defects that are atypical, show up more in the kind of media you use which we may not use as often or at all during our evaluations. Equally possibly a printer that was a disaster for someone else may work flawlessly for you and be a real money maker for your company.

So if we inspect a printer in a printshop (a site-visit case study), and that owner/operator is content with their printer and we mention this; don't expect that you will automatically get the same results in your own printshop.

In some cases a product may work better on a Macintosh than on a PC. RIP software may function well with one operating system yet have bugs and crash on the same platform but with a different operating system. Thus be sure to test a printer under your own specific work conditions before you buy.

And if a printer, RIP, media, or ink does not function, return it with no ands, ifs or buts. Your best defense is to show an advertising claim that the printer simply can't achieve. Such advertising claims are in violation of federal regulations, and the printer companies know they are liable for misleading the public.

But before you make a federal case, just be sure that many of the issues are not user error or unfamiliarity. It may be that training or an additional accessory can make the printer do what you need it to accomplish. Of course if the printer ads did not warn you that you had to purchase the additional pricey accessory, that is a whole other issue. Our reviews do not cover accessories since they are endless, as is the range of training, or lack thereof, among users.

The major causes of printer breakdown and failure is lack of maintenance, poor maintenance, spotty maintenance, or trying to jerry-rig some part of the printer. The equally common cause of printer breakdown is improper use, generally due from lack of training or experience. Another factor is whether you utilize your printer all day

every day. Most solvent and UV printers work best if used frequently. If you are not going to use your printer for two or three days, you have to put flush into the system and prepare it for hibernation (even if for only four or five days). Then you have to flush the ink system all over again.

Also realize that the surface of inkjet prints are fragile and generally require lamination to survive much usage. Lamination comes in many kinds, and it is worth finding a reliable lamination company and receiving training on their products.

Also realize that no hybrid or combo UV printer can feed all kinds of rigid materials precisely. Some materials feed well; others feed poorly; others will skew.

Although we have found several makes and models to work very well in our facilities, how well they work in your facilities may also depend on your local dealer. Some dealers are excellent; others just sell you a box and can't provide much service after the sale. Indeed some low-bid internet sales sources may have no technical backup whatsoever. If you pay low-bid price, you can't realistically expect special maintenance services or tech support later on from any other dealer (they will tell you to return to where you paid for the product). This is why we make an effort to find out which dealers are recommendable. Obviously there are many other dealers who are also good, but we do not always know them. To protect yourself further, always pay with a level of credit card which allows you to refuse payment if you have end up with a lemon. A Gold American Express card allows you to refuse payment even months after the sale. This card may also extend your warranty agreement in some cases (check first).

Most of the readers of the FLAAR Reports look to see what printers we use in our own facilities. Readers realize that we will have selected the printers that we like based on years of experience and research. Indeed we have met people at trade shows who told us they use the FLAAR web site reports as the shopping list for their corporate purchases.

Yes, it is rather self-evident that we would never ask a manufacturer to send a product which we knew in advance from our studies was no good. But there are a few other printers which are great but we simply do not have them in our facilities yet.

So if a printer is not made available by its manufacturer, then there is no way we can afford to have all these makes and models in our facility. Thus to learn about models which we do not feature, be sure to ask around in other print shops, with IT people in other corporations, at your local university or community college. Go to trade shows.... but don't use only the booth...ask questions of people in the elevator, in line at the restaurant, anywhere to escape the smothering hype you get in the booth.

Realize that a FLAAR Report on a printer is not by itself a recommendation of that printer. In your local temperature, in your local humidity, with the dust that is in your local air, with your local operator, and with disorientation of the insides of a printer during rough shipment and installation, we have no knowledge of what conditions you will face in your own printshop. We tend to inspect a printer first in the manufacturing plant demo room: no disjointed parts from any shipment since this printer has not been lifed by cranes and run over a rough pot-holed highway or kept in smeltering heat or freezing cold during shipment.

Taking into consideration we do not know the conditions in which you may be using your hardware, software, or consumables, neither

the author nor FLAAR nor either university is liable for liability, loss or damage caused either directly or indirectly by the suggestions in this report nor by hardware, software, or techniques described herein because.

Availability of spare parts may be a significant issue

Chinese printers tend to switch suppliers for spare parts every month or so. So getting spare parts for a Chinese printer will be a challenge even if the distributor or manufacturer actually respond to your e-mails at all. Fortunately some companies to have a fair record of response; Teckwin is one (based on a case of two problematical hybrid UV printers in Guatemala). The distributor said that Teckwin sent a second printer at their own expense and sent tech support personnel at their expense also. But unfortunately both the hybrid UV printers are still abandoned in the warehouse of the distributor; they were still there in January 2009. But Teckwin has the highest rating of any Chinese company for interest in quality control and realization that it is not good PR to abandon a client or reseller or distributor all together.

Recently we have heard many reports of issues of getting parts from manufacturers in other countries (not Asia). So just because you printer is made in an industrialized country, if you are in the US and the manufacturer is X-thousand kilometers or miles away, the wait may be many days, or weeks.

Lack of Tech Support Personnel is increasing

The book of sales in the third quarter of 2008 resulted in many tech support problems.

The recession resulted in even more: some manufacturers may need to skimp on quality control during a recession, or switch to cheaper parts suppliers. Plus they are not hiring enough tech support during a recession. So the bigger and more successful the company, in some cases the worse these particular problems may be.

Any new compiled printer may take a few months to break in

Any new printer, no matter who the manufacturer, or how good is the engineering and electronics, will tend to have teething issues. Until the firmware is updated, you may be a beta tester. This does not mean the printer should be avoided, just realize that you may have some downtime and a few headaches. Of course the worst case scenario for this was the half-million dollar LUSCHER JetPrint: so being "Made in Switzerland" was not much help.

Counterfeit parts are a problem with many printers made in China

Several years ago many UV printers made in China and some made elsewhere in Asia had counterfeit parts. No evaluation has the funding available to check parts inside any printer to see if they are from the European, Japanese, or American manufacturer, or if they are a clever counterfeits.

Be realistic and aware that not all materials can be printed on equally well

Many materials don't feed well through hybrid (pinch roller on grit roller systems) or combo UV systems (with transport belts). Banding, both from poor feeding, and from bi-directional (lawnmower effect) are common on many UV-curable inkjet printers.

It is typical for some enthusiastic vendors to claim verbally that their printer can print on anything and everything. But once you unpack

the printer and set it up, you find that it requires primer on some materials; on other materials it adheres for a few weeks but then falls off.

And on most hybrid and many combo printers, some heavy, thick, or smooth-surfaced materials skew badly. Since the claim that the printer will print on everything is usually verbal, it is tough to prove this aspect of misleading advertising to a jury.

Not all inks can print on all materials. And at a trade show, many of the materials you see so nicely printed on, the manufacturer may be adding a primer at night or early in the morning: before you see the machine printing on this material.

We feel that the pros and cons of each product speak more than adequately for themselves. Just position the ad claims on the left: put the actual performance results on the right. The unscrupulous hype for some printers is fairly evident rather quickly.

Be sure to check all FLAAR resources

Please realize that with over 200 different FLAAR Reports on UV printers, you need to be sure to check the more obscure ones too. If a printer has a printhead issue, the nitty gritty of this may be in the FLAAR Report on printheads. The report on the model is a general introduction; if we discussed the intimate details of printheads then some readers might fall asleep. And obviously do not limit yourself to the free reports. The technical details may be in the reports that have a price to them. Our readers have said they prefer to have the general basics, and to park the real technical material in other reports that people can buy if they really want that level of information.

So it may be best to ask for personal consulting. The details of the problems with the ColorSpan 5400uv series are rather complex: namely the center row of the Ricoh printheads. This would require an expensive graphic designer and consultants to show the details. And the design of the printhead would probably be altered by the time we did any of this anyway. So it is essential to talk with people: with other end-users, and with FLAAR in person on a consulting basis.

Acknowledgements

With 12 employees the funding has to come from somewhere, so we do welcome project sponsorship, research grants, contributions that facilitate our educational programs, scholarships for co-op interns and graduate students, and comparable project-oriented funding from manufacturers. The benefit for the end-user is a principle called academic freedom, in this case,

- The freedom of a professor or student to speak out relative to the pros and cons of any equipment brought to them to benchmark.
- The freedom to design the research project without outside meddling from the manufacturer.

Fortunately, our budget is lean and cost effective as you would expect for a non-profit research institute. As long as we are not desperate for money we can avoid the temptation to accept payment for reprinting corporate PR hype. So the funding is used for practical research. We do not accept (nor believe) and certainly do not regurgitate corporate PR. For example, how many manufacturer's PR photos of their products have you seen in our reports or on our web sites?

Besides, it does not take any money to see which printers and RIPs function as advertised and which don't. We saw one hyped printer grind to a halt, malfunction, or otherwise publicly display its incapacities at several trade shows in a row. At each of those same trade

shows another brand had over 30 of their printers in booths in virtually every hall, each one producing museum quality exhibits. Not our fault when we report what we see over and over and over again. One of our readers wrote us recently, "Nicholas, last month you recommended the as one of several possible printers for our needs; we bought this. It was the best capital expenditure we have made in the last several years. Just wanted to tell you how much we appreciate your evaluations...."

FLAAR is a non-profit educational and research organization dedicated for over 36 years to professional photography in the arts, tropical flora and fauna, architectural history, and landscape panorama photography.

Our digital imaging phase is a result of substantial funding in 1996 from the Japanese Ministry of Public Education for a study of scanning and digital image storage options. This grant was via Japan's National Museum of Ethnology, Osaka, Japan. That same year FLAAR also received a grant of \$100,000 from an American foundation to do a feasibility study of digital imaging in general and the scanning of photographic archives in particular.

The FLAAR web sites began initially as the report on the results of these studies of scanners. Once we had the digital images we began to experiment with digital printers. People began to comment that our reports were unique and very helpful. So by 1999 we had entire sections on large format printers.

FLAAR has existed since 1969, long before inkjet printers existed. Indeed we were writing about digital imaging before HP even had a color inkjet system available. In 2000 FLAAR received an educational grant from Hewlett-Packard large format division, Barcelona, Spain, for training, for equipment, and to improve the design and navigation on the main web sites of the FLAAR Network. This grant ran its natural course, and like all grants, reached its finishing point, in this case late 2005.

In some cases the sponsorship process begins when we hear end-users talking about a product they have found to be better than other brands. We keep our ears open, and when we spot an especially good product, this is the company we seek sponsorship from. It would not be wise of us to seek sponsorship from a company with a sub-standard or otherwise potentially defective printer. So we usually know which printers are considered by end-users to be among the better brands before we seek sponsorship. After all, out of the by now one million readers, we have heard plenty about every single printer out there.

We thank MacDermid ColorSpan (now part of HP), Hewlett-Packard, Parrot Digigraphic, Color DNA, Canon, Gandinnovations, and other companies for providing funding for technology training for the FLAAR staff and our colleagues at Bowling Green State University in past years and for funds to allow us to attend all major international trade shows, which are ideal locations for us to gather information. We thank Sun LLC, Caldera, Raster Printers (EFI Rastek), DEC LexJet, DigiFab, Barbieri electronic, Seiko, Mutoh Europe, IP&I, Dilli, Yuhan-Kimberly, GCC, Grapo, Durst, and WP Digital for providing funds so that we can make more of our publications free to end-users. During 2000-2001 we had grants to cover all the costs of our publications, and all FLAAR Reports were free in those early years. As that early grant naturally expired after a few years, we had to begin charging for some of our reports to cover costs. Now (in 2009), we are seeking corporate sponsorship so we can gradually make another 20% of our publications free to our readers.

Since 2006 we do a major part of our evaluations at a factory and headquarters demo room. Since the university does not fund any of

these trips, it is traditional for the manufacturer to fund a research sponsorship. In the US this is how most university projects are initiated for decades now, and it is increasing. In fact there is a university in Austria that is not an "edu" but is a "GmbH", funded by the chamber of commerce of that part of Austria. In other words, a university as an educational institution, but functioning in the real world as an actual business. This is a sensible model.

It has been helpful when companies make it possible for us to fly to their headquarters so we can inspect their manufacturing facilities, demo rooms, and especially when the companies make their research, engineering and ink chemistry staff available for discussions. When I received my education at Harvard I was taught to have a desire to learn new things. This has guided my entire life and is what led me into wide-format digital imaging technology: it is constantly getting better and there is a lot to learn every month. Thus I actively seek access to improving my understanding of wide format printer technology so that we can better provide information to the approximately quarter-million+ readers of our solvent and UV printer web site (www.large-format-printers.org) and the over half a million who read either our wide-format-printers.org site or our roughly half million combined who read our digital-photography.org and www.FineArtGicleePrinters.org sites.

Barbieri electronic (color management), Caldera (RIP), ColorSpan, DEC, Durst, Gerber, Grapo, IP&I, Mimaki USA, Mutoh, Dilli, GCC, NUR, Oce, Shiraz (RIP), Sun, Teckwin, VUTEK, WP Digital, Xerox, Yuhan-Kimberly, Zund have each brought FLAAR staff to their headquarters and printer factories. Bordeaux, InkWin and Sunflower ink have brought us to inspect their ink manufacturing facilities and demo rooms. We have visited the world headquarters and demo rooms of HP in Barcelona and received informative and helpful technology briefings. We are under NDA as to the subjects discussed but it is important that we be open where we have visited. Mimaki Europe has had FLAAR as their guest in Europe to introduce their flatbed UV printer, as have other UV-curable manufacturers, again, under NDA as to the details since often we are present at meetings where unreleased products are discussed. Xaar has hosted an informative visit to their world headquarters in the UK. You don't get this level of access from a trade magazine writer, and I can assure you, we are provided much more detailed information and documentation in our visits than would be provided to a magazine author or editor. Companies have learned that it's a lot better to let us know up front and in advance the issues and glitches with their printers, since they now know we will find out sooner or later on our own. They actually tell us they realize we will find out on our own anyway.

Contributions, grant, sponsorships, and project funds from these companies are also used to improve the design and appearance of the web sites of the FLAAR Information Network. We thank Canon, ColorSpan, HP, ITNH, and Mimaki for providing wide format printers, inks, and media to the universities where FLAAR does research on wide format digital imaging. We thank Epson America for providing an Epson 7500 printer many years ago, and Parrot Digigraphic for providing three different models of Epson inkjet printers to our facilities on loan at BGSU (5500, 7600, 7800). We thank Mimaki USA for providing a JV4 and then a Mimaki TX-1600s textile printer and Improved Technologies (ITNH) providing their Ixia model of the Iris 3047 giclee printer.

We thank 3P Inkjet Textiles and HP for providing inkjet textiles so we could learn about the different results on the various textiles. IJ Technologies, 3P Inkjet Textiles, ColorSpan, Encad, HP, Nan Ya Pepa, Oracal, Tara and other companies have provided inkjet media so we can try it out and see how it works (or not as the case may be; several

inkjet media failed miserably, one from Taiwan, the other evidently from Germany!). We thank Aurelon, Canon, ColorGate, ColorSpan, ErgoSoft, HP, PerfectProof, PosterJet, Onyx, Ilford, CSE ColorBurst, ScanvecAmiable, Wasatch and many other RIP companies for providing their hardware and software RIPs.

We thank Dell Computers for providing awesome workstations for testing RIP software and content creation with Adobe Photoshop and other programs. We also appreciate the substantial amount of software provided by Adobe. As with other product loaned or provided courtesy of ProVar LLC (especially the 23" monitors which makes it so much easier to work on multiple documents side by side).

We thank Betterlight, Calumet Photographic, Global Graphics, Westcott, Global Imaging Inc. Phase One, and Bogen Imaging for helping to equip our archaeological photo studios at the university and its archaeology museum in Guatemala. Heidelberg, Scitex, CreoScitex (now Kodak) and Cruse, both in Germany, have kindly provided scanners for our staff to evaluate.

We really liked some of the results whereas some of the other products were a bit disappointing. Providing samples does not influence the evaluations because the evaluators are students, professors, and staff of Bowling Green State University. These personnel are not hired by any inkjet printer company; they were universities employees (as was also true for Nicholas Hellmuth). The testing person for the HP ColorPro (desktop printer) said he frankly preferred his Epson printer. When we saw the rest results we did not include this Hewlett-Packard ColorPro printer on our list of recommended printers, but we love our HP DesignJet 5000ps so much we now have two of them, one at each university.

Sometimes we hear horror stories about a printer. The only way we can tell whether this is the fault of the printer design, or lack of training of the operator, is to have the printer ourselves in-house. Of course some printer manufacturers don't understand the reasons we need to have each make and model; they are used to loaning their demo units for a week or so. That is obviously inadequate for a serious review.

Some of the media provided to us failed miserably. Three printers failed to meet common sense usability and printability standards as well (HP 1055, one older desktop model (HP Color Pro GA), and one Epson). Yet we know other users who had better results; maybe ours came down the assembly line on a Monday or Friday afternoon, when workers were not attentive. One costly color management software package was judged "incapable" by two reviewers (one from the university; second was an outside user who had made the mistake of buying this package).

So it's obvious that providing products or even a grant is no shield from having your products fail a FLAAR evaluation. The reason is clear: the end user is our judge. The entire FLAAR service program is to assist the people who need to use digital imaging hardware and software. If a product functions we find out and promulgate the good news. If a product is a failure, or more likely, needs some improvement in the next generation, we let people know. If a product is hyped by what an informed user would recognize as potentially false and misleading nonsense, then we point out the pathetic discrepancies very clearly.

This is what you should expect from an institute which is headed by a professor.

Actually, most of our reviews are based on comments by end users. We use their tips to check out pros and cons of virtually every product

we discuss. You can't fool a print shop owner whose printer simply fails to function as advertised. And equally, a sign shop owner who earns a million dollars a year from a single printer brand makes an impact on us as well. We have multiple owners of ColorSpan printers tell us that this printer is their real money earner for example. We know other print shops where their primary income is from Encad printers. Kinkos has settled on the HP 5000 as its main money maker production machine, and so on.

Yet we have documentation of several print shop companies whose business was ruined by specific brands that failed repeatedly. It is noteworthy that it is always the same brand or printer at both locations: one due to banding and printheads then simply no longer printing one color; the other brand due to pokiness of the printer simply not being competitively fast enough. Same with RIPs, we have consistent statements of people using one RIP, and only realizing how weak it was when they tried another brand which they found substantially better. Thus we note that companies which experiment with more than one brand of product tend to realize more quickly which brand is best. This is where FLAAR is in an ideal situation: we have nine RIPs and 25 printers. Hence it is logical that we have figured out which are best for our situation.

Grant funding, sponsorship, demonstration equipment, and training are supplied from all sides of the spectrum of printer equipment and software engineering companies. Thus, there is no incentive to favor one faction over another. We receive support from three manufacturers of thermal printheads (Canon, ColorSpan and HP) and also have multiple printers from three manufacturers of piezo printers (Epson, Seiko, Mutoh, and Mimaki). This is because piezo has definite advantage for some applications; thermal printheads have advantages in different applications. Our reviews have universal appeal precisely because we feature all competing printhead technologies. Every printer, RIPs, inks, or media we have reviewed have good points in addition to weaknesses. Both X-Rite and competitor GretagMacbeth provided spectrophotometers. Again, when all sides assist this program there is no incentive to favor one by trashing the other. Printer manufacturer ad campaigns are their own worst enemy. If a printer did not make false and misleading claims, then we would have nothing to fill our reviews with refuting the utter nonsense that is foisted on the buying public.

It is not our fault if some printers are more user friendly, print on more media than other brands. It is not our fault that the competing printers are ink guzzlers, are slow beyond belief, and tend to band or drop out colors all together. We don't need to be paid by the printer companies whose products work so nicely in both our universities on a daily basis. The printers which failed did so in front of our own eyes and in the print shops of people we check with. And actually we do try to find some redeeming feature in the slow, ink gulping brands: they do have a better dithering pattern; they can take thick media that absolutely won't feed through an HP. So we do work hard at finding the beneficial features even of printers are otherwise get the most critique from our readers. Over one million people will read the FLAAR Information Network in the next 12 months; 480,000 people will be exposed to our reports on wide format printers from combined total of our three sites on these themes. You can be assured that we hear plenty of comments from our readers about which printers function, and which printers fail to achieve what their advertising hype so loudly claims.

An evaluation is a professional service, and at FLAAR is based on more than 11 years of experience. An evaluation of a printer, an ink, a software, laminator, cutter or whatever part of the digital printing workflow is intended to provide feedback to all sides. The manufacturers appreciate learning from FLAAR what features of their printers

need improvement. In probably half the manufacturers FLAAR has dealt with, people inside the company did not, themselves, want to tell their boss that their pet printer was a dog. So printer, software, and component manufacturers have learned that investing in a FLAAR evaluation of their product provides them with useful return on investment. Of course if a printer manufacturer wants only a slick Success Story, or what we call a "suck up review" that simply panders to the manufacturer, obviously FLAAR is not a good place to dare to ask for such a review. In several instances it was FLAAR Reports that allowed a company to either improve their printer, or drop it and start from scratch and design a new and better one.

And naturally end-users like the opportunity to learn about various printers from a single source that covers the entire range from UV through latex through all flavors of solvent.

We have also learned that distributors often prefer to accept for distribution a printer or other product on which a FLAAR Report already exists.

We turn down offers of funding every year. These offers come from PO Box enterprises or products with no clearly visible point of manufacture. Usually the company making the offer presumes they can buy advertising space just by paying money. But that is not what our readers want, so we politely do not accept such offers of money.

Contributions, grants, sponsorships, and funding for surveys, studies and research is, however, open to a company who has an accepted standing in the industry. It is helpful if the company has a visible presence at leading trade shows and can provide references from both end users and from within the industry. Where possible we prefer to visit the company in person or at least check them out at a trade show. Obviously the product needs to have a proven track record too. Competing companies are equally encouraged to support the FLAAR system. We feel that readers deserve to have access to competing information. Competition is the cornerstone of American individualism and technological advancement.

FLAAR also covers its costs of maintaining the immense system of 8 web sites in three languages and its facilities in part by serving as a consultant such as assisting inkjet manufacturers learn more about the pros and cons of their own printers as well as how to improve their next generation of printers. It is especially useful to all concerned when manufacturers learn of trends (what applications are popular and for what reasons). For example, manufacturers need to know whether to continue designing software for Mac users, or concentrate software for PC users. So the survey form that you fill out is helpful to gather statistics. You benefit from this in two ways: first, you get the FLAAR reports in exchange for your survey form. Second, your comments bring (hopefully) change and improvement in the next generation of printers. When we do survey statistics, then the names, addresses, and telephone numbers are removed completely. A survey wants only aggregate numbers, not individuals. However, if you ask about a specific brand of printer, and do not opt out, we forward your request to a pertinent sponsor so you can obtain follow-up from that brand, since we ourselves do not have enough personnel to respond to each reader by telephone. But we do not provide your personal information to outsiders and our survey form has an opt out check-off box which we honor.

FLAAR also serves as consultants to Fortune 500 companies as well as smaller companies and individuals who seek help on which printers to consider when they need digital imaging hardware and software.

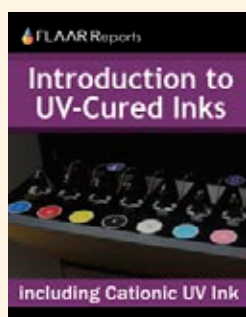
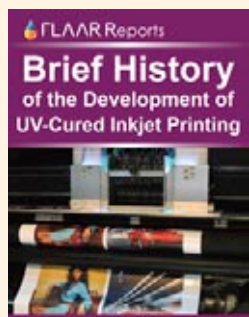
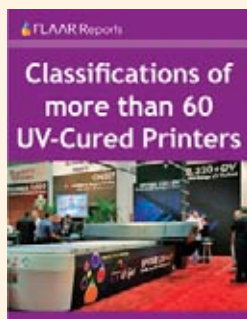
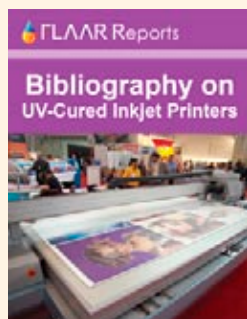
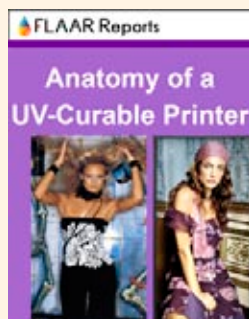
A modest portion of our income comes from our readers who purchase the FLAAR series. All income helps continue our tradition of independent evaluations and reviews of inkjet printers, RIPs, media, and inks.

These are some of the most

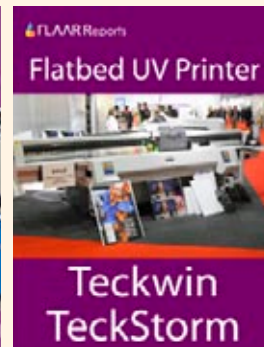
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