

HP Designjet T920 PostScript ePrinter vs. Canon imagePROGRAF iPF765



HP Designjet T920 PostScript ePrinter



Canon imagePROGRAF iPF765

		HP Designjet T920 PostScript ePrinter	Canon imagePROGRAF iPF765
Ink Consumption and Waste	Ink Used to Fill Ink Lines	✓	
	Ink Consumed and Wasted During Printing	✓	
	Ink Wasted During Cleaning Process	=	=
Image Quality		✓	
End-to-End Workflow Productivity	Standard Print Methods	=	=
	HPGL2 File Handling	✓	
	Ergonomics/Ease of Use	✓	
Mobility		✓	
Total Cost of Ownership		✓	

Advantage denoted by ✓

TEST OBJECTIVE

Buyers Laboratory LLC (BLI) was commissioned by Hewlett Packard to conduct an independent comparative evaluation of the six-color HP Designjet T920 PostScript ePrinter and the five-color (six-ink) Canon imagePROGRAF iPF765, both 36-inch wide format inkjet printers, and produce a report comparing the relative strengths and weaknesses in terms of ink consumption and waste, image quality, end-to-end workflow productivity, mobility and total cost of ownership. All testing was performed in BLI's U.S. test facility in Hackensack, New Jersey.

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Executive Summary

The HP Designjet T920 PostScript ePrinter outperformed the Canon imagePROGRAF iPF765 in a majority of the categories evaluated and gave an equivalent performance in two categories. Notably, the HP T920 utilized less ink over the course of three days while printing 300 Arch D-size documents, and concurrently wasted less ink than the competitor under each scenario. The HP unit's success during this undertaking reflected positively in the total cost of ownership (TCO) study, in which the HP Designjet T920 was estimated to have a three-year cost that was 11.5 percent lower than that of the Canon imagePROGRAF iPF765, after accounting for not only ink usage and waste, but maintenance tank and printhead replacement, as well. During the printhead cleaning process, the Canon printer utilized less ink than the HP T920 when undergoing five consecutive printhead "A" cleanings; on the other hand, it used considerably more ink when five consecutive "B" cleanings were performed. (The HP device has only one level of cleaning; the Canon has two.)

Aiding the HP Designjet T920's superior end-to-end workflow productivity is its versatile design, which incorporates a flat-top surface that proved to be an effective location on which to place multiple sets of various-sized prints, thereby making mark-ups on those prints an effortless task. Additionally, the surface enabled technicians to easily organize the numerous job sets printed throughout the evaluation. In comparison, the Canon unit's curved surface did not readily accommodate more than a page or two before those pages tended to drop to the floor, thus requiring additional table-top space to perform the same tasks. More importantly, the HP unit's new top stacker seamlessly and repeatedly collected finished prints in perfect order throughout testing, no matter the media type, size or thickness, while the hinged cover enabled easy print removal. Conversely, the Canon iPF765, whose front stacker simply allows finished prints to drop face-down into it, would collect prints that frequently curled, sometimes causing them to fall off the stacker and unquestionably did not allow for as orderly collection as the HP Designjet T920.

Both devices provided an equivalent performance when using standard print methods via their respective print drivers with half the scenarios favoring the speed of the HP and half the Canon. Likewise, both device's cloud solutions enabled relatively straightforward cloud file storage and sharing processes. However, the HP T920 once again outshone the competitor when it came to its HPGL2 file handling and USB connectivity capabilities. Each of the HPGL2 test files were successfully printed by the HP T920, whereas the Canon unit, which required third-party software to submit those files and thus additional time and effort, failed to print half of them. Moreover, these files, among numerous others, were easily selected at the HP T920 control panel and submitted to the printer once a USB drive containing those files was inserted into the control panel port. The control panel also enabled the convenience of color file previewing, whether files resided on a USB drive, in the cloud or on the unit's hard drive. To be sure, other noteworthy mobility advantages for the HP Designjet T920 are its embedded email address, which allows particular files to be printed simply by sending them to the address as email attachments, as well as the unit's support for printing from Android and Apple Smartphones and tablets. The Canon imagePROGRAF iPF765 does not offer USB connectivity, file previewing from its control panel, an embedded email address, or Smartphone and tablet support, major shortcomings for that device in regards to ease of use and mobility by comparison.

The HP Designjet T920's image quality was considered better overall than that produced by the Canon imagePROGRAF iPF765, which was especially evident in the sharper text and more consistent fine lines produced by the HP T920. Although the Canon iPF765 generated text that was darker, it appeared "bloated," with more than average halving, which could conceivably be attributed to ink over-saturation and the ensuing ink waste BLI measured during the evaluation.

Ink Consumption and Waste

Ink Consumption and Waste Methodology

BLI technicians installed both the HP Designjet T920 PostScript ePrinter and Canon imagePROGRAF iPF765 in the lab with their respective latest firmwares, and assigned IP addresses via their control panels. Each print driver was installed on a Windows 7 workstation via the supplied installation disks and linked to the printers via 100BaseT TCP/IP connections. Each of the six 130-ml. ink cartridges used by the HP and Canon devices was weighed directly out of the box and then again after being installed in the printer, the results for which are found in Table 1 for the HP T920 and Table 2 for the Canon iPF765. Likewise, to determine ink waste, the HP T920 service station, which collects the waste ink, was weighed before the start of testing and after the ink lines were full, and the same procedures were followed for measuring the Canon iPF765's maintenance tank, which also collects the waste ink. (Since the HP unit's service station is not intended to be removed or replaced by an end-user, HP provided BLI technicians a video outlining the procedures to properly remove it.)

The ink consumption and waste analysis during printing was conducted using three BLI color test targets—GIS, CAD and Line Art, each of which is 24" x 36" or Arch D-sized. To replicate a typical printer usage scenario, a start/stop method was employed during which 25 copies of each document were printed at a time on each unit, followed by a wait of at least one hour, during which the printers were allowed to enter sleep mode. The procedure was repeated until 100 pages were printed on each. The ink cartridges, as well as the HP's service station and the Canon's maintenance tank, were weighed before and after each 25 page run. The test results for the GIS document printed on the HP T920 and Canon iPF765 are found in Tables 3 and 4, respectively; for the CAD document the results are found in Tables 5 and 6, and for the Line Art document the results are found in Tables 7 and 8. Coated paper was selected in each device's driver for printing the GIS file, while plain paper was selected for the other two files. The HP driver was set to Normal quality and Printer Managed Colors for each of the files, while the Canon driver was set to Standard quality for each; as well as Image, Color for the GIS file and Lines/Text, Color for the CAD and Line Art files.

For the ink consumption and waste analysis during printhead cleaning, a new set of ink cartridges was installed in both devices after again weighing them out of the box. Likewise, the HP service station and Canon maintenance tank were weighed before the process began. A total of five printhead cleanings were performed on the HP T920, which were initiated from the control panel, and the cartridges and service station were weighed after each one with the results found in Table 9. The same procedures were followed for the Canon iPF765; however, since that device enables two levels of cleaning—A and B—both were conducted five times in succession, first A, followed by B, the results for which are found in Tables 10 and 11, respectively.

+ , - and O represent positive, negative and neutral attributes, respectively.

Ink Used To Fill The Ink Lines

- + At the outset of testing, the HP Designjet T920 utilized 6.8 percent less ink (269.0 g vs. 288.5 g) than did the Canon imagePROGRAF iPF765 to fill the ink lines. (See Tables 1 and 2.)
- + The ink weight used by the HP printer to fill the lines represents 33.5 percent of the total ink across its six cartridges, while the weight used by the Canon printer represents 34.7 percent of its total ink weight. In terms of the total ink needed to fill the lines, the HP printer required 3.5 percent less than did the Canon iPF765.

- The HP service station gained 104.4 grams in weight after the filling process completed, while the Canon waste maintenance tank gained 47.0 grams in weight after the same process, indicating the HP device wasted 122.1 percent more ink during the filling process than did the Canon device.

Ink Consumed And Wasted During Printing

- + To print 100 pages of BLI's GIS document on coated paper, the HP Designjet T920 utilized 16.8 percent less ink (118.2 g) than did the Canon imagePROGRAF iPF765 (142.0 g). In terms of the percentage of total ink used, the HP consumed 14.7 percent of the total ink available, while the Canon consumed 17.1 percent of its total available ink. (See Tables 3, 4 and 12.)
- + To print 100 pages of BLI's CAD document on plain paper, the HP T920 utilized 20.1 percent less ink (68.4 g) than did the Canon iPF765 (85.6 g). In terms of the percentage of total ink used, the HP consumed 8.5 percent of its total available ink, while the Canon consumed 10.3 percent of its total available ink. (See Tables 5, 6 and 12.)
- + To print 100 pages of BLI's Line Art document on plain paper, the HP T920 utilized 8.3 percent less ink (48.7 g) than did the Canon iPF765 (53.1 g). In terms of the percentage of total ink used, the HP consumed 6.1 percent of its total available ink, while the Canon consumed 6.4 percent of its total available ink. (See Tables 7, 8 and 12.)
- + For the first scenario above, the HP Designjet T920 wasted 71.3 percent less ink overall (2.9 g) than did the Canon imagePROGRAF iPF765 (10.1 g). (See Table 13.)
- + After printing 100 pages of the CAD document, the HP T920 wasted 18.0 percent less ink overall (4.1 g) than did the Canon iPF765 (5.0 g). (See Table 13.)
- + Similarly, after printing 100 pages of the Line Art document, the HP T920 wasted 59.6 percent less ink overall (2.1 g), than the Canon unit wasted (5.2 g). (See Table 13.)
- + Over the duration of printing the 300 pages in aggregate, the HP T920 wasted exactly half the amount of its total available ink (1.2%) than did the Canon iPF765 (2.4%).

Ink Wasted During Cleaning Process

- BLI technicians measured 43.1 grams of ink used after five printhead cleanings were conducted on the HP Designjet T920. Conversely, after performing five "A" printhead cleanings on the Canon imagePROGRAF iPF765, 16.7 grams of ink were measured, which is 61.3 percent less ink. (See Tables 9 and 10.)
- At the same time, the HP device's service station increased in weight by 41.3 grams, while the Canon maintenance tank increased in weight by 38 grams, or 8.0 percent less.
- + After conducting five "B" printhead cleanings on the Canon iPF765, however, the unit used 247.1 percent more ink (149.6 g) than did the HP T920 (43.1 g). (The Canon iPF765 offers two levels of printhead cleaning—A and B, while the HP T920 offers only one level.)
- + Consequently, the Canon iPF765 also wasted 258.6 percent more ink (148.1 g) than did the HP T920 (41.3 g), as evidenced by the increase in weights of their respective maintenance tank and service station. (See Tables 9 and 11.)

Table 1 – HP Designjet T920 Ink Cartridge Weights (in grams)

	CYAN	MAGENTA	YELLOW	PK	G	MK	Service Station
Cartridge Start Weight	191.5	190.8	192.7	192.6	189.7	194.9	1,175.5
Cartridge Weight After Installation	147.5	145.4	148.6	150.5	144.8	146.4	1,279.9
Weight of Inks After Installation	44.0	45.4	44.1	42.1	44.9	48.5	104.4
Ink Weight Required to Fill Ink Lines							269.0
Weight of Empty Cartridge at End of Life	58.2*	58.2*	58.2*	58.2*	58.1	58.3	
Ink Net Weight	133.3	132.6	134.5	134.4	131.6	136.6	
Ink Weight Contained in Six Cartridges							803.0

* Empty cartridge weights were estimated from the average weight of two depleted cartridges

Table 2 – Canon imagePROGRAF iPF765 Ink Cartridge Weights (in grams)

	CYAN	MAGENTA	YELLOW	MBK	MBK	BK	Waste Tank
Cartridge Start Weight	175.3	178.6	172.6	175.0	174.8	176.6	610.4
Cartridge Weight After Installation	125.9	130.2	125.0	128.5	127.6	127.2	657.4
Weight of Inks After Installation	49.4	48.4	47.6	46.5	47.2	49.4	47.0
Ink Weight Required to Fill Ink Lines							288.5
Weight of Empty Cartridge at End of Life	37.1	36.4	36.8*	36.8	36.8	36.8*	
Ink Net Weight	138.2	142.2	135.8	138.2	138.0	139.8	
Total Ink Weight of Six Cartridges							832.2

* Empty cartridge weights were estimated from the average weight of four depleted cartridges

Table 3 – HP Designjet T920 Ink Consumption – 100-Pages GIS Document (in grams)

	CYAN	MAGENTA	YELLOW	PK	Gray	MK	Total Ink Weight	Service Station Weight
Cartridge Start Weight	190.5	191.2	191.6	192.4	190.2	193.0		1,252.3
Weight After First 25 GIS Pages	182.7	187.5	186.0	190.3	180.7	189.3		1,253.6
Ink Weight Used After 25 Pages	7.8	3.7	5.6	2.1	9.5	3.7	32.4	1.3
Separator								
Cartridge Start Weight	182.5	187.3	185.8	190.3	180.5	189.0		1,253.7
Weight After Second 25 GIS Pages	175.1	184.0	180.6	188.6	171.9	186.5		1,254.2
Ink Weight Used After 25 Pages	7.4	3.3	5.2	1.7	8.6	2.5	28.7	0.5
Separator								
Cartridge Start Weight	174.9	183.8	180.4	188.5	171.6	186.1		1,254.6
Weight After Third 25 GIS Pages	167.4	180.3	175.1	186.8	162.8	183.4		1,255.2
Ink Weight Used After 25 Pages	7.5	3.5	5.3	1.7	8.8	2.7	29.5	0.6
Separator								
Cartridge Start Weight	167.1	180.0	174.7	186.6	162.3	182.9		1,250.0
Weight After Fourth 25 GIS Pages	160.0	176.8	169.7	185.0	154.1	180.4		1,250.5
Ink Weight Used After 25 Pages	7.1	3.2	5.0	1.6	8.2	2.5	27.6	0.5
TOTALS	29.8	13.7	21.1	7.1	35.1	11.4	118.2	2.9

Table 4 – Canon imagePROGRAF iPF765 Ink Consumption – 100-Pages GIS Document (in grams)

	CYAN	MAGENTA	YELLOW	MBK 1	MBK 2	BK	Total Ink Weight	Waste Ink Cartridge
Cartridge Start Weight	175.2	178.1	167.5	174.5	175.1	170.7		657.2
Weight After First 25 GIS Pages	162.6	170.6	159.2	172.1	172.9	167.6		658.4
Ink Weight Used After 25 Pages	12.6	7.5	8.3	2.4	2.2	3.1	36.1	1.2
Separator								
Cartridge Start Weight	162.1	169.9	158.6	171.7	172.4	166.8		658.4
Weight After Second 25 GIS Pages	149.5	160.0	150.2	166.2	166.7	162.6		661.5
Ink Weight Used After 25 Pages	12.6	9.9	8.4	5.5	5.7	4.2	46.3	3.1
Separator								
Cartridge Start Weight	149.2	159.6	149.9	165.8	166.4	162.2		661.3
Weight After Third 25 GIS Pages	138.0	153.3	142.4	164.7	165.4	159.7		663.6
Ink Weight Used After 25 Pages	11.2	6.3	7.5	1.1	1.0	2.5	29.6	2.3
Separator								
Cartridge Start Weight	137.6	152.8	142.2	164.4	165.2	159.5		663.6
Weight After Fourth 25 GIS Pages	126.1	146.3	135.3	163.1	163.6	157.3		667.1
Ink Weight Used After 25 Pages	11.5	6.5	6.9	1.3	1.6	2.2	30.0	3.5
TOTALS	47.9	30.2	31.1	10.3	10.5	12.0	142.0	10.1

Table 5 - HP Designjet T920 Ink Consumption - 100-Pages CAD Document (in grams)

	CYAN	MAGENTA	YELLOW	PK	Gray	MK	Total Ink Weight	Service Station Weight
Cartridge Start Weight	159.5	176.3	169.2	184.6	153.5	179.1		1,251.6
Weight After First 25 CAD Pages	158.8	175.4	166.9	184.2	148.4	170.2		1,253.7
Ink Weight Used After 25 Pages	0.7	0.9	2.3	0.4	5.1	8.9	18.3	2.1
Section 2								
Cartridge Start Weight	158.5	175.1	166.5	184.0	147.9	169.4		1,243.2
Weight After Second 25 CAD Pages	158.1	174.5	164.5	183.8	143.4	161.0		1,243.6
Ink Weight Used After 25 Pages	0.4	0.6	2.0	0.2	4.5	8.4	16.1	0.4
Section 3								
Cartridge Start Weight	190.5*	174.4	164.4	183.8	143.2	160.8		1,243.1
Weight After Third 25 CAD Pages	190.1	173.7	162.2	183.7	138.3	152.3		1,243.6
Ink Weight Used After 25 Pages	0.4	0.7	2.2	0.1	4.9	8.5	16.8	0.5
Section 4								
Cartridge Start Weight	190.0	173.6	162.0	183.6	138.2	151.9		1,243.2
Weight After Fourth 25 CAD Pages	189.4	172.8	159.8	183.4	133.5	143.2		1,244.3
Ink Weight Used After 25 Pages	0.6	0.8	2.2	0.2	4.7	8.7	17.2	1.1
TOTALS	2.1	3.0	8.7	0.9	19.2	34.5	68.4	4.1

* Cyan cartridge no longer recognized by T920 and required replacement

Table 6 - Canon imagePROGRAF iPF765 Ink Consumption - 100 Pages CAD Document (in grams)

	CYAN	MAGENTA	YELLOW	MBK 1	MBK 2	BK	Total Ink Weight	Waste Ink Cartridge
Cartridge Start Weight	126.1	146.3	135.3	163.0	163.6	157.2		663.9
Weight After First 25 CAD Pages	122.9	142.5	131.6	157.9	158.6	157.0		664.2
Ink Weight Used After 25 Pages	3.2	3.8	3.7	5.1	5.0	0.2	21.0	0.3
Section 2								
Cartridge Start Weight	122.3	141.9	131.3	157.5	158.3	156.4		664.2
Weight After Second 25 CAD Pages	119.3	138.1	127.7	152.2	152.8	156.3		665.7
Ink Weight Used After 25 Pages	3.0	3.8	3.6	5.3	5.5	0.1	21.3	1.5
Section 3								
Cartridge Start Weight	118.7	137.5	127.5	151.8	152.6	155.7		665.6
Weight After Third 25 CAD Pages	115.4	133.6	124.3	146.5	147.2	155.5		667.4
Ink Weight Used After 25 Pages	3.3	3.9	3.2	5.3	5.4	0.2	21.3	1.8
Section 4								
Cartridge Start Weight	115.3	133.4	124.0	146.1	146.9	155.2		667.4
Weight After Fourth 25 CAD Pages	112.0	129.3	120.7	140.8	141.6	154.5		668.8
Ink Weight Used After 25 Pages	3.3	4.1	3.3	5.3	5.3	0.7	22.0	1.4
TOTALS	12.8	15.6	13.8	21.0	21.2	1.2	85.6	5.0

Table 7 – HP Designjet T920 Ink Consumption – 100-Pages Line Art Document (in grams)

	CYAN	MAGENTA	YELLOW	PK	Gray	MK	Total Ink Weight	Service Station Weight
Cartridge Start Weight	188.8	172.1	159.1	182.7	132.6	141.3		1,244.2
Weight After First 25 Line Art Pages	188.5	170.4	158.2	182.5	131.7	133.3		1,244.7
Ink Weight Used After 25 Pages	0.3	1.7	0.9	0.2	0.9	8.0	12.0	0.5
Cartridge Start Weight	188.5	170.2	158.1	182.5	131.6	132.9		1,244.8
Weight After Second 25 Line Art Pages	188.2	168.6	157.3	182.3	130.6	124.9		1,245.4
Ink Weight Used After 25 Pages	0.3	1.6	0.8	0.2	1.0	8.0	11.9	0.6
Cartridge Start Weight	188.2	168.3	157.1	182.3	130.4	124.5		1,245.4
Weight After Third 25 Line Art Pages	187.9	166.5	156.2	182.0	129.4	116.2		1,246.0
Ink Weight Used After 25 Pages	0.3	1.8	0.9	0.3	1.0	8.3	12.6	0.6
Cartridge Start Weight	187.9	145.1*	156.1	182.0	129.3	115.8		1,245.8
Weight After Fourth 25 Line Art Pages	187.7	143.5	155.3	181.8	128.3	107.4		1,246.2
Ink Weight Used After 25 Pages	0.2	1.6	0.8	0.2	1.0	8.4	12.2	0.4
TOTALS	1.1	6.7	3.4	0.9	3.9	32.7	48.7	2.1

* The magenta cartridge was no longer recognized by T920 and required replacement

Table 8 – Canon imagePROGRAF iPF765 Ink Consumption – 100-Pages Line Art Document (in grams)

	CYAN	MAGENTA	YELLOW	MBK 1	MBK 2	BK	Total Ink Weight	Waste Ink Cartridge
Cartridge Start Weight	112.0	129.3	120.3	140.5	141.3	154.2		666.3
Weight After First 25 Line Art Pages	111.4	126.2	119.7	135.7	136.6	154.0		667.9
Ink Weight Used After 25 Pages	0.6	3.1	0.6	4.8	4.7	0.2	14.0	1.6
Cartridge Start Weight	111.0	125.9	119.3	135.1	135.9	153.6		667.8
Weight After Second 25 Line Art Pages	110.6	123.3	118.6	131.3	131.9	153.3		668.0
Ink Weight Used After 25 Pages	0.4	2.6	0.7	3.8	4.0	0.3	11.8	0.2
Cartridge Start Weight	110.2	122.7	118.3	130.8	131.7	153.1		668.1
Weight After Third 25 Line Art Pages	109.7	120.2	117.9	126.0	127.1	152.8		669.8
Ink Weight Used After 25 Pages	0.5	2.5	0.4	4.8	4.6	0.3	13.1	1.7
Cartridge Start Weight	109.5	119.8	117.5	125.7	126.7	152.4		669.3
Weight After Fourth 25 Line Art Pages	109.1	116.8	116.6	120.8	121.9	152.2		671.0
Ink Weight Used After 25 Pages	0.4	3.0	0.9	4.9	4.8	0.2	14.2	1.7
TOTALS	1.9	11.2	2.6	18.3	18.1	1.0	53.1	5.2

Table 9 – HP Designjet T920 Ink Consumed During Printhead Cleaning (in grams)

	CYAN	MAGENTA	YELLOW	PK	GRAY	MK		Service Station
Start Weight	190.1	191.0	192.2	192.5	190.1	193.9		1,266.5
Weight After Cleaning	189.3	189.3	190.4	191.8	189.5	191.6		1,274.4
Weight After Cleaning	188.4	187.4	188.5	191.0	188.7	189.2		1,282.5
Weight After Cleaning	187.5	185.5	186.5	190.1	187.8	187.1		1,290.9
Weight After Cleaning	186.6	183.7	184.6	189.3	186.9	184.7		1,299.3
Weight After Cleaning	185.8	181.8	182.6	188.4	185.9	182.2		1,307.8
Total Weight Used In Cleaning	4.3	9.2	9.6	4.1	4.2	11.7	43.1	41.3

Table 10 – Canon imagePROGRAF iPF765 Ink Consumed During Printhead Cleaning “A” (in grams)

	CYAN	MAGENTA	YELLOW	MBK 1	MBK 2	BK		Waste Tank
Start Weights	175.2	177.9	167.6	174.4	174.3	171.0		886.2
Weight After Cleaning	175.1	177.8	167.4	174.2	173.6	170.9		893.7
Weight After Cleaning	174.9	177.6	167.3	173.8	172.7	170.7		901.1
Weight After Cleaning	174.6	177.5	167.2	172.0	171.8	170.6		908.9
Weight After Cleaning	174.4	177.3	166.9	170.6	169.9	170.4		916.5
Weight After Cleaning	174.2	177.0	166.8	167.3	168.2	170.2		924.2
Total Weight Used In Cleaning	1.0	0.9	0.8	7.1	6.1	0.8	16.7	38.0

Table 11 – Canon imagePROGRAF iPF765 Ink Consumed During Printhead Cleaning “B” (in grams)

	CYAN	MAGENTA	YELLOW	MBK 1	MBK 2	BK		Waste Tank
Start Weight	171.1	173.7	163.9	163.5	164.2	166.8		890.9
Weight After Cleaning	167.0	169.0	160.3	160.8	160.2	162.4		920.0
Weight After Cleaning	161.7	163.7	155.4	155.8	155.3	157.1		949.8
Weight After Cleaning	156.5	158.4	150.4	150.4	149.9	151.5		979.4
Weight After Cleaning	150.8	152.7	146.1	145.1	144.3	146.7		1,009.2
Weight After Cleaning	145.8	146.9	141.6	139.8	138.7	140.8		1,039.0
Total Weight Used In Cleaning	25.3	26.8	22.3	23.7	25.5	26.0	149.6	148.1

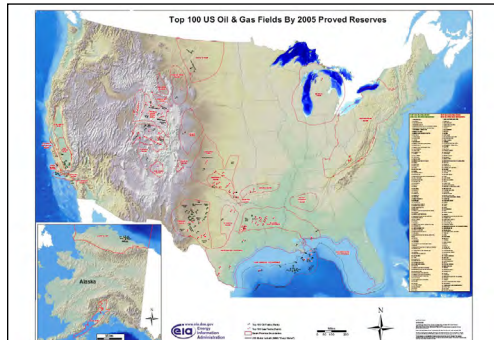
Table 12 - Ink Usage Calculations (in grams)

	HP Designjet T920	Canon imagePROGRAF iPF765
Ink required to print 100 pages GIS document	118.2	142.0
Percentage of ink used across all colors	14.7%	17.1%
Ink required to print 100 pages CAD document	68.4	85.6
Percentage of ink used across all colors	8.5%	10.3%
Ink required to print 100 pages Line Art document	48.7	53.1
Percentage of ink used across all colors	6.1%	6.4%
Calculated total ink weight for six cartridges	803.0	832.2

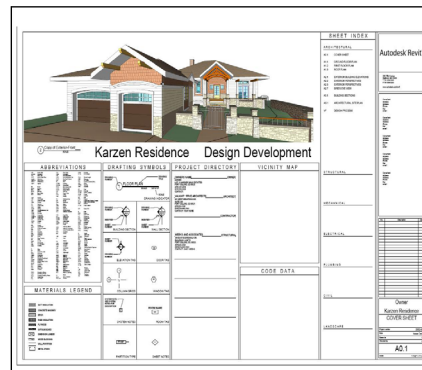
Table 13 - Ink Waste Calculations (in grams)

	HP Designjet T920	Canon imagePROGRAF iPF765
Ink wasted while printing 100 pages GIS document	2.9	10.1
Percentage of ink wasted across all colors	0.4%	1.2%
Ink wasted while printing 100 pages CAD document	4.1	5.0
Percentage of ink wasted across all colors	0.5%	0.6%
Ink wasted while printing 100 pages Line Art document	2.1	5.2
Percentage of ink wasted across all colors	0.3%	0.6%
Calculated total ink weight for six cartridges	803.0	832.2

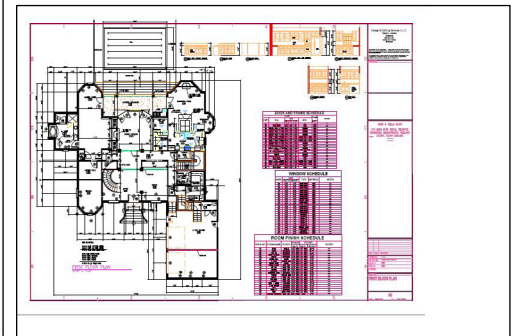
Exhibits



GIS Test Document



CAD Test Document



Line Art Test Document

Image Quality

Table 14 – Image Quality Ratings

	HP Designjet T920	Canon imagePROGRAF iPF765
Text	✓	
Fine Lines	✓	
Halftone Range	=	=
Halftone Fill	=	=
Gray Neutrality	✓	
AEC Graphics	=	=
GIS Graphics	=	=

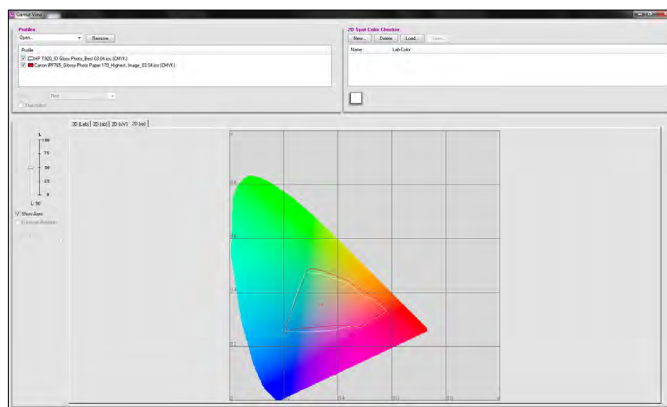
BLI test documents were produced on each company’s plain paper using the HP device’s normal, printer managed colors driver settings and the Canon device’s standard, line/text or image, color driver settings. GIS graphics were produced on heavy weight coated paper using the HP device’s best, printer managed colors settings, and the Canon device’s highest, image, color driver settings.

	HP Designjet T920	Canon imagePROGRAF iPF765
Density	✓	
Color Gamut	✓	
Solids	=	=

Density, color gamut and solids were assessed on each company’s gloss photo paper. Color charts were printed using the HP device’s best, printer managed colors driver settings and the Canon device’s highest, image, color driver settings.

Table 15 – Optical Density – Gloss Photo Paper

	HP Designjet T920	Canon imagePROGRAF iPF765
Cyan	1.03	0.96
Magenta	1.52	1.46
Yellow	1.04	0.86
Black	1.74	1.72

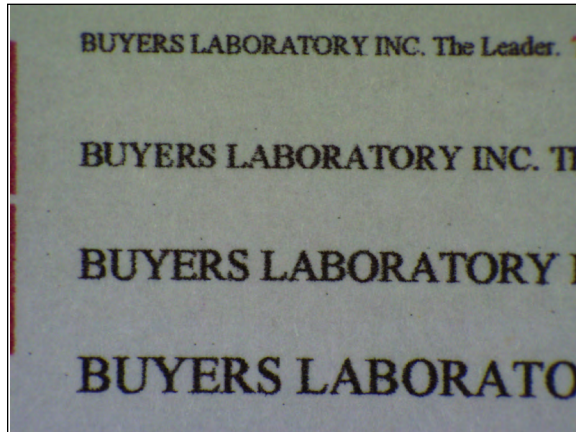


HP gamut representation in white, Canon in red

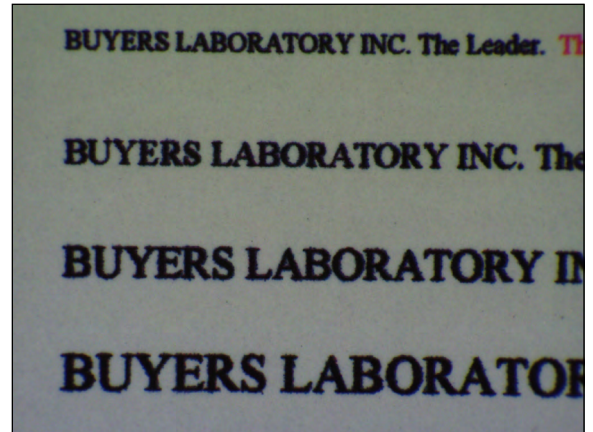
- + The HP Designjet T920 produced sharper, smoother text than did the Canon imagePROGRAF iPF765 with minimal halving. Although the Canon iPF765 produced text that was darker, it also appeared bloated, with more than average halving, a likely result of the Canon unit's overall higher ink densities.
- + The HP T920 produced both horizontal and vertical fine lines more distinctly, with better consistency and less halving than did the Canon iPF765, while the Canon unit produced circles that were more fully formed with less overspray than did the HP T920.
- Both units produced halftone patterns with no banding. The Canon unit delivered less graininess than did the HP printer; however, the HP printer's pattern was neutral gray, while the Canon unit produced the pattern with a cyan tint.
- + It was observed in numerous printed files that the HP T920 produced gray areas with better neutrality than did the Canon iPF765, which repeatedly produced these with a cyan tint. This was the case when the "Mono" driver setting was selected in the Canon driver.
- + When selecting the alternate "Mono BK Ink" setting in Canon's driver, the output tended to appear brown, and once again, not neutral gray.
- Both devices produced architectural pages that were considered equivalent. The HP T920 produced more distinct fine lines and text than did the Canon iPF765, but with more overspray. In contrast, the Canon iPF765 produced diagonal lines with less stairstepping than did the HP T920.
- Both devices produced high ink coverage topographical maps with very good contrast, fine detail and no banding on heavy weight coated paper. Areas of elevation on the maps were represented as three-dimensional by both units.
- + On photo gloss paper, the HP Designjet T920 delivered higher densities than did the Canon imagePROGRAF iPF765 for each of the four colors.
- + As a result, the HP unit produced a slightly wider color gamut than did the Canon unit, with a gamut volume measured to be 319,992 versus 305,831 for the Canon iPF765.
- Solids generated by both units on photo gloss paper were considered equal, with very good saturation and no observable mottling.

Image Quality Exhibits

Text

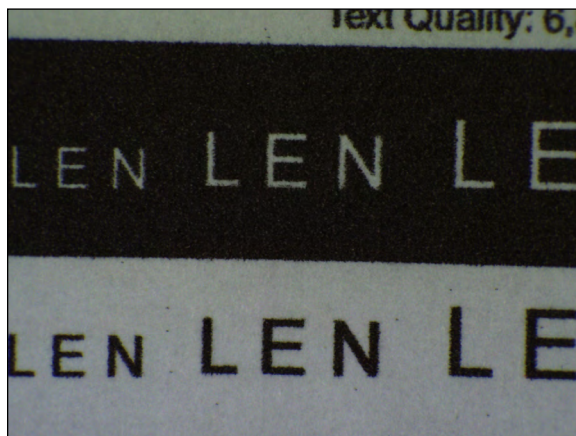


HP T920

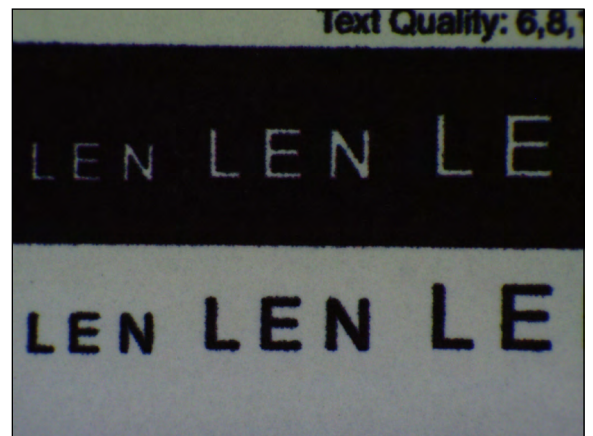


Canon iPF765

Reverse Text

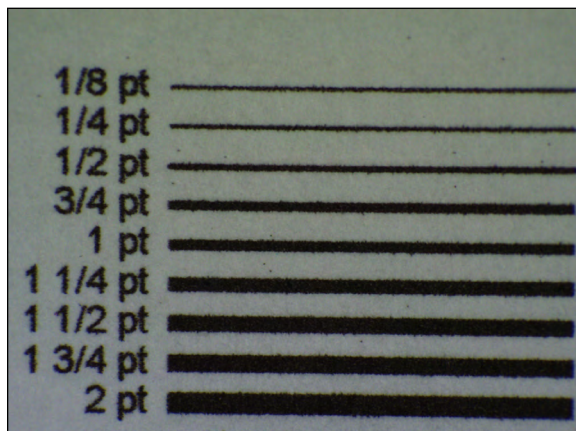


HP T920

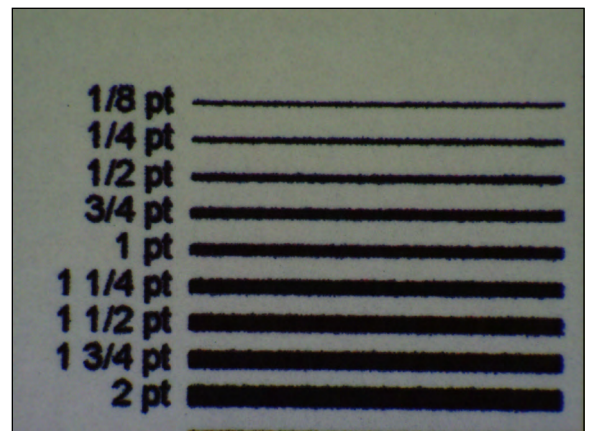


Canon iPF765

Horizontal Lines

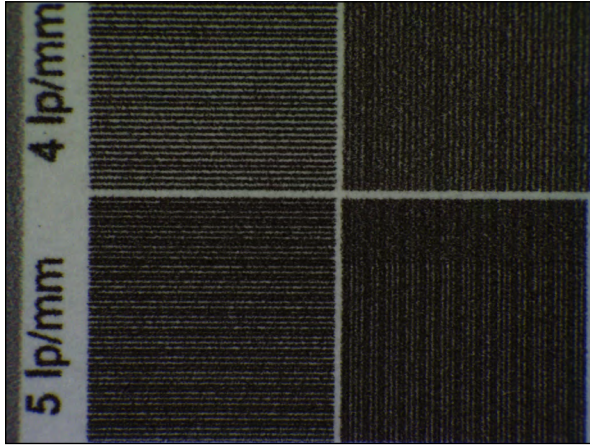


HP T920

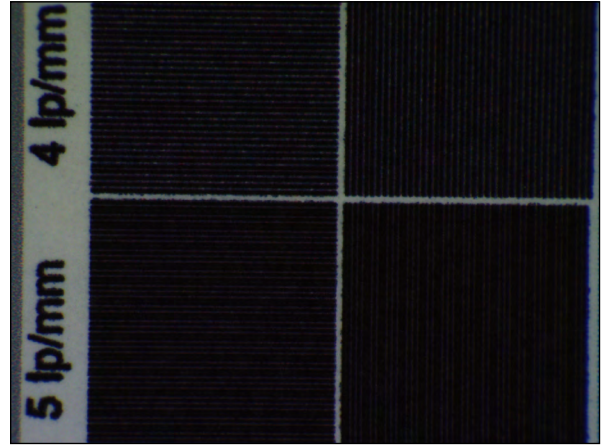


Canon iPF765

Horizontal/Vertical Lines

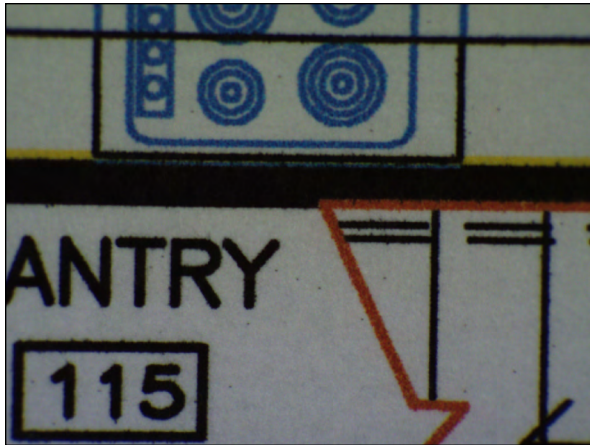


HP T920

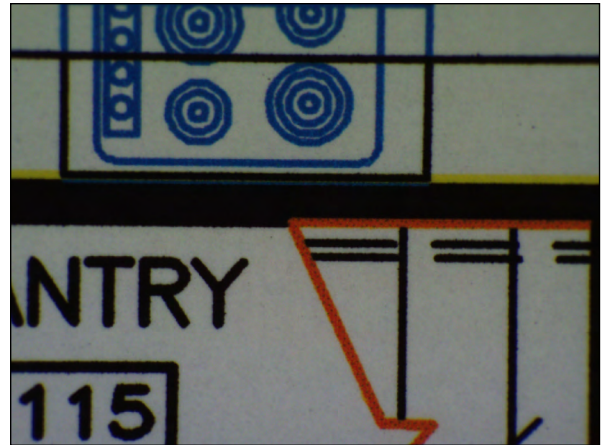


Canon iPF765

Architectural Page

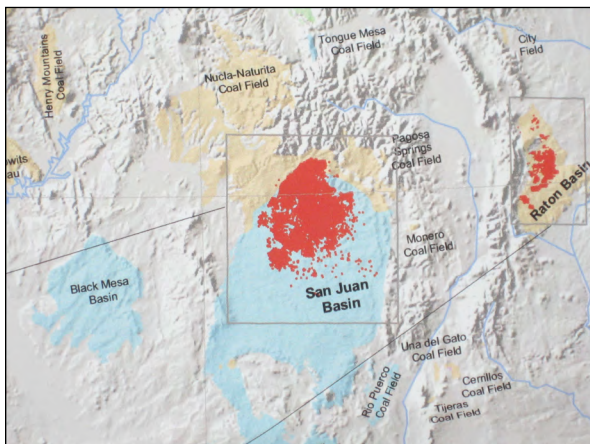


HP T920

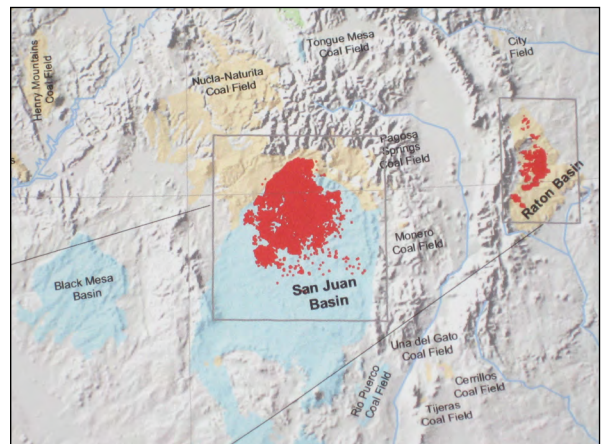


Canon iPF765

GIS Page



HP T920



Canon iPF765

End-to-End Workflow Productivity

Standard Print Methods Using Print Drivers

- Using the traditional File/Print method via each device's print driver, the HP T920 exhibited faster print speeds for half the scenarios, while the Canon iPF765 exhibited faster print speeds for the other half of the print scenarios.
- When printing BLI's 12-page DWF document, the HP T920 delivered a 10.2 percent faster print speed than did the Canon iPF765 using each device's Fast driver setting on plain paper. Conversely, in Normal/Standard mode, the Canon device produced the 12-page document 24.1 percent faster than did the HP T920.
- With BLI's monochrome 10-page PDF document, the Canon iPF765 delivered a print speed that was 16.1 percent faster than the HP unit using each device's Fast driver setting on coated paper. However, at the Normal/Standard driver setting, the HP T920 was 3.8 percent faster than the Canon device.
- When printing the same 10-page document on plain paper, the HP T920 exhibited a 11.9 percent speed advantage using each device's Fast driver setting, while the Canon exhibited a 16.2 percent speed advantage when printing the file at the Normal/Standard driver settings.
- On their respective gloss medias, the Canon iPF765 exhibited a 33.9 percent speed advantage over the HP T920 when printing one TIFF file at the Normal/Standard print driver settings. Conversely, at each device's premium quality settings, the HP T920 delivered a 26.4 percent speed advantage.

Table 16 – Productivity Results (Standard Print Methods)

HPGL2 Driver Setting	HP T920 (Time in Min:Sec)	Canon Driver Setting	Canon iPF765 (Time in Min:Sec)
Arch D-size 12-page DWF Document Printed on Plain Paper, Landscape Orientation			
Fast, Printer Managed Colors	6:26.53	Fast (300), Line/Text, Color	7:10.41
Normal, Printer Managed Colors	16:54.72	Standard (600), Line/Text, Color	12:50.37
Arch D-size 10-page PDF Document Printed on Coated Paper, Landscape Orientation			
Fast, Grayscale	7:39.22	Fast (300), Line/Text, Mono	6:25.28
Normal, Grayscale	15:12.97	Standard (600), Line/Text, Mono	15:49.41
Arch D-size 10-page PDF Document Printed on Plain Paper, Landscape Orientation			
Fast, Grayscale	5:32.69	Fast (300), Line/Text, Mono	6:17.66
Normal, Grayscale	15:14.19	Standard (600), Line/Text, Mono	12:46.16
A1-size one-page TIFF File, Printed on HP Gloss Photo and Canon Glossy Photo 170 Paper, Landscape Orientation			
Normal, Printer Managed Colors	4:15.19	Standard (600), Image, Color	2:48.69
Best, Printer Managed Colors	6:13.82	Highest (600), Image, Color	8:27.69

HPGL2 File Handling

- + The HP Designjet T920 has a USB port atop the control panel, which makes file submission from a USB drive a simple process. In fact, technicians used this method to successfully print ten files comprising these file types – .HP, .HP2, .PLT, .PRN and .RTL from BLI's library. Once the USB drive is inserted, the user simply has to select the USB icon on the control panel home window to access files that reside on the drive. Once a file is chosen, all print parameters can be selected before the file is printed. The Canon iPF765 does not offer USB connectivity.

- + There is no standard method by which these file types can be submitted to the Canon imagePROGRAF iPF765. As mentioned, the unit neither features USB connectivity, nor does the Direct Print & Share utility enable submission of these file types to the printer.
- + The only method by which these files can be submitted to the Canon device is via third-party software, which must be downloaded and installed on each workstation from which users wish to submit them, a time consuming process. Technicians used a freeware utility named "Printfile" to submit the same files to the Canon iPF765. In doing so, five of the ten files printed successfully. Of the remaining five files, one .HP2 file caused the Status Monitor message "GL2:W0502 The parameter is out of range" to appear and the file did not print. Although no errors were reported with four additional files, none printed correctly on the Canon iPF765.

Ergonomics/Ease of Use

- Both the HP Designjet T920 and Canon imagePROGRAF iPF765 hold one roll of paper at a time. A roll is loaded on the HP printer from the front of the device, while a roll is loaded on the Canon unit at the top of the device. As a result, both devices can be easily placed flush against a wall. The loading process for neither proved to be an advantage.
- + With the bottom catch basket, which did not get used during this evaluation, in its retracted position, the depth of the HP Designjet T920 is approximately 29.5 inches. (The top stacker tray was used instead, which does not add to the depth of the unit.) With the Canon iPF765 catch basket extended so as to hold the highest number of pages as neatly as possible, the depth of the unit is approximately 42 inches. As a result, more floor space is needed for the Canon iPF765.
- + One of the primary highlights of the HP Designjet T920 design is its top stacker, which is the default location for finished prints after they exit the device. Technicians routinely and easily collected 50 Arch D-size prints at a time in the stacker, which provides extremely orderly collection, without any complications caused by media curl, a typical occurrence with wide format inkjet printers in general. In contrast, the Canon iPF765 has a flat print collection stacker basket situated at the front of the unit, which collects prints that drop into it face down. No matter the media type used during the evaluation, this method of collection allows the natural curl of finished prints to hinder the collection of more than 30 Arch D-size pages, on average, at a time.
- + After technicians submitted three jobs consisting of 48 total pages to each printer in the same order, starting with one 10-page, 24" x 36" (Arch D-size) document; followed by two sets of a 9-page 11" x 17" (ledger-size) document; and lastly two sets of another 10-page 23.4" x 33.1" (A1-size) document, the final output was collected in extremely orderly fashion in the HP Designjet T920 stacker. The front guide, which keeps the pages in place, is hinged for easy print removal from the front/top of the unit. Once the 48 pages were removed, they were layed out on top on the flat surface of the printer, and quickly separated by job, presenting three orderly stacks of prints, as outlined in the photos below. On the other hand, pages began folding over in the Canon imagePROGRAF iPF765's flat stacker at approximately 30 pages. Even so, the remainder of prints were allowed to collect in the stacker, and when printing completed, the 48 pages were set on top of the Canon printer and separated. As seen in the final photo below, the process was much less orderly for these pages, with a stray page falling back into the tray during the process, thereby requiring the technician to find the correct location for that page. Overall, print collection on the HP Designjet T920 is a much easier, neater and streamlined process than it is for the Canon iPF765.
- + The flat surface atop the HP T920 enabled the placement of documents, large and small, on that surface for making annotations, as well as for resting pages securely throughout the evaluation. Since the top surface of the Canon printer is rounded, it is not a practical location for holding printed pages, nor is it able to readily hold more than one page at a time for making annotations, etc.
- + The flat surface also comprises a hinged, tinted window through which users can readily view the progress of print jobs. The Canon device does not have this capability.



HP Designjet T920 with 48 pages, including three different page sizes in the stacker



Three jobs containing three different sizes sorted on top of the HP Designjet T920 sorted immediately after removal from stacker



First 30 of 48 pages beginning to curl in Canon imagePROGRAF iPF765 stacker basket



Canon imagePROGRAF iPF765 with all 48 pages in the stacker basket

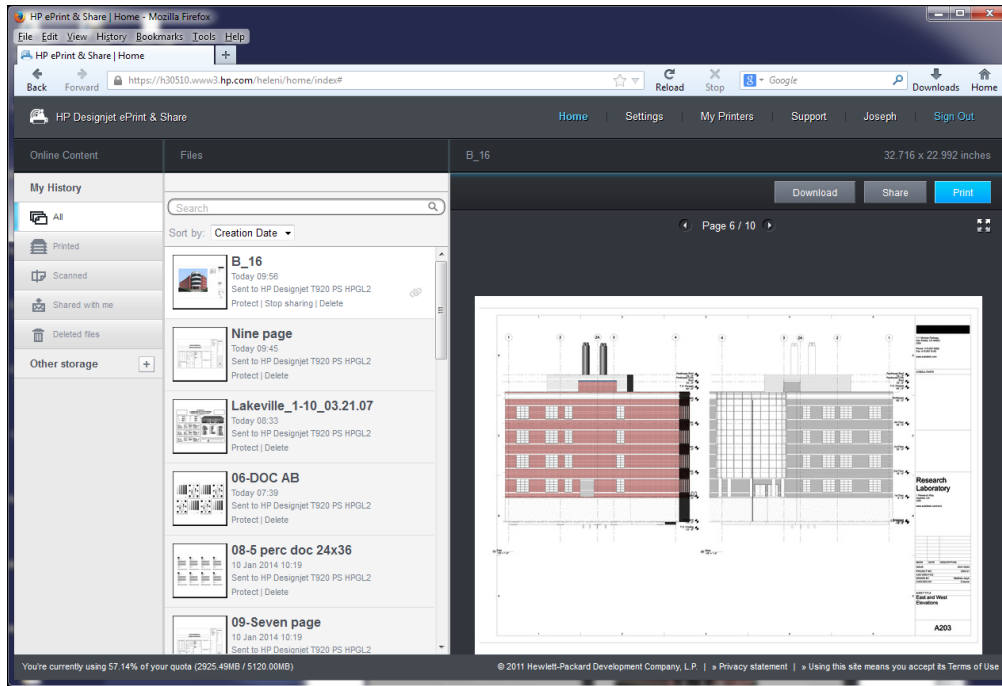


Three jobs comprising three different page sizes sorted on top of the Canon imagePROGRAF iPF765 immediately after removal from stacker basket

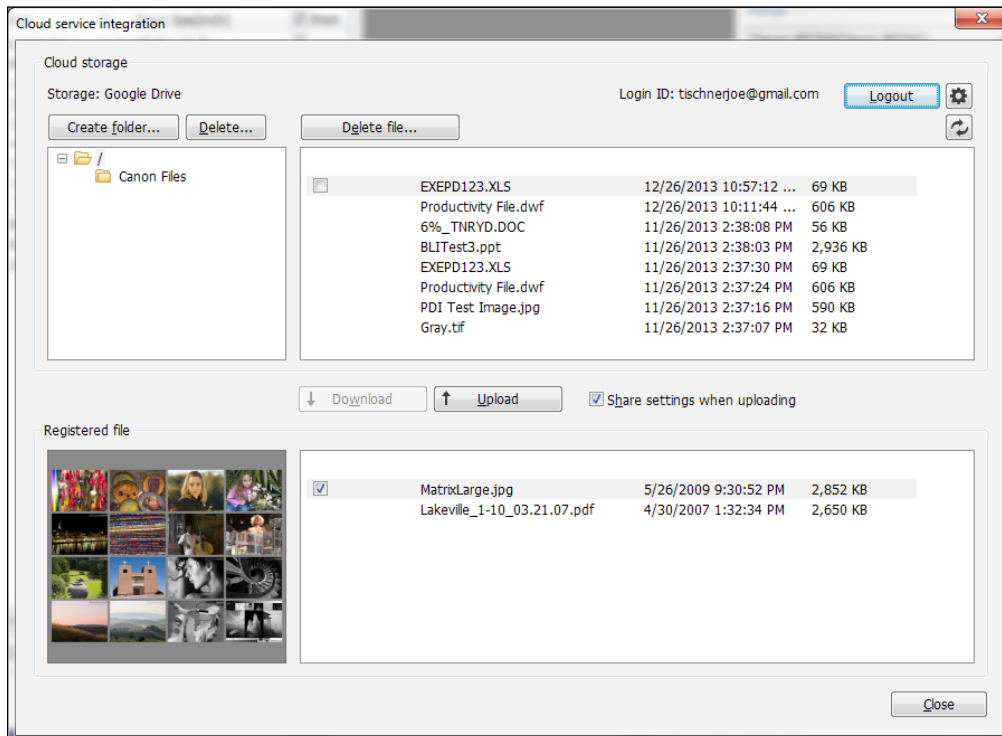
Mobility

- + The HP Designjet T920 features a unique embedded email address, as do all HP Designjet ePrinters. BLI technicians emailed PDF, TIFF and JPEG files to that address, each of which successfully printed on the unit. The Canon device does not offer this feature. The alphanumeric email address can be easily modified by the user after registering the device at www.hpconnected.com.
- + Directly after the HP T920 was installed, the control panel indicated that a firmware update was available for the device, which was automatically downloaded and installed via the unit's control panel. The Canon iPF765 does not offer this convenience.
- + As mentioned, since the HP T920 has a USB port atop the control panel, file submission from a USB drive is a very easy process. During evaluation, file types that were successfully printed via this method include PDF, TIFF, JPEG, HP2, GL2, PLT, RTL and PRN. Formats that could not be printed via this method include DOC, PPT, XLS, DWF and DWG. Once again, the Canon iPF765 does not have a USB port and therefore files cannot be printed in this manner.

- + The HP T920 enables control panel previews of the compatible files that reside not only on the USB drive, but also in the cloud and on the unit's hard drive. Previews are presented in color and can be enlarged by tapping on the preview once. Although users can access and reprint jobs that have already been printed on the Canon iPF765 from the Stored Job queue on the control panel, previewing is unavailable.
- + By default, every file submitted to the HP T920 via the HPGL2 print driver installed on a workstation is uploaded to HP Designjet ePrint & Share cloud storage utility. Conveniently, the HP Upload Manager auto-launches as soon as a file is submitted, and all files are listed chronologically in the Upload Manager and in the ePrint & Share window. (Automatic uploading can be disabled within the Upload Manager.) In contrast, Canon Direct Print & Share users must upload their selected files to Direct Print & Share manually, which is a more time consuming process. Typically, the larger the file size, the longer the upload process takes for both devices.
- + All files that reside in the HP ePrint & Share cloud storage can be accessed for printing directly from the HP Designjet T920 control panel after the user logs in with his or her username and password. Conveniently, all print parameters can be modified before a file is printed. Moreover, each of the stored files can be previewed on the panel before submitting. Cloud access from the Canon iPF765 control panel is not available.
- Although only PDF, JPEG and TIFF file types can be printed by the Canon iPF765 via Canon Direct Print & Share, the utility can be used to store and share virtually any file type of any size. Typically though, the larger the file size, the longer the upload and sharing process takes, as mentioned. In contrast, HP Designjet ePrint & Share users are limited to storing and sharing only those files that can be printed via the HP Designjet T920's HPGL2 print driver.
- The HP Designjet ePrint & Share account is created on the HP website; the Canon Direct Print & Share account is created via Google Docs.
- Both utilities can be used to readily share files with anyone in any location. Within HP ePrint & Share, once the "share" button is selected for a file, a URL is created that the user simply copies and pastes into an email that is then sent to all intended recipients' email addresses. A separate URL is created for each file the user wishes to share, each of which can be pasted into the same email. Once the email is received, selecting the URL opens HP ePrint & Share where the file is immediately available for download. Additionally, the user can login to his or her ePrint & Share account to print the document. Alternatively, with Canon Direct Print & Share, after clicking on "Cloud service integration," the "Share settings when uploading" box is checked by default. When uploading one or more files, a window opens in which each recipient's email address is added before uploading. Once the process is complete, recipients receive one email for each file that has been shared. Clicking on the link listed in the email opens the file within the Google Drive where it can be downloaded or printed.

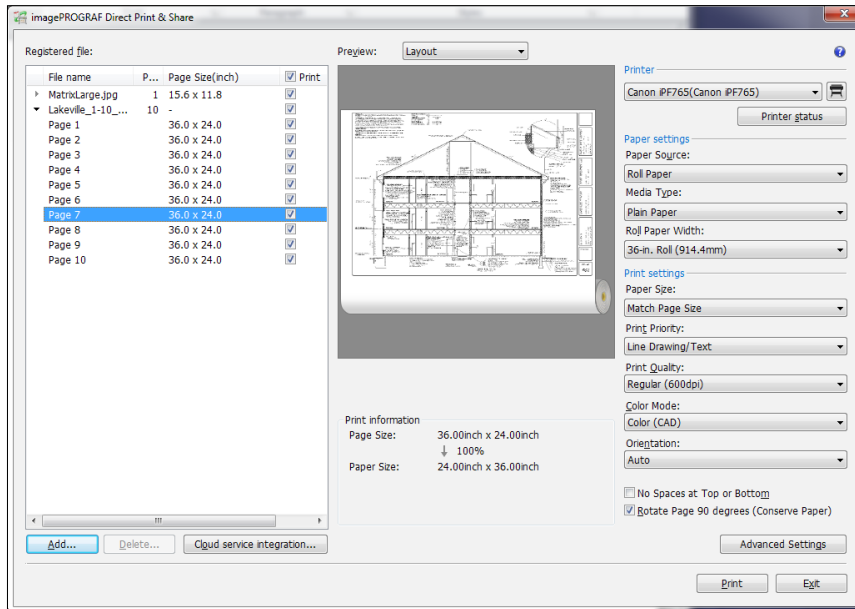


HP Designjet ePrint & Share with a list of files that were automatically saved to cloud storage

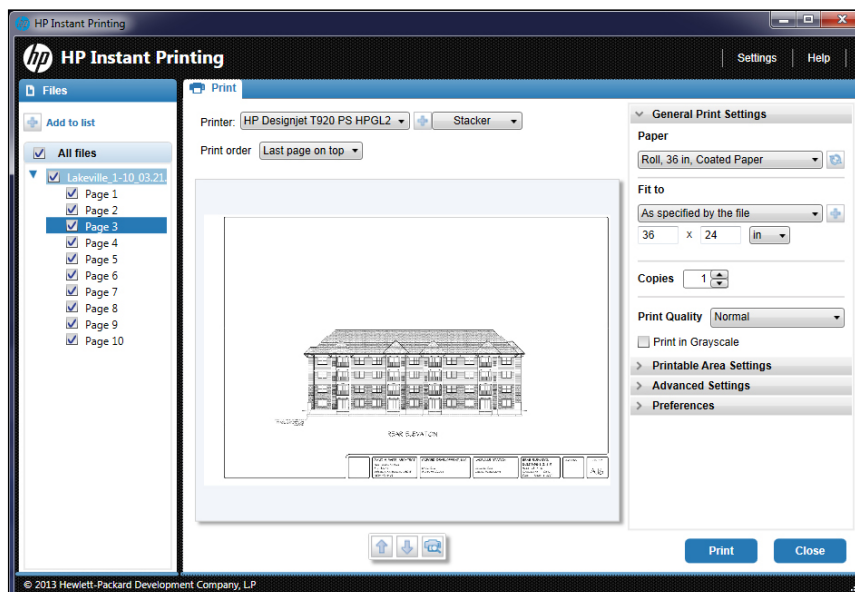


Canon Direct Print & Share Cloud Service Integration with files that are stored in the cloud in the top section and files ready to be uploaded in the bottom section

- Canon Direct Print & Share can be used as a direct print tool from any workstation on which it is installed. Users simply add PDF, JPEG and TIFF files to the utility and submit them together to the printer, thus bypassing application software and the print driver. Any print settings selected in the utility are applied to all the files being printed. Although HP Designjet ePrint & Share no longer offers this capability, users can download the HP Instant Printing Utility from the company website, which offers comparable functionality. In fact, the HP utility enables direct printing of more file types than the Canon, including PLT, DWF, PRN and PPT.
- + The HP Designjet T920 offers significant mobility advantages in that it supports printing from Apple and Android smartphones and tablets, which the Canon iPF765 does not.



Canon Direct Print & Share used for direct file submission



HP Instant Printing Utility used for direct file submission

Total Cost of Ownership

- + For the 300 Arch D-size pages printed during the ink usage evaluation, the HP Designjet T920 utilized 29.3 percent of its six inks, and wasted 1.2 percent of its inks for a total of 30.5 percent. In contrast, the Canon imagePROGRAF iPF765 utilized 33.8 percent of its six inks to print 300 pages, while wasting 2.4 percent over that time for a total of 36.2 percent. Since this is being considered as the typical monthly usage scenario, over a three year span, total ink usage will be 1,098.0% of the six original HP T920 cartridges (30.5% x 36 months), and 1,303.2% of the six original Canon iPF765 cartridges (36.2% x 36 months). Therefore, the HP T920 will require replacing each of its six cartridges 10.980 times, while the Canon iPF765 will require 13.032 replacements for each of its six cartridges. Thus, a total of 65.880 cartridges would be required by the HP T920 (10.980 replacements x 6 cartridges), and a total of 78.192 cartridges would be required by the Canon iPF765 (13.032 replacements x 6 cartridges) over the three year span. (For this theoretical usage, it is assumed that each color cartridge will be depleted equally over the three year span.)
- + BLI obtained price quotes from an independent dealer for each HP cartridge, which is \$59.65, and for each Canon cartridge, which is \$62.50. Based on these values, the HP T920 cartridges will cost \$3,929.74 (\$59.65 x 65.880), while the Canon iPF765 cartridges will cost \$4,887.00 (\$62.50 x 78.192) over the three year span.
- + Since the time required to replace the Canon iPF765 maintenance (waste ink) tank upon filling to capacity cannot be determined, BLI estimates that two additional tanks would be required for the three year test span. At \$69 each, the cost for which BLI obtained from the same independent dealer, the three year cost would be \$138. As mentioned, the HP T920 does not contain a replaceable waste tank, but instead uses a service station, which the company states will last the lifetime of the printer.
- HP recommends that the HP Designjet T920's printhead be replaced after every 4.3 liters of ink used. The 65.880 ink cartridges required for the three year scenario equate to 8.5644 liters (65.880 cartridges x 0.130 liters/cartridge), therefore, nearly two printheads would need to be replaced on the HP T920 over the test's duration. The cost of \$275 per HP printhead was provided by a third-party dealer. Although BLI found that the Canon iPF765 printhead is under warranty for one trillion drops over a one year span, BLI could not obtain an exact recommendation for its replacement. It is projected that over the span of three years, the Canon iPF765 would also require two printhead replacements at a cost of \$400 each.
- + Based on the above scenario and pricing, BLI estimates that the overall three-year TCO for the HP Designjet T920 PostScript ePrinter will be \$9,474.74, while the three-year TCO for the Canon imagePROGRAF iPF765 will be \$10,710. The three-year total cost of ownership is approximately 11.5 percent lower for the HP Designjet T920 than it is for the Canon imagePROGRAF iPF765.

Estimated Costs For:	HP Designjet T920	Canon imagePROGRAF iPF765
Acquisition	\$4,995 ¹	\$4,885 ²
Ink ³	\$3,929.74	\$4,887
Maintenance (Waste) Tank Replacement ³	-	\$138
Printhead Replacement ³	\$550	\$800
Estimated Three-Year Cost	\$9,474.74	\$10,710.00

¹ Acquisition cost obtained from HP website.

² Actual acquisition cost for the BLI test device from a third-party dealer.

³ Ink, maintenance tank and printhead replacement quotes obtained from a third-party dealer.

About Buyers Lab LLC

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