

# INTEGRATED LED/OLED CONTROLLER AND DISPLAY

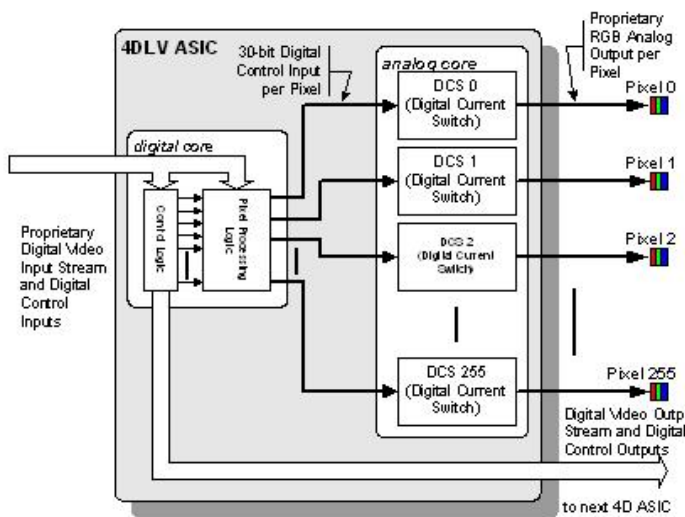
## The Opportunity

IMAGINUM has developed a system for combining control electronics and a matrix of light sources on a single substrate, greatly increasing the brightness, contrast, size, and flexibility of flat (or curved) screen displays.

## Technology

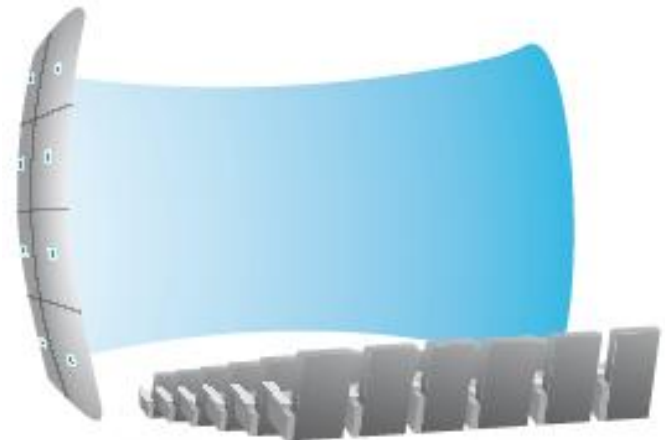
This technology represents a fundamentally new and different approach to flat screen displays. IMAGINUM has designed and patented:

- A driver chip: to drive any light source, including LEDs and OLEDs
- A driving method: to simultaneously drive the light sources.
- An architecture to tile display modules into a very large displays.



The system can be used for:

- LCD TV active intelligent LED backlighting
- Giant LED/OLED Displays, Billboards
- Control Room Displays
- Hemispherical Displays; Aircraft Simulators
- Lighting
- LED based televisions
- OLED, QLED lighting control
- Information appliances, PCTV, PDAs, I-pods, palmtops, etc.
- Medical lighting systems
- Appliance lighting - Oven, Microwave, etc.
- Toys, games, novelty devices



The technology offers the following improvements to currently available flat screen displays:

- *Integrated* display system on a single board, with pixels/sub-pixels and driver ICs on opposite faces.
- Scalability, Speed, and Brightness
- Control of individual pixels, addressing
- HDR: High Dynamic Range
- Cost Savings
- Better image quality
- Adaptability

## Intellectual Property

IMAGINUM's system is protected by broad patent filings:

- PCT WO 02/48993 "Digital video display device"
- US Patent Application 2004/0233225 "Digital video display device"
- US Patent Application 2006/0170666 "Digital video screen device"
- PCT WO 2007/131334 "Multi-Pixel Light Emitting Module"
- PCT WO 2008/022463 "Integrated Circuit with Digitally Switched Components to Drive Output..."
- PCT WO 2008/022464 "Curved Emissive Screens..." and strategic global filings.

## For More Information

The Company is seeking a qualified manufacturer to bring its innovative new technology into commercial use in targeted application areas. For more information, contact:

Dr. Stephen P. Weeks, President  
First Principals, Inc.

1768 East 25<sup>th</sup> Street  
Cleveland, OH 44114

Tel: 216-881-8521 Fax: 216-881-8522

email: [spweeks@firstprincipals.com](mailto:spweeks@firstprincipals.com)

Website: <http://www.firstprincipals.com>



# Imaginum Patent Portfolio

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CONFIDENTIAL

Dr. Stephen P. Weeks, President, First Principals, Inc.  
spweeks@firstprincipals.com  
+1 216 881 8521

## Executive Summary

The Imaginum portfolio consists of one issued patent and 18 patent applications. The portfolio has extensive worldwide coverage with active applications in the US, Japan, Brasil, China, Canada, Europe, India, Ukraine, South Korea, Mexico, Singapore, New Zealand, France and Hong Kong. The portfolio is still primarily in the application phase and is currently being prosecuted by Smart and Biggar, one of Canada's oldest and most reputable Intellectual Property firms.

The portfolio discloses a display system for use with any number of illumination technologies currently available in today's market place including but not limited to LED, OLED, and Plasma. The technology improves upon currently available display systems by eliminating the interdependency between display refresh rate and image resolution, image loading rate and display dimensions. The portfolio claims multiple aspects of the display system including the basic illumination element, the pixel module, and the display system itself. The portfolio also discloses and claims curved screens for use in aircraft simulators and/or games.

Prototypes of display systems incorporating the portfolio inventions have been constructed and have proven and validated the technology. In particular the prototypes have proven to be effective in applications such as LCD backlighting and giant video screens. In addition to the immediate applications, the concepts disclosed in the portfolio also lend themselves well to future technologies. For instance the ability to individually and simultaneously control pixel/sub-pixel intensity makes this technology ideally suited for High Dynamic Range (HDR) applications; and the technology enabling the manufacture of curved screens will find increase application as gaming and lighting technology matures.

As mentioned, the portfolio is still mostly in the application phase and as such there exists an opportunity to refine the patents considerably; tailoring them to suit specific needs.

## 1.0 Portfolio Overview

The Imaginum portfolio consists of one issued patent and 18 patent applications. The portfolio has extensive worldwide coverage with active applications in the US, Japan, Brasil, China, Canada, Europe, India, Ukraine, South Korea, Mexico, Singapore, New Zealand, France and Hong Kong. The portfolio is currently being prosecuted by Smart and Biggar, one of Canada's oldest and most reputable Intellectual Property firms.

Imaginum specializes in display technologies and the portfolio has been developed as a result of its research and development activities in that space. The Chief Technology Officer and the named inventor on all of Imaginum's patents is Philippe Guillemot, who's elegant and innovative approach to display design has resulted in a number of low cost less complex solutions that are well suited for variety of current display systems as well as the emerging High Dynamic Resolution (HDR) systems. The functioning prototypes developed by Imaginum incorporate the concepts captured by the patents thereby proving that the solutions are both viable and manufacturable.

## 1.1 Portfolio Summary

The following set of tables provides a summary of the Imaginum portfolio including areas of coverage, assignee and active applications.

Inventor(s)	Coverage	Number of Patents/Applications
Guillemot, Philippe	US, JP, BR, CN, CA, EP, IN, UA, KR, MX, SG, NZ, FR, HK, PCT	19 <i>1 issued</i> <i>18 applications</i>

Technology Field	Assignee	Current Owner
Digital Video Display Device	Imaginum	Imaginum

Earliest Priority Date	Patents Issued	Patent Applications		
		Published	Unpublished	Abandoned
Dec. 12, 2000	1			
WO 02/48993 A1	WO 02/48993 A1	11	7	14

### Active Applications (does not include abandoned assets)

Country	Application Number	Publication Number	Title	Filing Date
US	10/433,278	2004/0233225	DIGITAL VIDEO DISPLAY DEVICE	December 11, 2001
US	11/389,186	2006/0170666	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001
JP	2002-550627	N/A	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001

Country	Application Number	Publication Number	Title	Filing Date
BR	PI0116111-3	BR0116111	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001
CN	01821945.4	01821945.4	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001
CA	2,437,000	2,437,000	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001
EP	01270871.5	1354309	DIGITAL VIDEO DISPLAY DEVICE	December 11, 2001
IN	00928/DELNP/2003	N/A	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001
UA	2003076435	N/A	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001
KR	7007814/2003	N/A	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001
MX	PA/a/2003005232	3005232	DIGITAL VIDEO DISPLAY DEVICE	December 11, 2001
SG	200303437-8 97121	97121	DIGITAL VIDEO DISPLAY DEVICE	Issued: March 31, 2006  Will expire: December 11, 2021
NZ	526947	526947	DIGITAL VIDEO DISPLAY DEVICE	Issued: 6 avril 2006  Will expire: December 11, 2021
FR	0016620	2817992 0016620	DISPOSITIF D'ÉCRAN VIDÉO NUMÉRIQUE	Issued: 18 avril 2003  Will expire: December 11, 2021
HK	04107499.7	1064780	DIGITAL VIDEO SCREEN DEVICE	December 11, 2001
PCT	PCT/CA07/000814	Not available yet	MULTI-PIXEL LIGHT EMITTING MODULE	May 11, 2007
PCT	PCT/CA07/001496	Not available yet	CURVED EMISSIVE SCREENS AND APPLICATIONS THEREOF	August 24, 2007
PCT	PCT/CA07/001495	Not available yet	INTEGRATED CIRCUIT WITH DIGITALLY SWITCHED COMPONENTS TO DRIVE AN OUTPUT TO WHICH IS CONNECTED A LOAD	August 24, 2007

Abandoned applications include: RU(1), AU(1), IL(1), ID(1), PL(1), RO(1), AE(1), VN(1), ZA(1), PCT(1), and US(4). Note that the four abandoned US applications (provisional) were captured by the three PCT applications 000814, 001496 and 001495.

## 1.2 Technology Overview

The Imaginum portfolio discloses a display system for use with any number of illumination technologies currently available in today's market place including but not limited to LED, OLED, and Plasma. The portfolio also includes applications claiming the structure of the basic illumination cell used in the preferred embodiment of the issued PCT patent WO 02/48993 A1.

The patented technology improves upon currently available display systems that have inherent limitations stemming from interdependency between display refresh rate, image resolution, image loading rate and display dimensions. This interdependency will cause picture quality to degrade as the display becomes larger.

The Imaginum inventions circumvent the "degrade with increasing size" limitation through the use of a novel design for driving sub-pixels that facilitates the elimination of the interdependence between refresh rate and image resolution/image size. The solution offered by the Imaginum technology is designed to work with display illumination technologies commonly used for "matrix" systems including LED, OLED and Plasma, but also proposes and claims a customized illumination cell. The solution is digital right up to the display and as such complex digital to analog conversion is not required at the last step of the display sequence.

The portfolio further discloses a display system that is realized on a single board, having the pixels/sub-pixels on one face and the driver IC's on the opposite face. This system is not only suitable for displays, but also for simple illumination as well; and is designed to send display information to all pixels/sub-pixels simultaneously resulting in a smoother picture than the "matrix" based displays that scan the image onto the screen.

The Imaginum technology further discloses a solution for displays/screens constructed using a mosaic of multi-pixel modules. The pixel display modules are fitted closely together and can be of various shapes including triangular or hexagonal. The mosaic screens facilitate larger displays having slimmer profiles and differing shapes such as planar, cylindrical and/or spherical.

## 2.0 Summary of Key Patents/Applications

### 2.1 WO 02/48993 A1

WO 02/48993 A1 is the single issued patent within the Imaginum portfolio and also has the earliest priority date, December 12, 2000. The portfolio teaches a digital video display device that eliminates the interdependency between refresh rate and image resolution, image loading rate and display dimensions. The invention includes a novel digitally based driver circuit that will activate switches to simultaneously load (as opposed to scanning in) an image/scene onto the display screen. The patent also discloses and claims a novel illumination unit which is described in the preferred embodiment.

**Claim Construction** – There are 14 claims in WO'993; one independent and 13 dependent. Claim 1, the independent claim, captures the basic sub-pixel element structure including the basic luminous unit, switch, and input memory; as well as the characteristics of the refresh

signal and simultaneous activation of surrounding elements. The remainder of the claims builds upon the sub-pixel element structure with dependent claims 4 and 5 primarily expanding upon the basic luminous unit; and dependent claims 2, 3, and 6 through 14 capturing the system built around the luminous units. The claims are all successively dependent which is potentially limiting.

## 2.2 US Application 2004/0233225

US Application 2004/0233225 is one of two US applications that claim the priority of WO 02/48993. The '225 application is the US counterpart to the WO patent and as such parallels the patent in both specification and claims.

**Claim Construction** – As with the WO'993 patent, there are 14 proposed claims in US'225, one independent and 13 dependent. As in the case of the '993 patent, all claims are successively dependent which is potentially limiting.

## 2.3 US Application 2006/0170666

US Application 2006/0170666 is a divisional of US'225 and is the second of two US applications that claim the priority of WO 02/48993. The specification of US'666 discloses the same material as both its parents but claims the Basic Illumination Unit.

**Claim Construction** – US'666 has 27 proposed claims, four independent and 23 dependent. All claims focus on the basic illumination cell described in the preferred embodiment of the display system disclosed in both the '666 and WO'993 publications. All four dependent claims (1, 8, 16 and 22) claim a gas based luminous unit that will emit a photon when the gas is ionized by a voltage difference across its terminals. The dependent claims build upon this foundation by defining the type of voltage applied to the terminals; and incorporating a capacitor and luminescent layer into the structure.

## 2.4 PCT Application PCT/CA07/000814

PCT Application PCT/CA07/000814 discloses a single PCB display solution where pixel/sub-pixel elements are mounted on one face of the board and electrical connections are run through the board to the opposite side where they can be connected directly to pixel driver ICs. The solution offers a reduction in display complexity.

**Claim Construction** – PCT'814 has 95 proposed claims, 11 independent and 84 dependent. All independent claims focus on a printed circuit board type structure that has the pixels on one face and trace or conductive pathways that extend through the board to the other side allowing electrical contact from one face of the board to the other. The dependent claims all build upon this basic structure by describing features of the board and how they were constructed.

The majority of the '814 independent claims (1, 14, 23, 43, 51, 52, and 64) describe the PCB with pixels on one side and conductive traces extending from pixel side of the board to the other face. However claims 60, 69 and 89 claim the same structure with the additional requirement that the IC drivers be located on the side opposite to the pixels. Claim 77 claims an illumination source (rather than a display system) having pixels/sub-pixels on one face of the board with traces electrically connecting the pixels to the opposite side.

## 2.5 PCT Application PCT/CA07/001496

PCT Application PCT/CA07/001496 discloses a curved screen display solution that is constructed by mosaicing multi-pixel display modules. The modules can be constructed according to designs disclosed and claimed in the PCT'496 patent and other patents of the Imaginum portfolio.

**Claim Construction** – PCT'496 has 154 proposed claims 10 independent and 144 dependent. Eight of the independent claims pertain to curved screens with three being specific to flight simulator applications (1, 23, 46) while the remaining five are for curved displays in general (66, 86, 104, 113, 127). The dependent claims associated with each of these first eight independent claims provide details regarding screen structure and the individual display modules used. The remaining two independent claims (137, 149) focus on the multi-pixel display modules themselves and claim a pixel display module mounted on a PCB type structure such as those claimed in PCT/CA07/000814. The dependent claims describe characteristics of the display module including pixel arrangement and electrical connection.

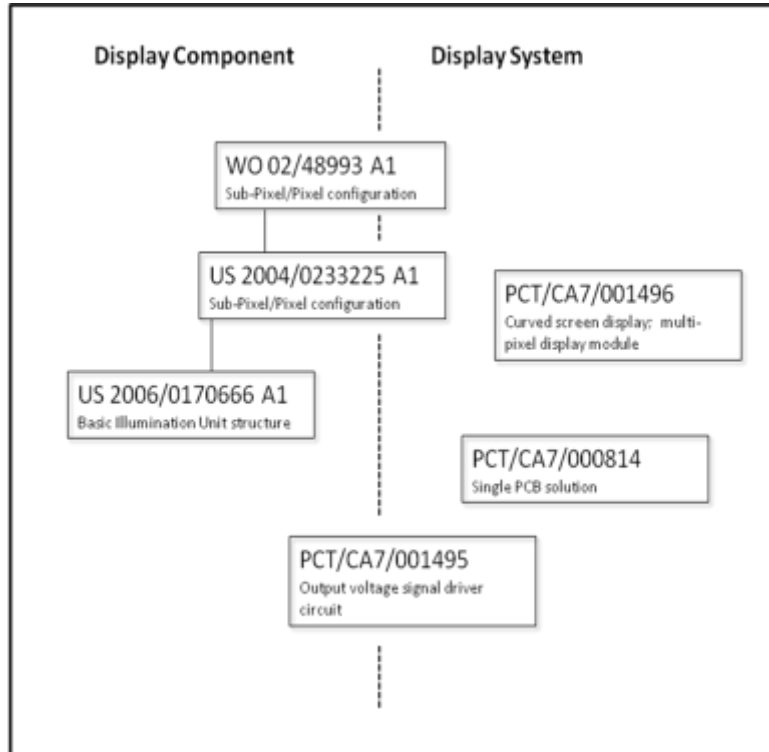
## 2.6 PCT Application PCT/CA07/001495

PCT Application PCT/CA07/001495 discloses a circuit that is one of the basic building blocks taught in the WO 02/48993 patent. Unlike the WO'993 patent and its US counterpart 2004/0233225 the circuit disclosed in the PCT'495 application is not necessarily limited to display systems. The circuit itself is designed to output a variable voltage/current that is dependent on the value of a digital input signal.

**Claim Construction** – PCT'495 has 75 proposed claims, five independent and 70 dependent. The claims disclose a solution for presenting a variable voltage or current level at the output, with the value of the output level being dependent on a digital input signal. Two of the claims (1, 5) are generally applicable to electronic systems while the remainder (9, 42, 75) are specific to display systems. Claim 75 discloses a display system using the subject variable output solution. The dependent claims disclose aspects of the invention including but not limited to specific types of electrical components, pixel structure and IC structure.



The following figure provides a pictorial view of how the six key Imaginum patents reviewed can be categorized.



The solid lines connecting WO'993 and US'225/'666 indicate they are from the same family. As can be seen, three of the six patents/applications have claims covering both the display components and the systems as a whole while the other three will apply to either a component of the system or the entire system itself.

### 3.0 Concluding Remarks

The Imaginum portfolio discloses an elegant and cost effective display system solution. The technology has been used and proven to be effective in applications such as LCD backlighting and LED based video screens. In addition to the immediate applications suitable to adopt the Imaginum technology, the concepts disclosed in the portfolio also lend themselves well to future technologies. For instance the ability to individually and simultaneously control pixel/sub-pixel intensity makes this technology ideally suited for High Dynamic Range applications; and the technology enabling the manufacture of curved screens will find increase application as gaming and lighting technology matures.

The portfolio is still mostly in the application phase and as such there exists an opportunity to refine the patents considerably, tailoring them to suit specific.