WAINHOUSE RESEARCH **WHITE PAPER**

The 2009 Update: Taking the Wraps off Videoconferencing in the U.S. Classroom

A National and State-by-State Analysis

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Executive Summary

This white paper updates an effort first conducted in spring 2006 to measure the adoption of videoconferencing in K-12 schools, by assessing the growth and evolution of classroom-based videoconferencing networks as of mid-2009. The paper attempts to answer several questions: what is the extent of adoption in any particular state, and how many schools and classrooms are likely to be enabled for professional-quality videoconferencing on a national and state-by-state basis. What ancillary technologies are beginning to matter to those interested in rich media for constructivist-based education, and what are the obstacles to success – as well as success factors – with these technologies. The data was gathered over several months via primary and secondary research, with numerous online resources contributing to a counting process, more than 44 end user organizations and state departments of education contacted via email or phone, and via conversations with numerous equipment manufacturers, state network providers, and resellers.

Wainhouse Research believes that approximately 29,200 public, primary and secondary school classrooms or administrative offices have been equipped with videoconferencing as of early 2009. *Correlating this number to the more than 98,000 public schools in the U.S. suggests that about 30% of U.S. schools have adopted videoconferencing* – up 5% since 2006. In compiling and analyzing this data, we make several assumptions to offset the inability to certify that directory listings or "sold systems" are for classrooms, auditoriums, or administrative offices. Except for instances where we know that districts contain certain quantities of video-enabled schools and classrooms, we associate one "video-enabled classroom" with any individual school. The overall growth of classroom-based videoconferencing over the three-year period is approximately 31%, from 22,300 in early 2006.

Typical estimates for the average number of K-12 classrooms per public school range from 25 to 32. Conservatively accepting the lower number would suggest that approximately 2.46M classrooms exist in the U.S. (25 x 98,790). This means that videoconferencing, in terms of the aggregate number of classrooms in the U.S., has achieved about a 1.2% penetration rate.

In terms of total video-enabled classrooms and offices, California, Texas, New York, Florida, and Michigan now lead, followed by Nebraska, Ohio, Oklahoma, Indiana, and Pennsylvania (in that order). An additional 5 states have more than 500 schools and offices video-enabled; another 18 states have between 250 and 500 schools and offices enabled; another 10 states have between 100 and 250 classrooms and offices. A total of 8 states have fewer than 99 video-enabled classrooms.[1]
In terms of the percentage of schools per state that are videoconferencing-enabled, one of the most geographically isolated states in the nation, Hawaii, continues to have the greatest penetration; Alaska has been supplanted by Nebraska in the number 2 spot for penetration. Other top-ranking states include the highly rural or geographically dispersed regions like New Hampshire, Nebraska, Maine, Oklahoma, Arkansas, North and South Dakota, and Utah, as well as densely populated (but large) leaders like New York and California.

Those states showing the greatest statistical increases since 2006 are Delaware, Arizona, Louisiana, Maine, Michigan, Massachusetts, Vermont, West Virginia, Nebraska, and New Hampshire. Those states showing the greatest decreases since 2006 are Idaho, Maryland, Ohio, Washington, Connecticut,

[1] For the purpose of convenience, District of Columbia is included as a "state," thus the total number adds up to 51.

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Wisconsin, and Georgia. Reasons for declines are discussed later in this white paper but range from loss of funding, lack of leadership at statewide levels, and loss of champions, to lack of interest on the part of educators and lack of training/professional development.

For almost 20 years videoconferencing in K-12 classrooms has been adopted in a number of growth stages, or waves. Wave I consisted of using videoconferencing in K-12 to access remote resources. Wave II, which Wainhouse Research believes crested 2004-2007, consisted of the shift to IP technologies and an explosion of content providers delivering rich resources to the classroom. Wave III will consist of increased student collaborative projects and student creation and delivery of content, which will include a shift to desktop videoconferencing and other collaborative technologies over time. Students will help drive Wave III as a result of their rapid adoption of Internet-based tools like YouTube.

While current leaders will likely continue to set the pace, less geographically isolated districts that have previously not emphasized videoconferencing technologies may be increasingly motivated by economics (drastically lowered tax bases and severe budget cutbacks that threaten educator access to mandated professional development activities) and evolving content and applications to implement new programs. Technology funding initiatives and increasingly compelling content may motivate legislators and school boards in lagging states to review their implementation strategies. The data is conflicting regarding the impact of No Child Left Behind; some states report that videoconferencing is enabling their educators to better address NCLB mandates through professional development; other states indicate NCLB itself is a distraction, where “teaching to the test” has driven educators to focus on NCLB to the exclusion of what are considered “nice to have” external content sources. The relatively high adoption rates in diverse states suggests that there are compelling educational benefits and business models for states with high and low populations, whether concentrated or dispersed.

Wainhouse Research does not believe that classroom-based videoconferencing is the sole panacea for all educational woes, or that it is the only technology best suited to opening up the walls of the classroom. We do believe, however, that deployed strategically and with proper care and planning, it can address many of the crucial issues faced by urban and rural schools alike. These include issues of equity, budget cutbacks, travel restrictions, the need for professional development, and economic development. At the end of the day, with a culture and economy that has been lax in preparing a workforce for a truly global economy, the U.S. may find itself adopting classroom-based videoconferencing – along with many other tools – as one means of preparing learners to be 21st century workers and innovators.

Overview

This white paper measures videoconferencing adoption in the United States K-12 community as of April 2009, and attempts to answer several questions: what is the extent of adoption in any particular state, and how many schools and classrooms are likely to be enabled for professional-quality videoconferencing on a national and state-by-state basis. New to the 2009 update of this white paper (first published in 2006) is an exploration of other questions, such as satisfaction rates, obstacles to success, and whether or not interactive videoconferencing in the classroom is helping educators achieve their academic goals for their learners.

Why is this collection of information important? For one, it allows content providers (museums, zoos, research labs, and other informal educational organizations) and others to assess the potential markets for their services. Many content providers in recent years have transformed themselves into national and global resources for schools, and find themselves struggling to understand how and to what extent the demand for their services will continue. Some content providers report that they are fully booked with classroom engagements – activities that go beyond virtual field trips and are evolving into academically-structured student engagements – and wish to understand if they need to add capacity.

This information also can serve as an informal report card that may prod some states to examine how they are faring in comparison to their peers – and to consider what can be done to improve the planning, funding, purchasing, and deployment processes – and what it takes for sustainable, successful educational deployments. It should also serve as a policy tool at the state and national level (refer to the discussion of success factors later in this paper).

Finally, the information may help practitioners of video in the classroom – namely, educators themselves – to understand why their field seems so exciting and full of promise in pockets, and yet why they sometimes feel like they hit brick walls when approaching colleagues in other schools, states or regions about videoconferencing as an educational tool.

Historical View

For almost 25 years videoconferencing in K-12 classrooms has been adopted in a number of growth stages, or waves. The first wave of use of videoconferencing in K-12 began in the late 80's/early 90's, and predictably arose for the most pressing reason: access. Many rural states funded statewide networks that often included mixtures of higher education, state offices, vocational schools, and high schools. Commonwealth universities saw a mission to reach out to improve educational opportunities throughout their states; legislatures saw these networks as ways of reaching and binding together their constituents in vastly dispersed areas.

During this phase, K-12 users were spokes on a wheel, not the wheels themselves. Many urban exceptions existed, but as a rule, videoconferencing for K-12 was considered a rural application used to deliver advanced placement (AP) classes, mentoring, or otherwise unavailable courses. And often it was delivered over closed fiber networks that might not be accessible from one county away, much less one state away.

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The second wave began around 2000 and has already crested. This wave has consisted of new applications, new players, and new funding sources, as well as new approaches to technology deployment. Wave II has involved digitally tearing down walls, literally opening up the classroom to a more interactive, vastly broader world of opportunities. Suddenly content providers began to have an impact, and the idea of taking one's students for a virtual field trip became an operative mode. In parallel, Internet2 began a push to network states together with very high speed bandwidth and to bring bandwidth to schools with its SEGP/K20 Initiative; the Megaconference out of Ohio State University sparked a free-wheeling discovery of other users; and the Keystone Conference gave the K-12 community and content providers a single place to come together. Two leading concerns in 2000, connectivity and funding, began to fade away (for some but not all) in the midst of the conversion to Internet Protocol (IP) and the delivery of large quantities of e-Rate and RUS Grant dollars.

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This does not mean that all has gone smoothly, however. We discovered in the course of researching this document that at least 12 states now have fewer videoconferencing-enabled classrooms and offices in use than was the case in 2006, while about 30 states have shown slight or marked increases in deployments and usage. Satisfaction is mixed even in some of the states that have shown increased deployments. Yet, educators have continued to communicate better the uses (and abuses) of videoconferencing, helping one another to make "Wave II" extraordinarily successful (and somewhat more "viral") than was Wave I.

A third, coming wave – one that shifts from virtual field trips to content provider-individual learner and learner-learner engagements – is described later in this white paper.

Methodology

This report is the culmination of several months of primary and secondary research. Building upon work first conducted in 2006, Wainhouse Research collaborated with staff resources of the Center for Interactive Learning and Collaboration (www.cilc.org) – a sponsor of this white paper – who contacted individuals in state departments of education, educational technology networks, and large urban/county school districts for in-depth interviews (IDI's) concerning deployments, applications, and uses of videoconferencing and ancillary distance education technologies. These interviews – conducted with one or more knowledgeable individuals in a total of 49 states out of 51 entities tracked (including District of Columbia), were supplemented by lists of schools and districts throughout the U.S. based on several key – and searchable – sources. These include the following:

- The CILC Videoconferencing Site directory (www.cilc.org).
- The AT&T videoconferencing for learning website (www.kn.pacbell.com/wired/vidconf/vidconf.html)
- The Avon, Ohio School District website directory (www.avon.k12.oh.us/DistanceLearning/usdl.htm#Ohio-).

In addition, we visited every state's Department of Education website and used search tools to seek and identify unknown districts/schools in each state that have been listed online. We drew on Keystone Conference and NECC presentations and spoke to numerous equipment vendors, resellers, and content providers to gain an additional perspective on the evolution of some of the leading states.

The "counting" process consists of tracking deployments that are comprised of classroom-based, primarily H.320- or H.323-standards-based systems from the likes of TANDBERG, Polycom, LifeSize, and others. One major change we have identified that has occurred since 2006: a handful of states have shifted to statewide licenses of server-based web conferencing products or services *only* (e.g. Elluminate, Wimba, or WebEx, which have a different type of video capability more suited to the desktop). Many other states utilize a multitude of technologies, from classroom-based videoconferencing systems to video-centric desktop products to web conferencing. Our rationale for not counting server-based and web conferencing products is twofold: 1) they tend to be licensed for desktop use only, and 2) they tend to be less suitable for interactive group interactions. But their adoption will continue apace and over time they will more frequently be found deployed in the classroom, either as part of deployments with related group systems, or as stand-alone methods of adding a distance learning tool into the classroom. Several vendors have introduced highly scalable, standards-based servers (such as TANDBERG's MOVI and Polycom's CMA) that work on PCs/Macs with off-the-shelf webcams and that interoperate with traditional group systems. Additionally, our counting process does not take into account free video tools such as Skype, Apple iSight, Yahoo, and AOL. Any use of these tools tends to be at an individual level, not organizational.[2]

To varying degrees, each state may have its final totals increased by certain percentages based on our own sense of which states are especially active in the K-12 videoconferencing community. In other words, depending on the state, the numbers are based on the assumption that we could not find every school or district with videoconferencing; as mentioned above, in some instances when respondents felt they could not fully speak for activities within their respective states, additional classrooms are factored into the final totals. A very small set of states declined to make their numbers available. Yet after years of observing the K-12 market for collaboration technologies, Wainhouse Research believes the numbers contained in this report to be highly accurate.

In compiling and analyzing this data, we make several assumptions to offset the inability to certify that directory listings or "sold systems" are for classrooms, auditoriums, or administrative offices. Except for instances where we know that districts contain certain quantities of video-enabled schools and classrooms, we associate one "video-enabled classroom" with any individual school. Any undercounting on this score is likely to be offset by the fact that some classrooms contain multiple "systems" in what are called "full mesh" configurations – and the fact that we factored for missed classrooms. Similarly, many schools utilize videoconferencing-enabled carts or set-top systems that can be moved easily from classroom to classroom, or place their systems not in classrooms but instead in administrative offices, perhaps made available to adjacent or nearby elementary, middle, or high schools. Thus, in an imperfect universe of counting, the one-to-one method may be the most reliable for estimating the adoption of videoconferencing in K-12.

[2] At least one state, however, in the course of making technology recommendations, has placed links to free tools on its website. This is the exception, as most states and even districts prefer to promote infrastructure and the applications that utilize infrastructure – and have processes in place to discourage random, rogue adoption.

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How to Interpret this Data

State data are reported in ranges rather than specific numbers, reflecting our belief that the value in this data is based on how it demonstrates the relativity of each state to one another, and not in showing specific quantities of videoconferencing-enabled classrooms. Furthermore, because of the complexity of the topic and the variable reliability of some of the online sources, the data should be interpreted with some caution. We may have determined that a particular state has 240 video-enabled classrooms when in fact it has 275. These are estimates based on sound reasoning, but they are estimates.

State data are reported in ranges rather than specific numbers, reflecting our belief that the value in this data is based on how it demonstrates the relativity of each state to one another, and not in showing specific quantities of videoconferencing-enabled classrooms.

This is not a contest. But there are clear winners and losers. The winners are those states and networks where learners and educators have embraced the value of interactive videoconferencing – and adjacent collaboration technologies – in tearing down the walls of the classroom and enriching the educational experience. The losers are those states where opportunities for enhancing the classroom experience and constructivist teaching objectives lay dormant – and where the learning environment remains insular.

State of the States

National Aggregate Data

Wainhouse Research believes that approximately 29,200 public, primary and secondary school classrooms or administrative offices in the U.S. have been equipped with videoconferencing as of April 2009, up from approximately 22,300 in 2006. Correlating this number to the more than 98,000 public schools in the U.S. suggests that about 30% of schools have adopted videoconferencing.
Typical estimates for the average number of U.S. classrooms per public school range from 25 to 32. Accepting the lower number would suggest that approximately 2.46M classrooms exist in the U.S. (25 x 98,790). This means that videoconferencing, in terms of the aggregate number of classrooms in the U.S., has achieved about a 1.2% penetration rate. Note however that some units counted are located at regional/boards of educational service centers (ESC's/BOCES), as well as district or governmental offices. The actual classroom penetration rate is undoubtedly lower than 1.2%.

State Rankings by Numbers of Classrooms

Table 1 estimates the numbers of classrooms/systems associated with each state and Figure 1 provides a graphical representation of those numbers. In terms of total systems installed, California, Texas, New York, Florida, and Michigan are leading the way. (California, Florida, and Michigan have increased their usage tremendously in three years; California in particular has done a solid job of tracking these technologies.) They are followed by Nebraska, Ohio, and Oklahoma, each of which has more than 750 group systems located in schools and administrative offices. Nebraska is up in counts; Ohio and Oklahoma are both down, based on different reasons: Ohio has been undergoing a transition from an all-ATM statewide network and aging classroom equipment has not necessarily been replaced. We admit

that after further discussions with Oklahomans that we may have over counted their numbers in 2006 (and included some telemedicine and governmental deployments); nonetheless Oklahoma ranks 8th in our list of K-12 users. An additional 7 states have between 500 and 750 systems installed; another 2 states have between 400 and 500 systems installed; 8 states have between 250 and 400 systems installed; and 10 states have between 100 and 250 systems installed A total of 8 states have fewer than 99 video-enabled classrooms.

State	# of schools[3]	VC-enabled classrooms	State	# of schools	VC-enabled classrooms
California	10038	5000 - 7500	New Hampshire	482	250 - 400
Texas	8630	3000 - 5000	North Carolina	2470	250 - 400
New York	4708	2000 - 3000	Washington	2305	250 - 400
Florida	3952	1000 - 2000	North Dakota	534	250 – 400
Michigan	4133	1000 - 2000	Tennessee	1709	250 – 400
Nebraska	1166	750 - 1000	Hawaii	286	250 – 400
Ohio	3972	750 - 1000	Massachusetts	1879	250 – 400
Oklahoma	1794	750 - 1000	Arizona	2061	250 – 400
Indiana	1969	500 - 750	New Mexico	838	250 - 400
Pennsylvania	3286	500 - 750	Oregon	1284	100 - 250
Missouri	2384	500 - 750	Mississippi	1062	100 – 250
Kansas	1423	500 - 750	Maryland	1445	100 - 250
Wisconsin	2237	500 - 750	South Carolina	1172	100 – 250
Iowa	1509	500 - 750	Georgia	2463	100 - 250
Maine	671	500 - 750	Wyoming	383	100 - 250
Louisiana	1447	400 - 500	Illinois	4392	100 - 250
Minnesota	2665	400 – 500	Colorado	1736	100 - 250
Arkansas	1114	400 – 500	West Virginia	766	100 - 250
New Jersey	2470	400 - 500	Montana	831	1 - 99
Utah	1001	250 - 400	Nevada	590	1 – 99
Alaska	503	250 - 400	Rhode Island	336	1 – 99
Alabama	1583	250 – 400	District of Columbia	235	1 – 99
Virginia	2202	250 – 400	Idaho	726	1 – 99
South Dakota	736	250 – 400	Delaware	234	1 – 99
Kentucky	1534	250 – 400	Vermont	330	1 – 99
			Connecticut	1114	1 - 99

Table 1 U.S. States Ranked by Numbers of Schools with Videoconferencing

Higher numbers of videoconferencing-enabled classrooms in any state can be important for achieving the critical mass necessary to support local and remote content providers and training initiatives, provide the professional development support necessary to educators using videoconferencing, enable professional development support for other academic areas, and foster new, interesting course delivery, applications, and interactions between schools. For a variety of reasons, mostly having to do with factors like economic clout, grant-qualifying traits and grant-writing abilities, their large geographies with a mix of

[3] National Center for Educational Statistics: *Numbers and Types of Public Elementary and Secondary Schools: The Common Core of Data: School Year 2006–07*. October 2008. http://nces.ed.gov/pubs2009/2009304.pdf

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urban and rural populations, and a legacy of investing in statewide infrastructure, states like California, Texas, New York, Florida, and Michigan are continuing to lead the second wave of videoconferencing in K-12 (and setting the stage for wave three). Other states have aggressive statewide infrastructure initiatives and departments of education that have seen fit to foster adoption by addressing bandwidth or political obstacles (such as Arkansas, Alabama, and Wyoming). Some states, e.g., Nebraska, Missouri, Kansas, Arkansas, and Pennsylvania, have quietly moved forward with consistent programs, adding schools and administrative offices slowly and steadily. And some have shown dramatic recent growth through new, aggressively managed deployments, e.g., Maine, New Hampshire, Louisiana, North Carolina, and North Dakota. A few of these states may not yet have large numbers, but have grown significantly over 2006.

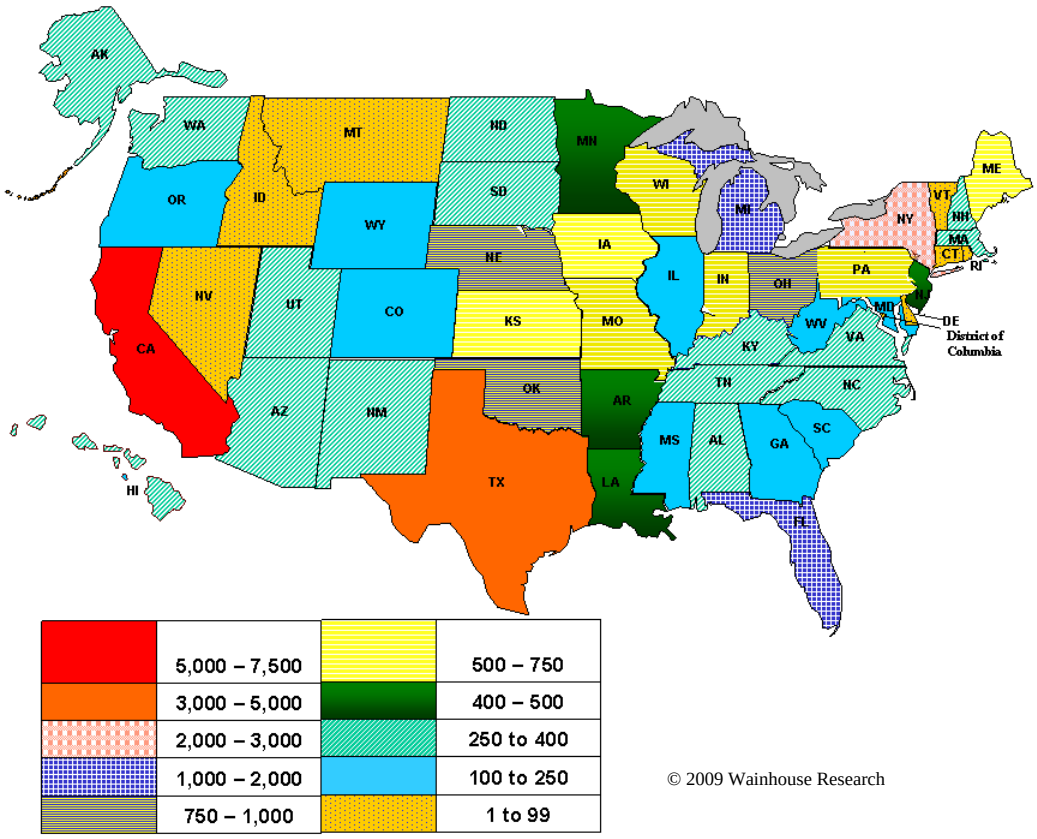

Figure 1 U.S. Mapped by Numbers of Schools with Videoconferencing

Degree of Adoption State by State as Percentage of Total Schools

The state-by-state story is somewhat different when we examine the numbers of video-enabled classrooms as a percentage of total number of schools per state, as shown in Table 3 and Figure 2. As might make sense, one of the most geographically isolated states in the nation, Hawaii, as well as the landlocked Nebraska, followed closely by isolated Alaska, have the greatest penetration of videoconferencing in the classroom. Other top-ranking states include some states that have seen large deployments since 2006 (Maine, New Hampshire, North Dakota), as well as the highly populated,

wealthier leaders that have large geographies (California, New York, and Texas) and some large, highly geographically dispersed states (South Dakota, Oklahoma, Arkansas, Utah, Kansas, Wyoming, and Iowa, among others).

State	# of Public Schools	Statewide penetration	State	# of Public Schools	Statewide penetration
Hawaii	286	80% - 100%	Rhode Island	336	20% - 40%
Nebraska	1166	80% - 100%	Alabama	1583	20% - 40%
Alaska	503	60% - 80%	Ohio	3972	20% - 40%
Maine	671	60% - 80%	Kentucky	1534	20% - 40%
New Hampshire	482	60% - 80%	Tennessee	1709	1% - 20%
California	10038	60% - 80%	Mississippi	1062	1% - 20%
North Dakota	534	60% - 80%	Pennsylvania	3286	1% - 20%
New York	4708	40% - 60%	Oregon	1284	1% - 20%
South Dakota	736	40% - 60%	Minnesota	2665	1% - 20%
Oklahoma	1794	40% - 60%	Virginia	2202	1% - 20%
Arkansas	1114	40% - 60%	New Jersey	2470	1% - 20%
Utah	1001	20% - 40%	South Carolina	1172	1% - 20%
Kansas	1423	20% - 40%	Nevada	590	1% - 20%
Wyoming	383	20% - 40%	Vermont	330	1% - 20%
Texas	8630	20% - 40%	West Virginia	766	1% - 20%
Iowa	1509	20% - 40%	Massachusetts	1879	1% - 20%
Louisiana	1447	20% - 40%	Washington	2305	1% - 20%
Indiana	1969	20% - 40%	North Carolina	2470	1% - 20%
District of Columbia	235	20% - 40%	Maryland	1445	1% - 20%
Florida	3952	20% - 40%	Arizona	2061	1% - 20%
New Mexico	838	20% - 40%	Montana	831	1% - 20%
Delaware	234	20% - 40%	Idaho	726	1% - 20%
Michigan	4133	20% - 40%	Georgia	2463	1% - 20%
Missouri	2384	20% - 40%	Colorado	1736	1% - 20%
Wisconsin	2237	20% - 40%	Illinois	4392	1% - 20%
			Connecticut	1114	1% - 20%

Table 2 U.S. States Ranked by Percentage Penetration of Classrooms

The list of states by percentage of penetration may be somewhat puzzling at first glance. The size of a state in terms of quantity of schools seems to have no bearing on its degree of penetration, with New York, California, and Oklahoma in the top 10 by penetration but Illinois, Arizona, Georgia, North Carolina, Massachusetts, Washington, and New Jersey – all of which have large numbers of schools – all with low penetration rates. Drivers for penetration rates are the results of other factors than quantity of schools. Some states that had highly active networks of users in the 1990's and early this decade (Illinois, Georgia, Idaho among others) have seen a decline in usage and numbers – and corresponding penetration rates. While hoping to not necessarily offend any particular state, we speculate that the obstacles and success factors we identified through the course of this research study will explain some of the shifts in rankings. Some *trading places* naturally has occurred as other states have gone through their own cycles of adoption, either coming to classroom-based videoconferencing in a big way recently,

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or growing their networks after remaining stable for a time. A few states have decided to focus on other collaboration technologies instead of classroom-based videoconferencing; in these states the drivers tend to be local districts and regional consortia, and only occasionally state government. Figure 2 illustrates the states mapped by percentage penetration of classrooms.

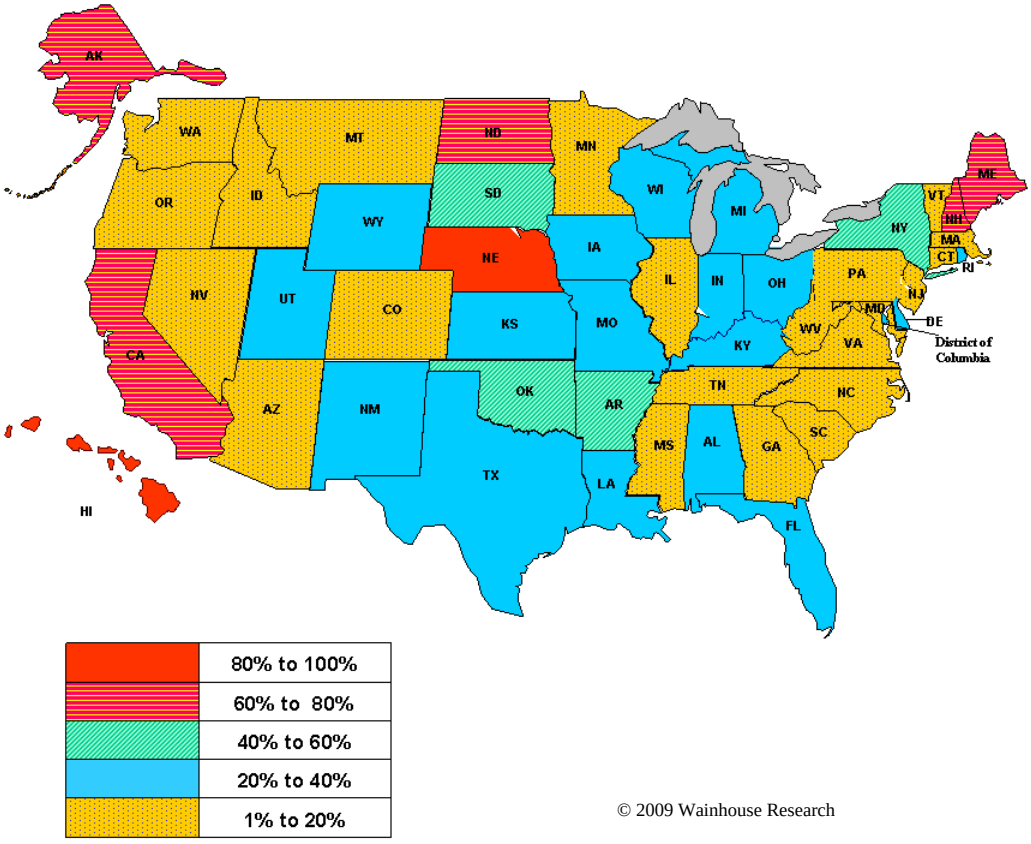

Figure 2 States Mapped by Percentage Penetration of Classrooms

What the highly penetrated states have in common is that to varying degrees they:

- Frequently are big and highly rural (Alaska, Nebraska, California, New York, North Dakota) or challenged by geography (Hawaii, Alaska)
- Have active legislatures or state policymakers who fund network infrastructure or otherwise make bandwidth available
- Have leadership that extends from what might be called K-12 or higher education “node” or “seed” networks
- Have either some type of champion leading the charge – or talented grant writers.
- Have a history of trust between disparate political entities and/or simply a legacy of best practices; in other words, some states like Nebraska and North Dakota and Alaska have been using classroom-based videoconferencing for years – and have learned lessons over time that have allowed them to grow slowly and steadily over time.

The underlying factors for the less penetrated states are less easily discernible. Arizona, North Carolina, West Virginia, Nevada, Montana, Colorado, and some other states are large and highly rural – and one would expect them to have a great need for delivery of courses, content, and professional development. Vermont, Massachusetts, Connecticut, and Maryland are small. We theorize that in the states with larger urban areas or in the small states, there is less of a sense of isolation or need to connect to other schools and resources. Another hypothesis is that in some of these states, the focus has been on higher education or telemedicine (university-to-university, university-hospital-to-clinic) videoconferencing initiatives instead of outreach to K-12 schools and communities. Finally, some of these states may have had seed projects in which certain school districts or networks adopted videoconferencing, but because of the complexities of deploying and paying for the technology or other factors, the equipment is under-utilized or neglected as a tool. In short, without an effective business model or reasons for organic growth, networks by nature remain stagnant.

Growth 2006 – 2009

As stated earlier, Wainhouse Research believes that approximately 29,200 public, primary and secondary school classrooms or administrative offices in the U.S. have been equipped with classroom videoconferencing as of April 2009 – approximately 30% of all schools – up from approximately 22,300 in 2006. This is a growth rate of about 31% over the three-year period, and "maps" well to other data obtained by Wainhouse Research from vendors in the course of reporting overall industry statistics.

Worth noting are the states that have increased the most in the past three years in terms of classroom deployments. These are Delaware, Arizona, Louisiana, Maine, Michigan, Massachusetts, Vermont, West Virginia, Nebraska, New Hampshire, North Carolina, California, Tennessee, North Dakota, and Utah. *Note, however that this ranking is based on growth from where they were in 2006; some of these states already had massive or large deployments, such as California and Kansas; most of the others show the fastest growth because they had minimal or smaller deployments, so their additions of large numbers of classroom systems are relatively high.* These states could be described as "where the action has been for *new deployments*" the past three years. California clearly has been a strong adopter and has led the way in overall totals. But some, such as Delaware, West Virginia, and Vermont, are still at the very early stages of adoption. Others, such as Louisiana, are special cases, where RUS grants and hurricane relief have contributed to high adoption over what was a partially penetrated state in 2006. Some other states, such as Arkansas, are not reflected here because they already had large deployments, but have added extensively since 2006. Figure 3 illustrates specific growth rates 2006 – 2009 for the top 15 fastest growing states.

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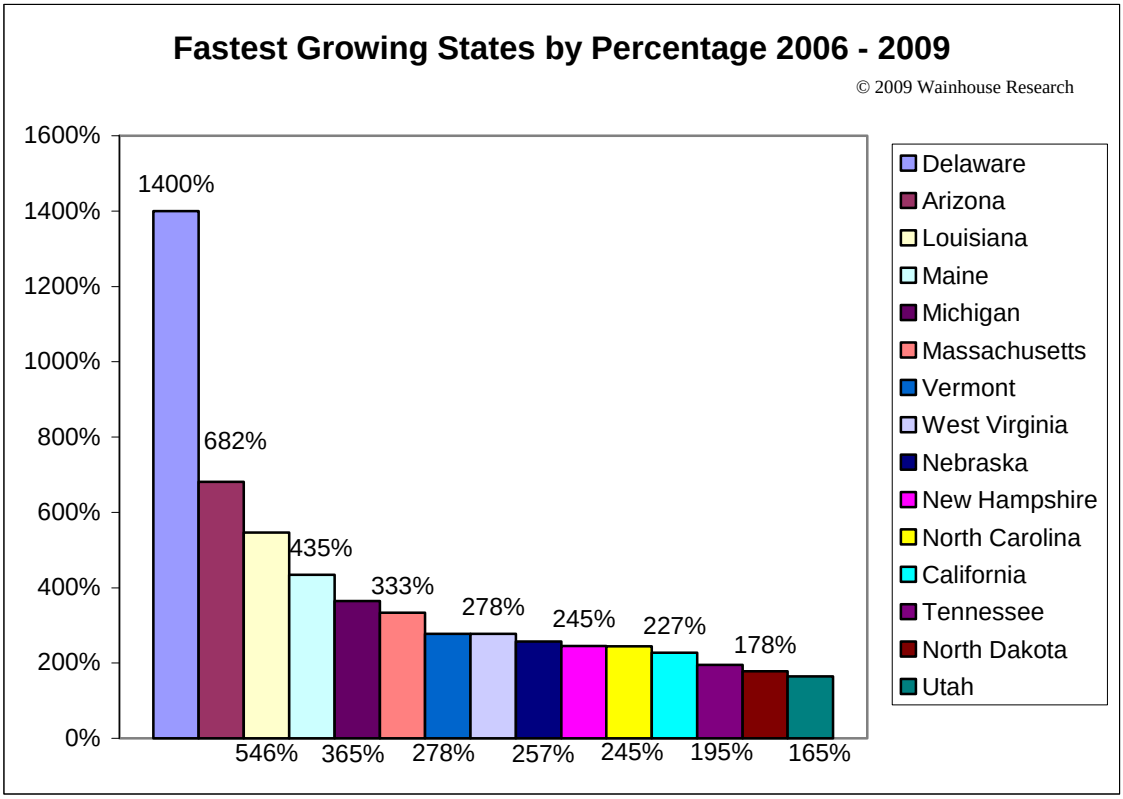

Figure 3 Fastest Growing States by Percentage 2006 - 2009

Roadblocks and Hurdles

Some states have struggled to grow as a result of several factors: lack of statewide infrastructure initiatives (bandwidth, especially in rural areas), lack of policy/leadership for this particular set of technologies at the state level, lack of an outreach sensibility, and perhaps competing sub-networks that never found a particularly compelling reason to cooperate and grow or exchange applications. The proverbial "last mile" challenge – the inability to extend sufficient broadband all the way to campuses – is especially big among K-12 users.

For this survey update we asked the respondents to identify the hurdles and roadblocks their states have faced in deploying classroom-based videoconferencing. This data is so extensive Wainhouse Research intends to publish a separate research note on the obstacles, ways of overcoming those obstacles, and critical success factors (which will be published later in 2009 and available at www.wrplatinum.com). Out of the need to keep this paper focused on its goal of sizing the community, a simple rank order of obstacles is contained in Table 3. Note that a number of cited obstacles tied one another.

Obstacle	Ranking
Lack of bandwidth and technology infrastructure, or old equipment	1
Staffing (inability to afford support personnel)	2

Obstacle	Ranking
Lack of interest on the part of sufficient educators and administrators	2
Funding challenges	2
No statewide or district-wide policy / standards / champions	5
Firewalls	6
Resistance to change	7
Bell schedules / calendars	8
Costs	8
Learning curve	8
The need to create awareness of availability / value	8
Lack of dedicated rooms or not enough equipment	12
Focus on testing / NCLB	12
The technology was not perceived as high enough quality initially	12
The state is in the early stages of deployment	12

Table 3 Rank Order of Obstacles to Successful Deployments

Satisfaction Rates

Of 40 respondents who felt they could speak for their states on the question of satisfaction with utilization and applications, 25% indicate they are fully satisfied, 50% indicate they are not satisfied, and 25% indicate a mixed, "yes and no." Often those who stated "yes and no" indicate that they are happy with what they have but believe their states could do more.

Another way to look at this data: some degree of satisfaction and accomplishment is being reached in about half the states, but work could be done in three out of four states on implementing success factors to either turn things around or simply build on relatively successful deployments. Satisfaction arises from the following reasons:

- Utilization is high (one state reports use 6 days a week, approximately 54 hours a week per classroom) and the delivery of courses and content is tracked and well understood.
- Value is recognized from the networks addressing clear needs: tackling equity issues, reach, and delivery of content and curricula not otherwise available or the ability to deliver professional development and improve on educator quality of life.
- Statewide or district-wide processes are in place promoting coordination – and effective teaching and learning.

Addressing Academic Goals and Challenges

We asked for the first time if interactive videoconferencing is helping schools, districts, and states address their academic goals. Almost 80% (4 out of 5 of the individuals in 43 states who felt they could answer this question) indicate that indeed, classroom-based videoconferencing is helping their educators meet

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academic goals. In some instances it is helping a state deliver the statewide recommended curricula; in many other situations, specific areas, such as reading and math, science, foreign language, remediation, and AP courses are targeted for delivery. Where successful, the sense is that the technology helps address college preparation and evolving graduation standards, and in some states it is perceived as a method of student retention: rural students may drop out by 8th grade if not properly engaged. Teacher shortages (rural districts struggling to recruit, pay disparities, or the need for those certified to teach certain subjects) are big issues addressed by classroom videoconferencing. Unfortunately those issues are most in play in locations that may also be affected by bandwidth limitations.

Internet2 SEGP Correlation

As of early 2006, 35 of 50 U.S. states were Internet2 Sponsored Educational Group Participant (SEGP) states, and by April 2009 that number had grown to 38. In 2006 we attempted to correlate the relationship between SEGP states and classroom adoption. We found no correlation between being an Internet2 SEGP state and classroom adoption – as SEGP status does not mean that bandwidth is necessarily overcoming what is known as the "last mile" problem. . (Often the case in a SEGP K12 deployment is that the large bandwidth runs to the district office but not necessarily the schools themselves.) Wainhouse Research continues to believe that much more can be done within states that are part of the SEGP program to promote videoconferencing in the classroom – but is somewhat skeptical that Internet2 itself (alone) has the means to or can address this problem. The solution will come more likely from political entities willing to fund bandwidth to schools (whether SEGP state or not).

Economic and Other Drivers

As stated earlier, a number of complex drivers intersect to help drive videoconferencing adoption in the classroom: geographies that "beg" for outreach, statewide or regional bandwidth initiatives, grant writers, characteristics that make a district or set of schools "grant worthy" (such as high poverty or rural nature), and even champions. Two factors are likely to have an impact on the direction of videoconferencing as a K-12 enrichment tool. These are a) funding, and b) evolving content. Key funding initiatives and larger economic issues are reviewed below before turning our attention to the evolution of applications and content.

In addition to individual state or regional bond initiatives, the major national funding sources in recent years for K-12 videoconferencing have been U.S. e-rate funds and Rural Development Telecommunications Program (RUS Distance Learning and Telemedicine) grants. Both of these programs pay for equipment but not for network or other services. This picture will change only to the extent that the American Recovery and Reinvestment Act (ARRA) will be driving significant funds into states for a variety of educational purposes – including technology upgrades. The specifics of the surplus package are too complex to detail here; what's worth noting is that while stimulus dollars will be flowing into underserved areas in every state, and states are being encouraged to be creative and accountable in their spending, the same challenges exist now as before: sustainability, best practices, and the melding of the technology with academic goals.

In 2006 Wainhouse Research pointed out that gas prices were beginning to have an impact on inflation and spending patterns and were beginning to impact school districts across the country. We believed that should gas prices remain in the $3.00 per gallon range, an increasing number of school districts would begin to seek alternatives to traditional local field trips and itinerant teacher solutions. While prices

have risen and fallen in the intervening three years, respondents to this project indicate that the economy continues to be a driver for adoption of classroom videoconferencing. Rural *and* urban districts report to us they are experiencing calamitous budget cuts to certain types of expenses, such as transportation, as a result of the economic meltdown of 2008/2009. A number of those interviewed stated very clearly that they are saving money by using classroom-based videoconferencing. We expect economic issues will continue to set the stage for return on investment justifications that go beyond other traditional arguments for videoconferencing in the classroom.

Economics alone, however, will not be the only factor that will lead to rapid adoption. Wainhouse Research predicted in 2006 that three major factors were leading to the coming third wave for videoconferencing in the classroom: an evolution of applications, a steady increase in numbers of content providers, and the bandwidth initiatives already discussed in this white paper. We add to this prediction a new factor: after eight years of NCLB and a very mixed report card on the state of education in the U.S., we believe that emphasis on the learner will lead to a drive to put more technological tools in learner hands – and that this will lead to the next wave of collaboration in the classroom, described in the next section of this white paper.

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The Coming Third Wave for Videoconferencing in the Classroom

Just as the drivers for videoconferencing in the classroom have evolved from statewide outreach to grant availability and increased content, the applications have evolved as well. What began as a simple extension to distance education through class delivery, mentoring, and the like in Wave I, and evolved in Wave II to include access to content providers, is about to undergo its next phase of development. Wave III will consist of increased content-provider-to-individual-learner contact, as well as learner-to-learner collaborative projects and even student creation and delivery of content. A shift away from the original concept of virtual field trips is underway as of 2009, as educators and content providers have begun to recognize that learners thrive on direct engagement with content providers. Connecting groups of students to participate in real-world, real-time learning engagements is a very powerful use of this technology and educators are just beginning to explore this application.

This is not to suggest that Waves I and II will go away. Each of these waves will co-exist and support one another (that is, content providers and distance education classes will continue to increase in numbers and offerings).

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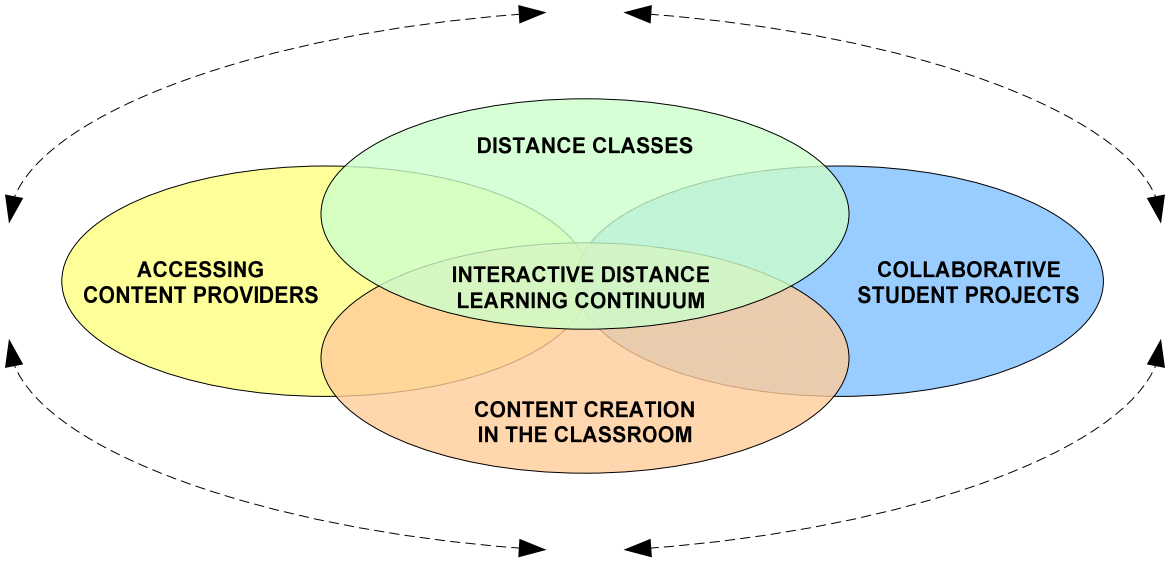

Figure 4 Evolution -- Wave III of Videoconferencing in K-12 [4]

But with the continued proliferation of classroom endpoints, the adoption of newer, more scalable server-based desktop collaboration products like the TANDBERG (co-sponsor of this paper) MOVI product, and adjacent technologies (web conferencing, groupware, Course Management Systems, electronic whiteboards, and lecture capture systems), and continued enthusiasm on the part of the educational champions of video in the classroom, the next wave could prove to be the "tipping point" for videoconferencing in K-12. Scalable, interoperable videoconferencing at the desktop will be key to mainstreaming video for individual learners; we make no prediction as to how quickly this will happen in K-12 but expect it to be a gradual, five-to-ten-year evolution.

Conclusions

It will require much "tipping" to shift from 1.2% penetration of classrooms to anything resembling mass adoption. The longer-term prospect is that videoconferencing will become as ubiquitous as blackboards and computers – but the jury is out as to how many years that will take. In the shorter term a few barriers need to be removed, and a number of states will continue to lag behind others, for lack of resources, champions or vision, or simply because of attention placed elsewhere. Challenges remain as a result of attitudes that developed when legacy systems were improperly deployed without sufficient training or ongoing resources. Perhaps the biggest challenge is the individual educator who may be neither attuned nor open to the concept of going outside the classroom walls to support constructivist learning models. A certain amount of openness to the uncontrollable, unpredictable nature of technology and human interactions across distance is a prerequisite for excitement about videoconferencing in the classroom. Yet videoconferencing has become easier to use in recent years, quality and reliability have improved, access to other school networks and content providers via Internet Protocol, firewall solutions and gateways have arrived, and the overall experience is more seamless and comfortable for both students and educators. Vendors also have initiated new, rich training and content programs that are further supporting their educational users.

[4] Source: Jan Zanetis, Education Market Manager, TANDBERG

The wave of bandwidth and funding initiatives in many heavy-hitting states and the nexus of classroom-content providers in existence today are likely to lead to steady and continued growth in the U.S. classroom for this technology. While current leaders will likely continue to set the pace, less geographically isolated districts that have previously not emphasized videoconferencing technologies may be increasingly motivated by economics and newer content and applications to implement new programs (or dust off unused equipment). Technology funding initiatives and increasingly compelling content may motivate legislators and school boards in lagging states to review their implementation strategies. Schools that wish to capitalize on Wave III applications should first review existing and evolving applications in relation to educational goals and then examine whether or not they have underutilized resources (bandwidth, champions/grant writers, and relationships with content providers). The relatively high adoption rates in diverse states suggests that there are compelling educational benefits and business models for states with high and low populations, whether concentrated or dispersed.

Ultimately, the promise of student-driven, collaborative, problem-solving activities (as evidenced in emerging best practice examples such as the 21st Century Skills movement)[5] will begin to mirror training and learning behaviors in the global workplace – where technologies from social networking to groupware to real-time collaboration have been quietly transforming how adult learners are trained. How educators will get there will be interesting to watch, as the blend of technologies, resources, and learner-oriented objectives continues to evolve over time.

[5] http://www.21stcenturyskills.org/

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About the Author

Alan D. Greenberg is Senior Analyst & Partner at Wainhouse Research. As consultant, analyst, and strategist, Alan has worked in the telecommunications, videoconferencing, software and services, and multimedia arenas for more than 25 years, holding positions with Texas Instruments, VTEL, and several Austin, Texas-based startups, and consulting to many organizations. He is distance education and e-Learning practice manager at Wainhouse Research, and co-lead analyst on WR's WebMetrics web conferencing survey program. He has conducted research into dozens of distance learning networks, was product marketing manager for a set of turnkey classroom packages, and led a number of educational and training initiatives, including serving on the Keystone Conference Steering Committee. Most recently he authored the three-volume segment report *The Distance Education and e-Learning Landscape* and authored the white papers *Best Practices in Live Content Acquisition for Distance Learning Networks*, *Navigating the Sea of Research into Videoconferencing-Based Distance Education*, and *Super-Size Bandwidth and Two-Way Video in the Classroom*. He also has authored reports on conferencing endpoints & bridges, streaming video, web conferencing, and voice/fax services. Alan holds an M.A. from the University of Texas at Austin and a B.A. from Hampshire College. He can be reached at agreenberg@wainhouse.com.

About Wainhouse Research

Wainhouse Research, www.wainhouse.com, is an independent market research firm that focuses on critical issues in the Unified Communications and rich media conferencing fields. The company conducts multi-client and custom research studies, consults with end users on key implementation issues, publishes white papers and market statistics, and delivers public and private seminars as well as speaker presentations at industry group meetings. Wainhouse Research publishes a variety of reports that cover all aspects of rich media conferencing, and the free newsletter, *The Wainhouse Research Bulletin*.

About TANDBERG

TANDBERG is the leading global provider of telepresence, high definition video conferencing and mobile video products and services with dual headquarters in New York and Norway. TANDBERG designs, develops and markets systems and software for video, voice and data. The Company provides sales, support and value-added services in more than 90 countries worldwide. TANDBERG trades publicly on the Oslo Stock Exchange under the ticker TAA.OL. For more information, please visit www.tandberg.com.

About CILC

The Center for Interactive Learning and Collaboration (CILC), established in 1994 as a not-for-profit, specializes in the utilization of videoconferencing for live interactive content and professional development as well as web-based collaborative learning environments for K-20 education. CILC provides consulting expertise in videoconferencing integration, problem-based learning projects, community partnerships in programming with schools, as well as techniques on the effective delivery and development of quality programs. CILC's website, www.cilc.org, provides access to thousands of programs accessible to over 12,000 members representing all U.S. states and over 61 countries/territories.