

# GIS Industry Outlook

## 2008—Full Responses

Anne Hale Miglarese, president and managing director, Fugro EarthData Inc.

### **Will industry consolidation continue at its rapid pace?**

正如 cliché 所说，人的一生之中除了死亡与交税外，没有什么是确定的。在商业中，除了改变——持续不断的改变外，没有什么是确定的。改变是“不可谈判的”，以保持与市场的联系并在竞争中获得领先。虽然在提供和使用空间数据的改变是一直持续着的，但是最近的改变步伐确实是显著的。

一个最显著的改变是在地理空间商务中大数量的合并和获取。是什么推动这个改变的？我认为，作为一个社会，我们会最终认识到长期的地理空间技术潜力，从而丰富我们的生活，推动受益，并处理许多世界上最紧迫的问题。技术和需求结合在一起，戏剧性的提高了投资回报，从此吸引了更大的商业世界的关注。

在技术方面，全数字产品工作流的介绍已经推动了私人制图公司购买数字相机和激光系统。然而，这仅仅只是必要投资的开始。

数字传感器在硬件，软件和处理由这些传感系统收集的大数据量的基础构造没有得到显著投资时是无法工作的。最终的，然而，经常又是成本最高的是培训使用这个技术。总体来讲，这些投资对于小公司来说是庞大和困难的。事实上，没有什么小公司能够负担得起这种全数字制图产品链的资本代价需求的。

Anne Hale Miglarese, president and managing director, Fugro EarthData Inc.

### **Will industry consolidation continue at its rapid pace?**

As the cliché says, few things in life are certain other than death and taxes. In business, few things are certain other than change—constant change. Change is a “non-negotiable” to stay in touch with the market and ahead of the competition. And although change has long been a constant in the business of supplying and using spatial data, the pace of recent change is truly remarkable.

One of the most obvious signs of change is the large number of mergers and acquisitions in the geospatial business space. What’s driving this transformation? I would argue that, as a society, we’re finally realizing the long-promised potential of geospatial technology to enrich our lives, drive profits and manage many of the world’s most pressing issues. Technology and need combined to dramatically improve the return on investment, consequently attracting the attention of the larger business world.

On the technological side of the equation, the introduction of the all-digital production workflow has driven private mapping companies to purchase digital cameras and laser systems. However, this is only the beginning of the investment required.

Digital sensors don’t work without significant investment in hardware, software and infrastructure to process the massive amounts of data gathered by these sensor systems. Most important, however, and often most costly, is the training to utilize the technology. All told, these investments are huge and very difficult for a small company. In fact, few small companies can afford the capital-expense requirements of a significant all-digital airborne-mapping production chain.

为了解这个分裂技术的影响，必须要理解美国专业制图商业结构的商业结构。大部分航测公司都是相关的小公司，从几个职员和不到\$1,000,000收入的公司，到更大的公司，每年的收入超过\$50,000,000。

这些公司中的许多是被那些对地图制图有激情和洞察力的人建立和发展的，但是他们已经到达退休年龄了，并且期望进行剥削。大家纷纷进入了这一行业， NGA 使用智能地理提供 warfighters， Microsoft 与 Google 推动商业需求。突然， 华尔街和大型全球公司们都对其产生兴趣。

Internet 服务提供者的影响不能被低估。他们把地理整合到实用，简单和吸引人的消费应用中，打开了一个新的，巨大的地理信息临时用户市场。此外他们的全球性，结合满足大批量政府需求地理空间信息的前述的能力，确实产生了一个全球的地理空间信息市场。

另一个有意思的趋势是，合并到处出现价值链。 Nokia 的购买 NAVTEQ 的努力； Tom 计划收购 Tele Atlas； Fufro NV 在 2007 年早些时候的收购 EarthData International；以及 Leica 最近对 Acquis Technology 的收购， ER Mapper 和 IONIC 仅仅是贯穿价值链的参与合并的一部分而已。

我相信我们只看到了改变的开端，并且我们能够期望它的加速。在地理空间市场什么将会掌控这些？发明的热情，对一份好工作满意，通过地理空间信息提高生活的愿望，最终对投资回报的需求，推动着一个高度竞争的环境，前途是光明的。

Bob Morris, president and CEO, Leica Geosystems  
Geospatial Imaging

To understand the impact of this disruptive technology, one must understand the business structure of the U.S. mapping profession. Most aerial mapping companies are relatively small enterprises, ranging from a few employees and less than \$1 million in revenue to larger companies with revenues in excess of \$50 million annually.

Many of these companies were founded and grown by those with a passion and vision for mapping, but they have now reached retirement age and wish to divest. Enter the alignment of NGA supplying warfighters with geointelligence, and Microsoft and Google driving commercial demand. Suddenly, Wall Street and large global companies are interested.

The impact of Internet service providers can't be underestimated. Their ability to integrate geography into consumer applications that are useful, easy and attractive opened a new and large market for the casual consumer of geospatial information. Moreover, their global reach, combined with the aforementioned ability of geospatial information to satisfy a host of governance needs, truly made for a global geospatial information market.

Another interesting trend is that the consolidation is occurring up and down the value chain. Nokia's effort to purchase NAVTEQ; Tom's planned acquisition of Tele Atlas; Fugro NV's acquisition of EarthData International earlier in 2007; and Leica's recent acquisitions of Acquis Technology, ER Mapper and IONIC are just a few of the consolidations of players throughout the value chain.

I believe that we're only seeing the beginning of change, and we can expect it to accelerate. What does the future hold for those in the geospatial marketplace? It's a promising future in a highly competitive environment driven by a passion to invent, finding satisfaction in a job well done, a desire to improve life through geospatial information and, finally, the need to show a return on investment.

Bob Morris, president and CEO, Leica Geosystems  
Geospatial Imaging

## **Where will the geospatial industry and technology be in 10 years?**

在 10 年中，关键词“地理空间”和“GIS”将发展并转变成包含在组织商业与决策支持系统中的组件。位置将成为通用的参照框架，以用来连接与结合其他尺度的商业信息。地理空间处理与分析工具将在一个组织商务与报告系统内智能运作。

下列的商业与工业驱动力将影响和引导地理空间工业：改变，品质，社众网络，传输与安全。随着地球的改变，我们需要量化确定，绘制和预测改变。改变将推动对数据和信息产品更强流通的需求。

终端用户和消费者将要求可靠和高保真的内容。内容提供者将竞相解决流通和地理空间内容整合问题。

社众网络将变得地理空间可用。查找，与用户连接和交互，以及共享线上内容与地理网络服务通讯的能力将成为现实。我们生活在一个“我现在就要”的时代，要求内容和线上服务传输有所区分。对保存关键数据的安全地理空间商业系统，信息投资和持股的需求将会是强制的。

另外，一个更大范围的地理空间数据范围将会公开可用。这个高质量数据将被包含在存在的和新的文件类型中，并且通过加强压缩机制，快速分发给用户的方式可用。这些用户将有多样的方式访问包括了更加强大的网络，可移动和企业技术的信息。多种类的数据将通过免费下载和基于订阅的服务来实现可用。在“地理入口”上的地理空间数据的流通将在 3-6 个月过时，全球某些地区每天都更新。伴随着地理空间影像技术，将会增加陆地和商业卫星提供的高分辨率，比一英尺精确的空间感应数据的融合。在这种整合下，基于位置的处理将很容易访问到。因为容易访问，这种整合与信息服务将不被妥协；它将通过基于安全许可的方式代受保护。

## **Where will the geospatial industry and technology be in 10 years?**

In 10 years, the keywords “geospatial” and “GIS” will evolve and transition into components contained within organizational business and decision-support systems. Location will be the common frame of reference used to associate and connect other dimensions of business-critical information. Geospatial processing and analysis tools will intelligently operate within an organization’s business and reporting system.

The following business and industry drivers will influence and guide the geospatial industry: change, quality, social networking, delivery and security. As the Earth changes, we need to digitally identify, map and predict change. Change will drive the need for greater currency in data and information products.

End users and consumers will demand reliable and high-fidelity content. Providers of content will compete in solving the currency and geospatial content-integrity problems.

Social networking will become geospatially enabled. The ability to find, connect and interact with users and communities sharing online content and geoweb services will be a reality. We live in an “I want it now” generation, where the on-demand delivery of content and online services will be the differentiator. The need for secure geospatial business systems to preserve key data, information investments and holdings will be mandatory.

In addition, a much broader scope of geospatial data will be publicly available. This high-quality data will be contained within existing and new file types and made available through enhanced compression mechanisms, quickly delivered to users. These users will have a variety of ways to access this information, including more powerful Web, mobile and enterprise technologies. A wide variety of data will be available through free downloads and subscription-based services. The currency of the geospatial data on “geo-portals” will be between 3-6 months old, globally, with some areas updated daily. With geospatial-imaging technology, there will be an increased fusion of terrestrial and airborne-sensed data,

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我们相信伴随着大公司的推动,收购趋势将会继续。这些收购将聚焦在高质量公司提供的验证结果。对于大型公司来说,资金起初会变得有点紧张,源于全球债务和信用危机的出现。然而,整体上,在长期的运行下,资金对于大公司来说不是问题。

对于小公司或者那些具有低流动资金的公司来说,合伙网络将继续成为一种收购的选择。然而,在我们快速移动的市场中,提供商业需求的“家庭式”全组件的公司将会是最成功的。

提供全面商业解决方案的公司将会分发更加强大的销售,取代一个消费者从多个软件供应商分开购买解决方案的传统方法。这种对于单一方案的增长需求可能将来加速工业合并,对小公司的生存造成更大的困难。

在我们全球市场中,对于感兴趣部分的全球投资,给每个地区的需求提供本地化的供应变得越来越重要了。随着我们的工业持续的合并,对于小型革新公司利用单一观念获得全球市场变得越来越难了。许多已经注入了风险投资的更小的公司将很可能寻求被收购,因为这些风险投资将通过投资其他地方而对市场变化做出回应。

Carl Reed, chief technology officer, Open Geospatial Consortium

with commercial satellites providing higher resolutions, capturing areas less than one foot per pixel. With this integration, location-based geoprocessing will be readily accessible. With this easy access, the integrity and service of this information won't be compromised; it will instead be protected by security-based permissions.

**Will industry consolidation continue at its rapid pace?**

We believe that the acquisition trend will continue, with larger companies driving this movement. These acquisitions will be focused on high-quality companies offering proven results. For larger industry players, capital will initially tighten a bit, responding to the global debt and credit risks emerging. However, as a whole, and in the long run, capital isn't a problem for larger industry players.

For smaller companies or those with less-fluid capital, partner networks will continue to be an alternative to acquisitions. However, in our fast-moving market, companies providing all the components of business needs “inhouse” will be the most successful.

Companies providing comprehensive business solutions will deliver stronger sales, replacing a customer's traditional method of purchasing separate solutions from multiple software vendors. This growing need for a single solution may further accelerate the industry consolidation, making it increasingly difficult for smaller players to survive for any length of time.

With our global marketplace, it's increasingly important for interested parties to be invested worldwide, offering a local presence catered to each region's needs. As our industry continues to consolidate, it's increasingly difficult for small innovative companies capitalizing on a single idea to gain global market access. Many smaller companies that have been powered by venture capitalists (VCs) will likely seek to be bought, as these VCs will respond to market changes by investing elsewhere.

Carl Reed, chief technology officer, Open Geospatial Consortium

## **Where will the geospatial industry and technology be in 10 years?**

回到 1995 年,我在会议上做了一个报告名为“普遍存在的 GIS”。在这个报告中,我建议,到 2005 年,地理空间服务和内容将变得普遍存在;Internet 将改变我们部署,访问和整合可用地理空间应用的方式。

显而易见,决定这个预测是否正确看法不同。我认为我们没有实现普遍存在的 GIS。然而,ICT 的基础结构正快速发展到“普遍存在的位置”——位置元素被整合到 Internet 和 Web 的完全结构了。在任何情形下,我都支持地理空间内容和服务的普遍存在将在下一个 10 年实现的预测。

到 2017 年,将会真正的出现“地理空间网络”,一个 Internet 和 Web 基础结构,在这个结构中位置就和 Internet 有效载荷与 IP 地址 Web 应用,DHCP 有效载荷或 URL 一样通用。位置将成为未来 Internet 与 Web 的一个强制性的要素。

位置有效载荷编码已经被指定为几个关键 Internet 标准了,比如 DHCP 和 SIP。这种趋势将会继续。在 IP 堆中的更高等级,网络访问传感器网络,可用 GPS 移动设备和可用 RFID 应用都正在创建基于位置的内容。

因此不仅易见的网络应用,比如地球浏览器,提供了简单的地理空间内容和服务反问,而且位置有效载荷将浸入 Internet 的真正基础结构。

每小时,成千上万的可用位置包将可访问,在大量的应用领域得到使用,比如灾害和位置服务,移动计算,反恐,社交网络和商业智能。

这种位置信息的可用性也随即带来了私人和秘密性的问题。与地理网络解决方案协力,使用更高权限的管理和安全性,将成为一个需求。

## **Where will the geospatial industry and technology be in 10 years?**

Back in 1995, I gave a presentation titled “Ubiquitous GIS” at a conference. In this presentation, I suggested that by 2005 geospatial services and content would become ubiquitous; that the Internet would change the way we deploy, access and integrate geospatially enabled applications.

Obviously, determining whether such a prediction is valid or not is a matter of opinion. I think that we haven't achieved Ubiquitous GIS. However, the ICT infrastructure is quickly evolving to “Ubiquitous Location,” where location elements are integrated into the very fabric of the Internet and the Web. In any case, I stand by the prediction that the ubiquity of geospatial content and services will continue for the next 10 years.

By 2017, there will truly be a “geospatial web,” an Internet and Web infrastructure in which location is as common an element of Internet payloads and Web applications as an IP address, DHCP payload or URL. Location will be a mandatory element of the Internet and Web of the future.

Already, location payload encodings have been specified for several key Internet standards, such as DHCP and SIP. This trend will continue. At a higher level in the IP stack, Web-accessible sensor networks, GPS-enabled mobile devices and RFID-enabled applications are creating location-based content.

So not only will the obvious Web applications, such as Earth browsers, provide easy access to geospatial content and services, but location payloads will permeate the Internet's very infrastructure.

Each hour, billions of location-enabled packets will be accessible for use in a huge number of application areas, such as emergency and location services, mobile computing, counter-terrorism, social networking, and business intelligence.

Such availability of location information also brings with it issues of privacy and confidentiality. In conjunction with the geoweb's evolution will be a need for more-than-adequate rights management and security.

### Does neogeography help or hurt the geospatial industry?

答案是“都有”。在积极的一面，位置“进入”了，并且使用地理已经成一个“很酷”的应用开发焦点了。在“neo”空间新应用的幅度是摆动的——不可能追踪全部的应用。

这种基于位置内容和应用的暴露与使用已经“对”和“让”工业受益。然而，有一种信心，那就是新地理是新颖的和奇妙的，并且这种信心对于一般意义上将地理作为一种科学和学科，与特殊的地理空间工业，产生了主要的伤害。

地理学科一直实践了千年。Strabo, Aristotle 和 Ptolemy 是新地理工作者吗，因为他们推动了地理科学？最早所知道的地图是 James Mellaart 在土耳其 Ankara 的 Anatolia 挖掘 *Catal Hyük* 期间，发现的壁画。这幅地图源于公元前 6200 年。创造这幅地图的人是个新地理工作者吗？

Richard Hartshorne 可能该叫做新地理工作者，因为铺垫了“地理准则”。但是等等，探索出地图覆盖图的 Ian McHarg 怎样，或者量化地理范例的 Walt Garrison 呢，抑或是定义我们现在所谓的 GIS 学科的 Roger Tomlinson 呢？地理科学一直在发展；“新地理”仅仅是发展的另一阶段。

更加阴险的（并且伤害了地理空间工业）是，许多新地理应用建立在很少或者没有参照对任何 GIS 专业人员是常识的基础地理与主要地理空间技术。数据品质，精确度，坐标参照系统，错误传播，地图比例尺，地图失真——列表继续下去。

### Does neogeography help or hurt the geospatial industry?

The answer is “both.” On the positive side, location is “in,” and using geography has become a “cool” application-development focus. The breadth of new applications in the “neo” space is staggering—to the point that it’s impossible to track all the applications and mashups.

Such exposure and utilization of location-based content and applications have been beneficial to and for the industry. However, there’s a belief that neogeography is something new and wonderful, and such belief does a major disservice to geography as a science and discipline in general as well as to the geospatial industry in particular.

The discipline of geography has been practiced for millennium. Were Strabo, Aristotle and Ptolemy neogeographers because they advanced the science of geography? The earliest known map is a wall painting discovered by James Mellaart in Ankara, Turkey, during an excavation of *Catal Hyük* in Anatolia. This map dates from around 6,200 B.C. Was the individual who created this map a neogeographer?

Perhaps Richard Hartshorne should be termed a neogeographer for penning “Principals of Geography.” But wait, what about Ian McHarg for exploring the power of map overlays or Walt Garrison for forging quantitative geography’s paradigm or Roger Tomlinson for defining the discipline we now call GIS? The science of geography is continuing to evolve; “neogeography” is just another step in the evolution.

More insidious (and hurtful to the geospatial industry) is that many neogeography applications are built with little or no reference to the basic geographic and geospatial technology principals that are common knowledge to any GIS professional. Data quality, accuracy, coordinate reference systems, error propagation, map scale, map distortion—the list goes on.

neogeo 应用的消费者对这些准则没有认识；他们也不关心。结果，更多的地理空间技术买家，不理解我们学科的基本准则，迷恋于他们在 neogeo “世界” 中看到的并想在他们的企业应用中拥有那些能力。这种知识的分离将通过引起混淆来损害地理空间工业。最坏的情况是，提供的错误信息能够导致财产与生命的损害。

然而，我相信这将是一个很好的机会来在 neogeo 团体与传统地理空间工业间形成积极的协作。彼此之间都能从对方中学到很多东西。同时，让我们停止魔化新地理术语了，并承认地理科学\学科会从第一个城市形成一直到最后一个城市毁灭为止。

Cary Mann, vice president, Geospatial Business Development Bentley Systems Inc.

### **Where will the geospatial industry and technology be in 10 years?**

预测未来 10 年不是个简单的工作。依观点来看，我们仅仅需要回头看看 1997 年。Clinton 是总统，欧洲提倡流通，并且 *Harry Potter* 即将发行。在计算方面，Windows95 是标准桌面，Internet 成为大众的媒体，[Larry Page](#) 和 [Sergey Brin](#) 已经开始合作了，这随后便成为了 Google 搜索引擎。

没有全部客观的知识而做出结果是个蠢事情，当然许多严谨的事实这个时候我们还不知道。然而，有可能是基于合理而确定的，到 2017 年形成我们的工业的趋势进行预测。因此在 Alan Kay 的精神中，那些讽刺“预测未来最好的途径是创造它”的计算机科学家，这里考虑了下个 10 年可能带来什么。

Consumers of neogeo applications have no knowledge of these principals; nor do they care. As a result, more buyers of geospatial technology, who don't understand the basic principals of our discipline, are enamored with what they see in the neogeo “world” and want those capabilities for their enterprise applications. This knowledge disconnect will hurt the geospatial industry by causing confusion. The worst-case scenario is that the provision of inaccurate information could lead to harm of property and life.

However, I believe there's a great opportunity for a positive synergy between the neogeo community and the traditional geospatial industry. There's much to be learned by each community from the other. In the meantime, let's stop glamorizing the neogeography term and recognize that the science/discipline of geography has been around since the first towns formed and will be around until that last cities crumble to dust.

Cary Mann, vice president, Geospatial Business Development Bentley Systems Inc.

### **Where will the geospatial industry and technology be in 10 years?**

To predict 10 years into the future is no easy task. For perspective, we need only look back to 1997. Clinton was President, the Euro was a proposed currency, and *Harry Potter* was about to be published. In computing, Windows 95 was the desktop standard, the Internet was the emerging medium for the masses, and [Larry Page](#) and [Sergey Brin](#) had begun to collaborate on BackRub, the search engine that later become Google.

Determining an outcome without knowledge of all facts is a fool's game, and, of course, many critical facts are unknown to us at this time. It's possible, however, to predict with reasonable certainly several trends that will shape our industry by 2017. So in the spirit of Alan Kay, the computer scientist who quipped “The best way to predict the future is to invent it,” here are thoughts on what the next 10 years might bring.

预测一：GIS 消失。通过基于地图报告，在一个位置引用信息并展示它，是一个简单并有力的范例。虽然 GIS 像一个小环境应用一样繁荣，但是它作为区位的独特学科已经缩水了，它将被嵌入到企业管理的各个方面中。

预测二：基础结构获得重视。当用户想要对他们的地图进行建模而非制图时，GIS 变成特殊工程和构造解决方案的一个属性。注意力转移到了建筑，道路，桥梁，设施，工业设备及其他基础结构的建设和管理上了。CAD/GIS 的分隔消失了。地理空间软件的价值由它的能力决定，这种能力帮助用户提高基础结构效率，并降低它的社会成本。

预测三：硬件的进步改变了我们使用计算机的方式。小型化带来了动力与轻便，并且它使得所有类型的手机可以处理日常事务。新的展示技术与数字笔—纸将地图，制图和建模带到任意地方。媒体的聚集与普遍存在的带宽使得地理空间内容成为主流来使用。

预测四：个人为共享让路。随着硬件的提升，个人计算的内在问题被溶解，协作的工作流进入旺盛时期。学科共享，并且贯穿基础结构整个生命周期而不用复制信息。

### **Does neogeography help or hurt the geospatial industry?**

新地理反映在 Internet 上。Internet 是一个从其使用与重用方面，对于富--媒体内容与固有信息描绘创造的广泛可访问分布式机制。讽刺的是，这种信息分布式的轻便性已经为内容创造性制造了贪婪无厌的要求。Internet 也是一种表达媒体；用来革新的规则是很少的，并且创造性与合作性是很有价值的。

虽然像 wiki 那样的投稿在新地理中是平凡的，但是它更像是分配信息而非创造信息。新地理很大部分是通过基于地图接口表现和报告信息，因此是 GIS 的一种。

**Prediction one: GIS disappears.** Referencing information to a location and displaying it through map-based reports is a simple and powerful paradigm. Although GIS flourished as a niche application, its position as a distinct discipline diminishes as location is imbedded within every aspect of enterprise operations.

**Prediction two: Infrastructure gains focus.** GIS becomes an attribute of specialized engineering and architectural solutions as users seek to model and not map their world. Attention turns to how buildings, roads, bridges, utilities, industrial plants and other infrastructure are built and operated. The CAD/GIS divide disappears. The value of geospatial software is determined on its capacity to help users improve the effectiveness of infrastructure and lower its societal costs.

**Prediction three: Hardware advances reshape the way we use computers.** Miniaturization brings power and portability, and it makes all types of mobile computing routine. New display technologies and digital pen-and-paper bring maps, drawings and models to anywhere and everywhere. Media convergence and ubiquitous broadband bring geospatial content to mainstream uses.

**Prediction four: Personal gives way to shared.** As the hardware advances dissolve the inherent introspectiveness of personal computing, collaborative workflows flourish. Disciplines share and don't replicate information throughout infrastructure lifecycles.

### **Does neogeography help or hurt the geospatial industry?**

Neogeography reflects the Internet. The Internet is a widely accessible distribution mechanism for media-rich content and inherently delineates creation of information from its use and reuse. Ironically, this ease of information distribution has created insatiable demand for content creation and repurposing. The Internet also is an expressive medium; the rules are few and made for changing, and creativity and collaboration are highly valued. Although wiki-like contributions are commonplace with neogeography, it's more about distributing information than it is about creating it. Neogeography is largely about presenting and



因此，新地理有增加 GIS 民主化的征兆。GIS 正慢慢的溶解在企业与公众结构中，并且，正如它所做的那样，基于空间的报告与分析被应用到每天不断增长的问题中了。

消费者，企业用户与 GIS 专业人员没有欲望去再造那些已经创造好的东西了。Google Earth 与 Virtual Earth 是很流行的，因为他们通过一种航空影像与矢量地图直觉上的合并提供了一种一致的起点。用户将期望杠杆平衡环境而非创造他们自己的不可自明的基础数据。这种杠杆平衡媒体的结果是，对一个行动的爆发不应该感到惊讶。

在创造与信息使用之间的描绘是对理解新地理可能的影响来说是临界的。创造性描绘，比如测量，制图，影像获取，摄影测量，工程与架构，将不会受到新地理和一般性民主 GIS 的逆向的影响。事实上，这些专业人员对内容创造的需求将高涨。

地理空间信息的听众是不同的，因此也是他们的需求。传统的工业用户未必将被替换掉；事实上，广阔的空间信息价值的公众接受性将增强他们的角色。我们将所看到的是，核心 GIS 技术作为工具，使用地理空间内容，变成普遍存在的一种场景。随着这种趋势的加深，GIS 作为一门独特的学科，将开始失去它的意义。

Chuck Drinnan, principal, eWAM Associates  
**Where will the geospatial industry and technology be in 10 years?**

在接下来的十年中，三股设施工业的力量将聚合在一起推动新的地理空间技术。

1. 恶化的基础结构将需要工业去寻找新的解决方案，以解决当延长现有资产的使用周期时增加系统可靠性的问题。

reporting information through map-based interfaces and, therefore, is a type of GIS.

Neogeography, moreover, is symptomatic of the increasing democratization of GIS. GIS is slowly dissolving into the enterprise and public fabrics, and, as it does, spatially based reporting and analysis is applied to an increasing array of everyday problems.

Consumers, enterprise users and GIS professionals have no appetite to recreate what has already been created and created well. Google Earth and Virtual Earth are popular because they provide a solid starting point with an intuitive synthesis of aerial imagery and vector base maps. That users would wish to leverage these environments rather than create their own base data should be self-evident. That this leveraged medium would result in an explosion of activity should not be surprising.

The delineation between creation and use of information is critical to understanding the likely impact of neogeography. The creation disciplines such as surveying, mapping, cartography, imagery acquisition, photogrammetry, engineering and architecture will not be adversely impacted by neogeography and the general democratization of GIS. In fact, the demand for the content created by these professionals will soar.

The audiences for geospatial information are diverse and so are their requirements. It's unlikely that traditional industrial users will be displaced; in fact, broader public acceptance of the value of spatial information will reinforce their roles. What we will see is a commoditization of core GIS technology as tools to use geospatial content become ubiquitous. As this trend deepens, GIS as a distinct discipline will start to lose its meaning.

Chuck Drinnan, principal, eWAM Associates  
**Where will the geospatial industry and technology be in 10 years?**

In the next decade, three utility-industry forces will converge to drive new geospatial technology.

1. Deteriorating infrastructure will require the industry to find new solutions that increase system reliability while extending the useful life of existing assets.

设施已经在传输与发送网络中开始投资了。美国能源部门评估出，60%的传输网格（价值将近1万亿）将在下个十年中不得不被取代。然而，这不是唯一的需要大量投资的基础设施。

在我的评估中，这个层次的投资将需要一个更长的时期。取而代之的是，设施将战略性的改变现存的网络，以降低失败的冲击，延长网络组件生命期，及在网络失效前对恶化的环境自动起作用。为了使这些网络得以增强，新的实时软件将被开发。

2. 工业将实现“数字设施”与“小电网”，来自自动化网络与组件控件，以提高网络可靠性而不管增加的组件不足。

通过安装更加敏感与可控的设备，并开发复杂的控制软件，设施将减少组件失败的冲击。他们将使用其他的途径，在系统感知到失效设备时自动重装的方式，安装新的网络模型。商业与住宅负担将自动管理，以保证可靠的网络管理。

对地理空间系统的冲击将是显著的。举个例子，GIS，损耗与其他系统必须实时支持不同的网络模型和组件能力。最佳的新设施位置需要通过增强的网络分析软件来决定。随着实时控制系统改变网络，地理空间系统需要自动反应。

3. 设施劳动力的管理和合成将变得降低成本，适应年轻人，经验不足的工程师，及充分利用资源。分布式的劳动力将集中管理，最佳的安排提供更有伸缩性和更好的员工工作。

Utilities have underinvested in transmission and distribution networks. The U.S. Department of Energy estimates that 60 percent of the bulk transmission grid (worth almost \$1 trillion) will have to be replaced in the next decade. However, this isn't the only infrastructure that demands massive investments.

In my estimation, this level of investment will be incurred over a much longer period. Instead, utilities will strategically change existing networks to reduce failure impacts, extend network components' life and react automatically to deteriorating conditions before the network fails. To enable these network enhancements, new real-time software will be developed.

2. The industry will implement “digital utility” and “smart grid” initiatives that automate network and component controls to increase network reliability despite increased component failures.

By installing more sensing and control devices and developing complex control software, utilities will lessen the impact of component failures. They will install new network models with redundant paths that will automatically reconfigure when the system senses failing equipment. Commercial and residential loads will be automatically managed to ensure reliable network operations.

The impact on geospatial systems will be significant. For example, GIS, outage and other systems must support different network models and component capabilities in real time. Optimal new equipment locations need to be determined by enhanced network-analysis software. As real-time control systems change the networks, geospatial systems need to react automatically.

3. The management and composition of the utility's workforce will change to reduce costs, accommodate younger, less-experienced engineers, and make more use of offshore resources. The distributed workforce will be centrally managed and optimally scheduled to provide more flexibility and better crew utilization.

随着老员工的退休,有经验的工程师将在管理和指导年轻员工方面花费更多的时间。野外工作人员,胜任特别的工作,将被组织进由中央办公室管理的地理分布式工作池中。

设施的优先权将推动工作安排。依靠准确与现时的地理空间数据,所有的工作将被始终如一的详细说明,并且空间定位。新的系统将通过工作位置最佳的安排工作;可用的设备;及员工可用性,位置与技巧。随着改变的发生,工作将会最优化,并且指派也自动改变。通过这些处理,设施将减少超过 30% 的野外员工并支持交通工具。

### **Will industry consolidation continue at its rapid pace?**

在设施工业中,大的,有名的公司正在通过获取组件系统来开发全面的产品套件。通过紧密整合这些系统,公司期望制造的产品能够更有效的实现成本降低,增强可靠性,并增长现有资产使用寿命周期。这一合并趋势将会继续。

然而,今天的市场已和十年前不同了。大部分设施是在产品套件可用前,从最初的供应商那里,单独购买需要的系统。因此,美国不再有一个对单独系统组件的大型市场了,并且对于那些需要特别组件的新产品套件来说,市场变得很困难。新的套件将不得不瞄准新的利益。

相信他们自己的市场定位,这些产品套件公司低估了紧密整合与配置这些复杂系统的困难度。为了成功的生产产品套件,单独的供应商将每个投资超过\$10,000,000。

在下个十年,我预测:

As older employees retire, experienced engineers will spend more time in the field managing and directing younger workers. Field workers, qualified for more work specialties, will be organized into geographically distributed work pools managed from a central office.

The priorities of utilities will drive work schedules. Relying on accurate and current geospatial data, all work will be defined consistently and located spatially. New systems will optimally schedule work by considering work location; available equipment; and crew availability, location and skills. As changes occur, work will be re-optimized and assignments automatically changed. Through these processes, utilities will achieve more than 30 percent reduction in field staff and supporting vehicles.

### **Will industry consolidation continue at its rapid pace?**

In the utility industry, large, well-known companies are developing comprehensive product suites by acquiring component systems. By tightly integrating these systems, the companies expect to create products that are more effective at achieving cost reductions, increased reliability and extended useful life of aging assets. This consolidation trend will continue.

However, the market is different today than a decade ago. Most utilities have purchased required systems individually from original vendors before product suites were available. Thus, there's no longer a large U.S. market for the individual system components, and the market is difficult for new product suites that require specific components. New suites will have to deliver new benefits.

Believing their own marketing pitches, these large product-suite companies have underestimated the difficulty of tightly integrating and configuring these complex systems. To produce successful product suites, individual vendors will each invest more than \$10 million.

In the next decade, I predict the following:

1. 合并，对新产品套件的系统组件的并购，将继续。成功的产品套件将实现真正的附加利益，并面对年轻劳动力与恶化资产的挑战。这些新的套件将在接下来的三到五年里浮现出来，并变成产品，为五到七年内的早期采用做好准备。

2. 一些当前的供应商将遗弃他们的产品套件。在一个重现的周期里，他们的系统组件将被其他供应商所并购。

3. 系统组件将被设计用来支持离岸工作。实质上，期望指引野外工作的任何工作都能够在离岸完成。

4. 大部分地理空间系统已经在工业与设施中由专家配置好了。年轻的劳动力将受到更好的培训并更有效的执行这些系统。

**Dale Lutz, vice president of development, Safe Software**

### **Where will the geospatial industry and technology be in 10 years?**

从今往后的十年，将有比以往更多的 GIS 数据，这些数据来自比以前更多的设备和记录技术。我们正在进入一个任何东西都将被记录下的时代。这已经在像 London 这样的城市里成为了一种案例。

许多蜂窝电话现在能够接收视屏与影像。通过 GPS 标记这些记录，我们将以一种令人惊讶的，大量的新型空间数据类型——地理参照图片与视屏而告终。大部分的人将会创造数据。由于这种大量的“拥挤来源”的数据集，我们将在适当的位置，看到更多的基础结构。

同样，大部分设备，用具，技术等等，将带有 GPS，使我们的世界的每样东西都能时刻连接在一起。这种普遍存在的连接对于寻找我的朋友来说是非常好的，因为我将能够在我的数字助理（每个人都拥有）上使用我的“临近服务”，在我接近了我认识的人的时候通报我。

1. Consolidation, through acquisition of system components for new product suites, will continue. Successful product suites will achieve substantial additional benefits and meet the challenges of a younger workforce and deteriorating assets. These new suites will emerge in the next three to five years and become production ready for early adopters in five to seven years.

2. Some of the current vendors will abandon their product suites. In a reoccurring cycle, their system components will be acquired by other vendors.

3. System components will be designed to support offshore work. Virtually any work, with the exception of direct fieldwork, can be done offshore.

4. Most geospatial systems have been configured by specialists in the industry or utility. The younger workforce will be better trained and more effective at implementing these systems.

Dale Lutz, vice president of development, Safe Software

### **Where will the geospatial industry and technology be in 10 years?**

Ten years from now, there will be more GIS data than ever before coming from more devices and recording technology than ever before. We're entering the era in which everything will be recorded. This already is the case in cities such as London.

Many cell phones now can capture videos and images. By tagging these recordings with GPS, we will end up with an amazing amount of a new type of spatial data: georeferenced pictures and videos. Almost everyone will be creating spatial data. We'll see more infrastructure in place for this massive "crowd sourcing" of data collection.

Also, almost every device, appliance, technology, etc., will have a GPS, making our world one in which everything is connected all of the time. This ubiquitous connectivity will be great for finding my friends, as I will be able to use my "proximity service" on my digital assistant (that every person will carry) to notify my when I'm in close proximity to someone I know.

当今，GIS 工业仅仅开始发掘 3-D 模型的潜力。从现在起十年后，3-D 的受益将会被完全的认识，并且在大部分纵向方面得以实现。我们也将看到在真实世界空间应用中看到更多的视屏游戏技术的整合。可以想象一下，能够提供基于真实 3-D 模拟精确模型建筑，允许他们展开交战的场景。

然而，在 10 年内，大部分组织也将面对如何有效的筛选所有数据的挑战。当今，我们拥有矢量与栅格（卫星影像）数据，而对 3-D 的关注也开始浮现了。但是通过一般的消费者人群生成全部的地理参照图片和视屏又怎么样呢？

清楚的是，对于如此多收集的感兴趣数据，将开始有用户想要使用它们实现很绚丽的应用了。除了明显的安全应用，那些应用会是什么将成为大问题。

当然，数据质量与格式一致性问题仍将存在，这些挑战在近期不会离开。如果有什么的话，这个数据难题将会进一步加强。

将来还会有一个传统的 GIS 工业吗？是的！事实是在许多纵向方面，人们将仍旧需要处理包裹，标签，基础机构等等。对这些传统 GIS 问题的解决方案仍将有需要。

然而，对空间的认识，要求和使用将显著增长，空间数据将最终让每个人使用到——在大部分情况中，没有用户知道他们正在使用“空间信息”。

在未来十年中，网络服务将成为空间工程中的一种标准需求，因为大部分组织将需要通过 Internet，以免费或者付费服务的方式共享他们的空间数据。

### **Does neogeography help or hurt the geospatial industry?**

新地理帮助了地理空间工业。Internet 是关于民主化信息创造的一切，同时新地理也正是这样的。新地理，对于告知我们使用一般的工具能够做什么，在很多时候，刺激 GIS 成为更大更好的事物来说是非常好的。

Today, the GIS industry is just beginning to tap into the potential of 3-D models. Ten years from now, the benefits of 3-D will be fully recognized and realized across most verticals. We also will see more integration of video-gaming technology in real-world spatial applications. Imagine being able to provide firefighters with a real-world 3-D simulation that precisely models the building they're about to enter to combat a fire.

In 10 years, however, most organizations still are going to face the challenge of how to effectively sift through all the data out there. Today, we have vector and raster (satellite imagery) data, with interest in 3-D starting to emerge. But what about all the georeferenced pictures and video that will be generated by the general consumer population?

Clearly, with so much interesting data being collected, there are going to be users who will want to leverage them to make cool applications. What those applications will be, aside from the obvious security applications, is the big question.

Of course, data quality and format-compatibility issues still will exist. These challenges aren't going away in the near future. If anything, the data conundrum will intensify.

Will there still be a traditional GIS industry? Yes! The reality is that in many verticals, people will still need to deal with parcels, lots, infrastructure, etc. Solutions for these traditional GIS problems will still be in demand.

However, the awareness of, demand for, and use of spatial data will grow significantly. Spatial data will eventually be used by everyone—in most cases, without users even knowing that they're using “spatial information.”

And during the next decade, Web services will be a standard requirement in spatial projects, as most organizations will need to share their spatial data via the Internet as a free or paid service.

### **Does neogeography help or hurt the geospatial industry?**

Neogeography helps the geospatial industry. The Internet is all about democratizing the creation of information, and neogeography is precisely that. Neogeography is great for showing us what can be done using common tools and, in many ways, is

新地理是分裂性的，但是分裂并不是坏事。它挑战了当前工业的秩序，并给与新型组织一个机会来升到顶层。新地理工作者凸显了机构从 GIS 供应商那里的期望，尤其是用户体验领域。

举个例子，在 Google Earth，Google Maps，Microsoft Virtual Earth 等等发布前，Web GIS 用户对于使用网络地图接口，配合“忙碌”指针的空白页，直到整个地图刷新屏幕，而感到满意。在工业中我们中的有些人认为，“噢，等待地图绘制是漫长的，也是有必要的，因为地图需要使用非常大的数据！”新地理工作者认为，“这种漫长的等待都要发出臭味了，因此我将使用 AJAX 来放大，然后在新的缩放等级上呈现地图图幅！”新地理挑战着我们所有人不要满足现状，尤其是用户体验领域。

传统的地理空间工业实力不在大市场中。一些 GIS 供应商已经有足够的力量做出 Google Earth 所做的那样，但是，在大部分技术工业情形下，他们没有大型市场基础结构和消费者商标需求来满足如此多人。另外，传统地理空间工业的定位，便是对于大型市场的渗透将不会出现。为了将 GIS 成功的带到大型市场，需要有像 Google 或 Microsoft 那样拥有大型基础结构与预算的公司放弃基础结构，并获得消费者的关注。

地理空间工业仍就很强大，它也一直很强大。现在它甚至会更强，而新地理工作者已经逐步意识到了通过空间数据能够做些什么了。举个例子，我们现在看到的数据转换发生在组织之间，而他们也看到了“空间智能”的价值，并想要把它加入到他们的“商务智能” workflows 中从而获得竞争优势。

spurring the GIS industry on to bigger and better things.

Neogeography is disruptive, but disruption isn't bad. It challenges the current order in the industry and gives new organizations a chance to rise to the top. Neogeographers have raised the bar on what organizations expect from GIS vendors, especially in the realm of user experience.

For example, before the release of Google Earth, Google Maps, Microsoft Virtual Earth, etc., Web GIS users had to be satisfied with a Web-mapping interface that went blank with a "busy" cursor until the entire map was redrawn. Those of us in the industry thought "Wow, waiting for a map to draw is long and necessary, because maps need to use so much powerful data!" Neogeographers thought "This long wait stinks, so I'm going to use AJAX to zoom in and then render the map tiles at the new zoom level!" Neogeography has challenged all of us to not accept the status quo, especially in the area of user experience.

The traditional geospatial industry's strength hasn't been in the mass market. Some GIS vendors have long had the ability to do what Google Earth does, but, as is the case in most technology industries, they didn't have the mass-market infrastructure and consumer brand required to reach so many people. In addition, the pricing model of the traditional geospatial industry was such that mass-market penetration could never happen. To successfully bring GIS to the mass market required companies such as Google or Microsoft with their massive infrastructure and budgets to lay down the infrastructure and get consumers' attention.

The geospatial industry is still strong where it has always been strong. It's even stronger now that the neogeographers have increased awareness about what can be done with spatial data. For example, we're now seeing data convergence happening within organizations that see the value of "spatial intelligence" and want to fold that into their "business intelligence" workflows so they can gain a competitive advantage.

简而言之，新地理工作者不会关注那些我们以前在工业培训所关注的东西了。他们有不同的观点，因此他们仅仅做一些令人惊讶的事情。

我们传统的 GISer 趋向于驻留在我们的地理空间盒子里，与其他地理空间团体协同工作。新地理工作者揭开了这个盒子，并给我们展示 Internet 中详尽的绚丽素材。真的很令人惊讶，这些机智的网络技术专家，通常没有传统 GIS 背景，已经实实在在的帮助我们推动了工业的边界，并且精炼了我们对市场的交流方式。

**David Linden, president, DSL Consulting**

### **Where will geospatial technology be in 10 years?**

在我们能够看到我们走向哪里前，我们需要回头看看我们从哪里来。普遍的数字地理空间技术商业开发开始于 20 世纪 70 年代中期，并且大部分都是基于大型机的。80 年代早期地理空间运算发展开始加速，并从大型机转换到了小型机。在 80 年代后期，地理空间运算和 GIS 发展在更高的层次了。从小型机到 UNIX 工作站的转移也在这个时期发生了。

90 年代前期与中期关注的焦点是 GIS 用户平台从 UNIX 工作站转移到微软 Windows 的 PC 机上。虽然早期聚焦在核心的地理空间处理能力上，但是这个时期更关注于令人振奋的网络技术，工作站和服务器上。90 年代包括了一项非常重要的核心技术发展，将关系型数据库服务器紧密整合成一个对全部地理空间与相关数据的完整数据存储。

自从 90 年代后，地理空间开发几乎全部聚焦于将现有地理空间处理能力转移到一个以 Internet 为中心的处理模型中。一个重要成果是，Internet 浏览器已经成为了地理空间应用的一个重要接口。

In short, neogeographers don't come to the table with concerns for the things that we in the industry have been trained to be concerned with. They come with a different viewpoint, and so they just do things—amazing things.

We traditional GISers tend to stay inside our geospatial box, working with others in the geospatial community. Neogeographers tip that box over and show us all the cool stuff that's in the Internet at large. It's amazing how these savvy Web technologists, who often have no background in traditional GIS, have really helped us to push the boundaries in the industry and refine our communication to the market.

**David Linden, president, DSL Consulting**

### **Where will geospatial technology be in 10 years?**

Before we can see where we are going, we need to look back from where we came. The widespread commercial development of digital geospatial techniques began in the mid 1970s and was mostly mainframe based. The early 1980s saw geospatial algorithm development start to accelerate and transition from mainframes to minicomputers. During the late 1980s, geospatial algorithms and GIS developments were at their highest level. A migration from minicomputer to UNIX workstation also took place during this time.

The early and mid-1990s saw a focus on migrating the GIS user platform from UNIX workstations to Microsoft Windows PCs. Although earlier periods focused on core geospatial processing power, this period focused more on moving existing technology to a network of PCs, workstations and servers. The 1990s included one very important core-technology development, the tight integration of relational-database servers as a complete data store for all geospatial and related data.

Since the late 1990s, geospatial development has focused almost entirely on moving existing geospatial processing capabilities to an Internet-centric processing model. An important outcome of this has been that the Internet browser has become an important interface for geospatial applications. The client-server model has become

C/S 模型已经成为了地理空间应用的标准, 包括了文件, 数据库, 应用与 Web 服务器。最近的地理空间技术趋势已经表明了要实现网络服务, 并将其作为一种对公众与私人访问 GIS 数据和处理的普遍接受的实际行动。

因此回头看看能够告诉我们, 由运算与数字技术组成的核心地理空间技术已经在近 10 年里相当成熟了。没有理由去认为这将会在下一个 10 年里发生改变。

因此, GIS 工业不太可能会显著受到任何新的核心地理空间能力的影响, 而用户接口与数据访问模型将来则会发生大的改变。

自从工业开始提供产品来允许使用 Web 浏览器访问地理空间技术以来, 已经有大约 10 年了。一开始进步是很慢而且困难的, 但是在最近几年开始加速和提升了。

虽然 GIS 的顶级专家仍旧依赖于高性能的工作站制图, 比如 MS-Windows, X-Windows 和 OpenGL, 但是几乎所有的终端用户应用现在都建立在 Web 浏览器上。两种趋势应该在接下来的 10 年继续前进。

虽然 Web 浏览器给终端用户应用提供了无以计数的优势, 但是他们当前缺少确定的核心制图能力, 这是许多高级地理空间任务需求, 比如矢量编辑与影像处理。虽然两种接口应该在接下来的 10 年内继续共存, 但是趋势将会随时有可能迁移到 Web 浏览器上。

地理空间数据的可用性是另外一个当前正经受着快速变革的领域。像 Google, Yahoo!, MapQuest 和 Microsoft 这样的提供者已经改变了对于地理空间数据访问的工业范例。用户为直接访问地理空间数据而付费的方式, 将会被公司为用户免费提供数据并从广告商那里获得收入的方式所取代。

the standard for geospatial applications embracing file, database, application and Web servers. The most recent geospatial technology trend has seen the implementation of Web services as a widespread accepted practice for public and private access of GIS data and processing.

So looking back shows us that core geospatial technology, comprised of algorithms and digital techniques, has been fairly mature for almost 10 years now. There's no reason to think that this will change during the next 10 years.

Therefore, it's unlikely that the industry will be significantly impacted by any new core geospatial capabilities. It's the user interface and data access models that will see the most change.

It has been about 10 years since the industry started offering products to allow access to geospatial technology using Web browsers. Progress was slow and difficult at first, but has accelerated and improved by an order of magnitude during the last few years.

Although hardcore GIS experts still rely on high-performance workstation graphics such as the MS-Windows, X-Windows and OpenGL, almost all end-user applications now are built to run on Web browsers. Both trends should continue through the next 10 years.

Although Web browsers offer innumerable advantages to end-user applications, they currently lack certain core graphics capabilities required for many serious geospatial tasks, such as vector editing and image processing. Although both interfaces should continue to coexist for the next 10 years, the trend will be to migrate to Web browsers whenever possible.

The availability of geospatial data is another area currently undergoing rapid change. Providers such as Google, Yahoo!, MapQuest and Microsoft have changed the industry paradigm for geospatial data access. Instead of the user paying for access to geospatial data directly, these companies provide it to users at no charge and generate revenue from advertisers.



这种模型增加了一般数据的可用性,并使那种数据对拥有 Web 浏览器,甚至是手机的任何用户立即可用。这是一种肯定会延续的趋势。更多的地理空间数据应该对基于广告商模型的一般公众成为可用的。

互操作性是另一个将来有显著变化的地理空间技术领域。到现在为之,OGC 已经为地理空间互操作工作了近 20 年。虽然这种标准的采纳一开始很慢,但是 OGC 标准与应用已经在近五年里看到了巨大的认可。

尽管如此,在 Google 的 Google Earth 与 KML 的冲击下,OGC 对地理空间互操作性的影响已经变得矮小了。这些相似的技术导致了新地理的出现。新地理允许非地理空间专家,通过创建混搭,把多个来源的数据连接到一个单独的 Web 应用上,然后创建基于 Web 的应用。

第一个混搭使用了来自 Google Maps 的地理空间数据,然后在 Craigslist 的真实状态数据里添加了位置信息。虽然 Craigslist 的发行人并不想地理可用化他的应用,但是一个相关的无经验开发人员能够使用一些 Google Earth 的功能相当轻松的完成开发。虽然混搭仍旧处于幼年,但是他们已经在地理空间景象中表现出了显著的效果,这可以从这篇文章的其他作者评论中得到证实。

**David Maguire, chief scientist, ESRI**

### **Where will the geospatial industry and technology be in 10 years?**

GIS 是牢固的建立在 IT 基础上的信息系统。正因为如此,GIS 体现了一般 IT 社会的关键开发。这里,关键的推动力将继续促进硬件的性能,网络带宽及小型化(比如手机)。

This model increases general data availability and makes that data available almost instantly to anyone who has a Web browser, even on a cellular phone. This is a trend that's certain to continue. More geospatial data should become available to the general public based on the advertiser model.

Interoperability is another geospatial technology area that will see significant change. The Open Geospatial Consortium (OGC) has been working on geospatial interoperability for almost 20 years now. Although adoption of its standards was slow at first, OGC standards and use have seen greater acceptance during the last five years.

Even so, OGC's impact on geospatial interoperability has been dwarfed by the impact Google had with its introduction of Google Earth and the Keyhole Markup Language (KML). These and other similar technologies enable what's becoming referred to as neogeography. Neogeography allows non-geospatial experts to create Web-based applications by creating mashups, which combine data from more than one source into a single Web-based application.

One of the first mashups used geospatial data from Google Maps to add location information to real estate data from Craigslist. Although the publisher of Craigslist had no intent of geo-enabling its applications, a relatively inexperienced developer was able to do so fairly easily using some of Google Earth's features. Although mashups are still in their infancy, they're already having a significant effect on the geospatial landscape, as evidenced by other author's comments found within this article.

David Maguire, chief scientist, ESRI

### **Where will the geospatial industry and technology be in 10 years?**

GISs are information systems built on firm IT foundations. As such, GIS reflects key developments in the general IT community. Here, the key driving forces continue to be advances in hardware performance, network bandwidth and miniaturization, which enable mobility.

目前为止 GIS 所关注的，关键的限制仍旧是用户接口。未来 10 年，在语音接口和非传统演示的提升将可能从根本上影响到 GIS 的使用。

两个立即开始的大改变是在 GIS 软件即服务和移动计算领域，在 SaaS 模型中，数据和功能一起被打包，并通过网络连接到分布的用户使其可访问。集中服务器能被用来发布最诡异的应用和最大型的数据库（比如，Google Maps 和 Microsoft Virtual Earth）。

SaaS 对于简单的，需要重复执行，良好定义的工作流来说工作的很好。这种“设施”或者“云形计算”GIS 对于发布 GIS 应用，尤其是应用和服务的结合来说将变得更加流行。

讽刺的是，集中服务正伴随着对移动计算增长性的关注。这里，优先权是将计算资源移出数据中心，放到其他领域，比如工人巡查，移动制图，嵌入式或者普遍深入的计算的应用。最近把这些东西包括进了随时计算和实时地理系统环境中的嵌入式传感器坐标网络。

在未来十年还会继续的一个关键趋势是，单一化操作先进的 GIS 功能和数据的用户体验应用的开发。两个当代的应用是车载导航与 Earth 浏览器。这些一流的 GIS “脚本”包将数据，功能与工作流程连接在一起，同时他们引导了非传统 GIS 专业地理使用的 massification。

As far as GIS is concerned, the key constraint remains the user interface. In the next 10 years, serious improvements in speech interfaces and nontraditional displays (projective or flexible) likely will have the most radical impact on GIS use.

Two major changes underway right now are in the areas of GIS software as a service (SaaS) and mobile computing. In the SaaS model, data and functionality are packaged together and made accessible via a Web connection to distributed users. Large, centralized server farms can be used to deliver even the most sophisticated applications and the largest databases (e.g., Google Maps and Microsoft Virtual Earth).

SaaS works best for simple, well-defined workflows that need to be performed repeatedly. This type of “utility” or “cloud computing” GIS will become increasingly popular for delivering GIS applications, especially where consistency of application and service is important.

Ironically, centralization of services is being accompanied by increasing interest in mobile computing. Here, the priority is to move computing resources out of data centers and into the field to enable applications such as itinerant worker inspections, mobile mapping, and embedded or pervasive computing. The later includes such things as coordinating webs of sensors embedded in the environment as well as wearable computing and real-time geographic systems.

A key trend that's set to continue in the next decade is the development of applications that simplify the user experience of manipulating advanced GIS functions and data. Two such contemporary applications are in-car navigation and Earth explorers. These elegant packages of “strips” of GIS combine data, functionality and workflow, and they have led to a “massification” of geographic use by nontraditional GIS professionals.

同时随着这些主要的新型发展，传统 GIS 应用，创造，维护，分析先进 GIS workflow，并生产首要的绘图产品，将会继续平行促进。这些仍旧是专业 GIS 的支柱。

### **Does neogeography help or hurt the geospatial industry?**

“新地理”术语是由 platial.com 的创始人之一，Di-Ann Eisner 提出的。她用这个词来描述覆盖或者混搭两个以上地理信息来源（比如在一个 Google 底图上加一个网络摄影）的“新型”地理。

后来，它被那些渴望将地理信息工作推进到现代基于网络方式的人所采纳。Andrew Turner 提供了一个的 *Introduction to Neogeography* 展望，由 O'Reilly 出版。

相同的，由 Michael Goodchild 等人普及的“无偿 GIS”新领域也是在类似的脉络中。有一个逐步的认识，那就是以标记自下而上（所谓的“民间法”），而非以权威来源自上而下（分类法）的方式建立数据库，在地理中扮演着一个重要的而且逐渐成长的角色。像这样的观点都是 Tim O'Reilly 的 Web 2.0 的主要部分。

新地理应用确实已经把地理思维和方法带来了一个新的，更加广阔的听众了。他们聚焦于简单的清楚呈现和查询应用，并挖掘自由可用的底图的可用性，这些底图就像一个画布一样展示各种各样不同的数据变量（例如餐馆，照片，天气，水样站点等）。

这种方法是流行的，因为他们代表性的使用了免费底图，而且实现相对简单些（由于技术像 JavaScript 和 REST，因此几乎不需要编程），同时他们也利用了网络。使用 GPS 的地理参照，基于底图的数字化，和地名词典/地理编码查找服务的新方法，使得查找出事物的位置并使用一个明晰的地理坐标描绘出位置来说相对容易了。这种坐标是允许操作地理数据集组合的“关键”。

At the same time as these major new developments, the traditional GIS applications that create, maintain and analyze advanced GIS workflows and produce premier cartographic products will continue to advance in parallel. These remain the mainstay of professional GIS.

### **Does neogeography help or hurt the geospatial industry?**

The term “neogeography” was coined by one of the founders of platial.com, Di-Ann Eisner. She used it to describe the “new” geography of overlaying or mashing up two or more sources of geographic information (e.g., webcams from Caltrans on top of a Google basemap).

Subsequently, it has been adopted by those keen to advance modern Web-based approaches for working with geographic information. Andrew Turner provides an overview in *Introduction to Neogeography*, which is published by O'Reilly Media Short Cuts.

The equally new field of “volunteered GIS” popularized by Michael Goodchild and others is in a similar vein. There's a growing realization that databases built from the bottom-up by tagging (so-called “folksonomy”), rather than top-down by authoritative sources (taxonomy), have an important and growing role to play in geography. Ideas like this are central to Tim O'Reilly's Web 2.0.

Neogeography applications certainly have brought geographic thinking and methods to a new and much wider audience. They focus on simple visualization and query applications, and exploit the availability of freely available basemaps that act as a canvas on which to display all manner of different data variables (e.g., restaurants, photographs, weather, water-sample sites, etc.).

Such approaches are popular because they typically use free basemaps, are relatively simple to implement (almost no programming is required because of technologies like JavaScript and REST), and they harness the appeal of the Web. New methods of georeferencing using GPS, heads-up digitizing on basemaps and gazetteer/geocoding look-up services now make it relatively easy to find out where things are located and describe the

从某种意义上讲，新地理不经意设下了一个圈套。绝对没有方法消除地理科学某些元素的基本重要性，甚至聚焦于可视化（而非分析与建模）的应用需要考虑到关键的地理概念，比如投影，分辨率和注册。否则，地理数据将无法正确排列，并且任何解释最多都将是可疑的。

很难说新地理“伤害”了地理空间工业，并且一般任何广阔传播 GIS 使用的事物都会受到欢迎的，尤其如果它捕获了人们的地理想象力，并鼓励他们找出更多有关地理与他们兴趣圈里的应用时。

争论新地理是不好的是个错误，因为争论本身就不是“正确的”或“权威的”。个人数据是明显不同的；这比没数据要好，而且这些数据有时候更加有用（比如对于要参观地方进行本地化描述，或者交通延迟“热点”）。

David Sonnen, senior consultant, Spatial Information Management, IDC

### **Where will the geospatial industry and technology be in 10 years?**

十年在一个每隔几个月重用自身的世界里是很长的，但是“首要的原则”看起来拖延了时间：信息技术总是在人们思考和行动的方向中进步。而位置是人们思考和行动方式的基本方面，因此我将以那种方面解决这个问题。

首先，人们需要知道他们在哪儿并且他们的周围是什么——那些是相关的。那种动力将推动地理空间技术的使用，就像推动制图几个世纪和 GIS 几十年。现在的不同是 GPS，Internet 和细微基础结构使精确的地理信息实时可用。那些技术也让人们生产和发布实时的，与他们相关的位置详细信息。

location using an explicit geographic coordinate. Such coordinates are the “keys” that allow multiple sets of geographic data to be combined.

In some senses, neogeography is laying a trap for the unwary. There’s simply no way to avoid the fundamental importance of some elements of geographic science. Even applications focused on visualization (rather than analysis and modeling) need to take into consideration key geographic concepts such as projection, resolution and registration. Otherwise, geodata won’t align correctly, and any interpretations will be questionable at best.

It’s difficult to say that neogeography “hurts” the geospatial industry, and generally anything which spreads the use of GIS more widely is to be welcomed, especially if it captures people’s geographic imagination and encourages them to find out more about geography and its applications in their sphere of interest.

It’s a mistake to argue that neogeography is bad because it isn’t “correct” or “authoritative.” Personal data are clearly different; they’re better than no data and can sometimes be more useful (e.g., local descriptions of places to visit or traffic-delay “hotspots”).

David Sonnen, senior consultant, Spatial Information Management, IDC

### **Where will the geospatial industry and technology be in 10 years?**

Ten years is a long time in a world that reinvents itself every few months. But there’s one “first principle” that seems to hold over time: information technology always evolves in the direction that people think and act. Location is a basic aspect of the ways people think and act, so I’ll tackle this question from that perspective.

First, people need to know where they are and what’s around them—what’s currently relevant. That dynamic will drive the use of geospatial technology, just like it has driven cartography for a few centuries and GIS for a few decades. The big difference now is that GPS, the Internet and cellular infrastructures make accurate geographic information available in real time. Those

这种趋势的动力是众所周知的,但是我将翻出一些集锦了。GPS 实际上一直是企业和消费者移动设备的列表项。手机, RFID, 网络传感器, 甚至一些相机, 从人们的生活中抽取出位置信息, 并且公司数据存储 24/7。

根据 IDC, 个人导航设备的销售将增长 92.3%, 从 2006 年到 2007 年的 2.03 千万件销售。大部分 PND 能够通过 Internet 进行通讯。Nokia 和 TomTom 标定了他们的未来, 他们注意到人们将为他们周围的当前信息付费, 并且通过带有 GPS 的无线电话捐献出位置详细的内容。

同样, Google 的“拥挤来源”正在流行: 850,000 人给 Google Earth 提供内容, 并且这一数字每天都在增加。

因此这里的预测是: 在 10 年中, 普遍存在, 实时, 准确的地理空间信息能力将成为共有信息基础结构的不可见部分。地理空间能力将通过广阔信息现象流通的方式传播, 就像 Internet, 无线, 企业信息系统, 被“地理专家”的观念所解放。

地理空间社会将经历一段对变革的焦虑, 而大部分的我们将适应。Lee Iacocca 闻名遐迩的建议, 让人们面对这种变革: “引导, 追踪或者避开这条路”。是个好建议。

### **Will the current wave of consolidation in the geospatial industry continue?**

“合并”的术语意味着不再面对成熟或者衰退的市场。它会一直出现。上个世纪末这个世纪初, 美国汽车工业将许多小的汽车公司合并到三个大的公司。钢铁工业在二战后也做了相同的事。

technologies also let people produce and publish location-specific information relevant to them in real time.

The dynamics of this trend are well known, but I'll recap a few highlights. Already, GPS is practically a checklist item for enterprise and consumer mobile devices. Cell phones, RFID, networked sensors and even a few cameras pump location information into people's lives and company data stores 24/7.

According to IDC, the sales of personal navigation devices (PNDs) will increase 92.3 percent from 2006 to 20.3 million units sold in 2007. Most PNDs can communicate through the Internet. Nokia and TomTom are staking their future on the notion that people will pay for current information about what's around them and will contribute location-specific content on GPS-enabled wireless phones.

Also, Google's "crowd sourcing" is catching on: 850,000 people have contributed content to Google Earth, and that number grows every day.

So here's the prediction: In 10 years, the capability for ubiquitous, real-time, accurate geospatial information will be an invisible part of the common information infrastructure. Geospatial capabilities will spread through the currents of broader information phenomena, such as the Internet, and wireless and enterprise information systems, unfettered by the notion of "geospecialists."

The geospatial community will go through a period of angst about the change, and most of us will adapt. Lee Iacocca famously offered advice for people facing this kind of change: "Lead, follow or get out of the way." That's good advice.

### **Will the current wave of consolidation in the geospatial industry continue?**

The term "consolidation" implies retrenchment in the face of maturing or declining markets. It happens all the time. At the turn of the last century, the U.S. auto industry consolidated from a few hundred small car companies to three large ones. The steel industry did much the same thing after World War II.

大型机厂商，小型计算机和 Unix 工作站由于产品需求的下降也纷纷进行了合并。但是在地理空间工业中最近发生的并购与归并风波并不是简单的合并。

更恰当的是，像 Leica Geosystems 购买 Acquis 的技术，Ionic 与 ER Mapper，或者 Nokia 收购 NAVTEQ 这样的并购，都是关于公司重新定位自己来更好的服务与扩展市场的。Leica Geosystems 正在重新定位自己，忙于满足大型企业信息系统的地理空间需求。Nokia 收购 NAVTEQ 是其正在努力进行的从一个设备生产商到服务公司的转换。

更多的例子包括 Pitney Bowes 收购 Group 1 和 MapInfo，First American 收购 Proxix，Microsoft 收购 GeoTango 和 Vexcel，TomTom 收购 Tele Atlas，Google 收购 Keyhole，Autodesk 收购 C-plan Topobase。所有的这些并购都是满足新的，扩展的市场，而不是合并。

回答这个问题：并购风波会继续吗？当然。它是合并吗？不是。这是扩展进入新市场。

Jill Smith, CEO, DigitalGlobe

**Where will the geospatial industry and technology be in 10 years?**

在目前航行中的地理空间工业中发生转变，几乎不可能预测出未来 10 年它将驶向何方。然而回顾历史总是有益的。

最近 10 年期间，地理空间工业从政府主导的市场发展并扩展到由商业扮演主要角色，并由商业决定规模与需求的市场中了。相应的，商业数据提供商已经在基础结构上做出了显著的投资，包括了世界第一个高分辨率卫星，广阔的集中与分布式地面管制操作，革新的大比例尺产品与附加值能力，以及新的基于网络分布式模型，用来延伸最广阔的政府，商业和消费者基础。

Manufacturers of mainframes, minicomputers and Unix workstations went through consolidation as demand for their products declined. But what's happening in the geospatial industry with the current wave of acquisitions and mergers isn't consolidation.

Rather, acquisitions such as Leica Geosystems purchasing Acquis' technology, Ionic and ER Mapper, or Nokia's purchase of NAVTEQ, are about companies re-orienting themselves to better serve obvious and expanding markets. Leica Geosystems is reorienting itself to address the geospatial needs of large enterprise information systems. Nokia's purchase of NAVTEQ is part of its ongoing effort to shift from being a device manufacturer to being a service company.

More examples include Pitney Bowes purchase of Group 1 and MapInfo, First American's purchase of Proxix, Microsoft's purchase of GeoTango and Vexcel, TomTom's purchase of Tele Atlas, Google's purchase of Keyhole, Autodesk's purchase of C-plan Topobase. All of these acquisitions are about addressing new, expanding markets—not consolidation.

To answer the question: Will the wave of acquisitions continue? Sure. Is it consolidation? No. This is an expansion into new markets.

Jill Smith, CEO, DigitalGlobe

**Where will the geospatial industry and technology be in 10 years?**

Given the transformation currently underway in the geospatial industry, it's nearly impossible to predict where it will be in the next 10 years. However, it's always instructive to review history.

During the last 10 years, the geospatial industry evolved and expanded from being a predominately government-sponsored market to one in which the commercial sector is playing a major role in shaping its size and requirements. In response, commercial data providers have made a significant investment in infrastructure, including the world's first high-resolution satellites, extensive centralized and distributed ground-control operations, innovative large-scale production and value-added capabilities, and new Web-based

因此未来 10 年的合理预测是，我们将生活在这样一个世界里：实时的，拥有精确地理空间数据，对更多人日益增加可访问性的人们日常生活和工作，以及设备的信息与应用。

我们总是看到地理空间数据个人化的运动趋势，我们能够期望这种趋势以大量的新地理网络应用，支持任何事情，从查找午餐约会到维护重要商业资产，再到支持全球安全和突发事件响应，的形式继续。主要消费者制图网站，比如 Google Earth 与 Microsoft 的 Virtual Earth，一直为数以万计的消费者与商业用户简单快速的访问基于卫星影像的地理信息而铺平道路。

移动应用允诺将成为地理空间信息与应用的一个新的主要增长领域，因为许多领先的个人导航设备，汽车和无线提供商对其进行投资，通过整合地理空间影像使其制图与基于位置服务更加丰富。移动设备上的卫星影像增殖也将影响地理空间数据的处理，压缩和恢复方式，以及他们怎样扩展成为其他主流商业应用。巨大的，笨拙的地理空间数据集将成为过去式。

许多新的需求能够通过高分辨率系统，和由发达国家商业数据提供商提供的能力所解决。然而，在接下来的几年中，我们也将在网上看到可观数量的次-米级商业卫星影像，许多是由发展中国家政府所拥有的，他们也向知识中心与科技方面投资，以促进更广范围应用的访问，分析和使用影像。

distribution models for reaching the broadest government, commercial and consumer customer base.

It's therefore reasonable to predict that, during the next 10 years, we will be living in a world in which timely, accurate geospatial data, information and applications are increasingly accessible to greater numbers of people as part of their daily lives and workflows, on any device.

We have already seen a movement toward the personalization of geospatial data, and we can expect this trend to continue with a plethora of new (and yet unimagined) geoweb-enabled applications supporting everything from finding your lunch date to maintaining mission-critical business assets to supporting global security and emergency response. Major consumer mapping sites such as Google Earth and Microsoft's Virtual Earth have already paved the way for millions of consumer and commercial customers to access satellite image-based geographic information simply and immediately.

Mobile applications promise to be a new major growth area for geospatial information and applications, as many of the leading personal-navigation device, automotive and wireless providers invest to make their mapping and location-based services richer by integrating geospatial imagery. The proliferation of satellite imagery on mobile devices also will have an impact on how geospatial data are processed, compressed and retrieved, and how extensible they could become to other mainstream commercial applications. Large, unwieldy geospatial datasets could become a thing of the past.

Much of this new demand can be met by the high-resolution systems and capabilities provided by the commercial data providers in the developed countries. However, we also will see a significant number of new sub-meter commercial-imagery satellites coming online during the next few years, many of which are owned by the governments of developing countries who also are investing in learning centers and technologies to advance access, analysis and utilization of imagery for broader applications.

更高的影像可用性可能普遍降低价格的压力。反过来,这将帮助进一步推动发达和发展中国家的需求。我们可以期望发展中国家成为主要的高分辨率地理空间信息的消费者,来帮助他们,从土地利用管理和基础设施建设方面到突发灾害响应与增加的移动应用方面。

### **Will industry consolidation continue at its rapid pace?**

随着更多的地理空间数据,信息和应用变得可用,同时更多的人和政府将它们作为个人与商业生活的一部分,挑战发生了转变,从简单的如何提供充足的影像和信息,到如何在各式各样的应用中更好的管理,访问,分析和发布高质量的数据。因此合理预测未来的合并应该是,公司转向提供端到端的解决方案,包括操作数据来源,解析工具,附加值解决方案和可伸缩发布选项。

同时,我们将继续看到新的革新公司浮现出来,利用 Web 2.0 的优点,扩展人们与商业何时,如何特别的访问和使用地理空间数据与影像。在最近,我们已经看到了像 Ask.com, Bushnell, Garmin, Oracle 和 Zillow 等公司改变了我们对影像的认识方式。

Jim Farley, senior product manager, Interoperability Standards, Autodesk Inc.

### **Where will the geospatial industry and technology be in 10 years?**

即便在成功的 LASIK 外科后,十年也是一个很长的距离来看清楚。然而,看看最近的趋势(以及思想中遗弃的东西),让我们来看看未来的清晰轮廓。

市场将成为全球性的,并且由地理数据的覆盖,类型,质量和可用性的一个爆发形成。最近考虑的非空间数据将增加性的合并到地理空间应用中,成为我们的三-四-(时间)和五-空间(成本)数据提供的需求。

The greater availability of imagery is likely to put downward pressure on prices across the board. This, in turn, will help to further drive demand in developed and developing countries alike. We can expect developing countries to be major consumers of high-resolution geospatial information for everything from land-use management and infrastructure build-out to emergency-response and, increasingly, mobile applications.

### **Will industry consolidation continue at its rapid pace?**

As more geospatial data, information and applications become available, and more people and governments consume them as part of their personal and business lives, the challenges shift from simply how to provide enough imagery and information, to how to better manage, access, analyze and deliver increased quantities of data and information in more varied applications. It's therefore reasonable to anticipate further consolidation as companies move to provide end-to-end solutions that include multiple data sources, analytical tools, value-added solutions and flexible delivery options.

At the same time, we will continue to see new innovative companies emerge to take advantage of Web 2.0, expanding when and how people and businesses access and use geospatial data and imagery in particular. In the last year alone, we have seen companies such as Ask.com, Bushnell, Garmin, Oracle and Zillow change how we think about imagery.

Jim Farley, senior product manager, Interoperability Standards, Autodesk Inc.

### **Where will the geospatial industry and technology be in 10 years?**

Even after successful LASIK surgery, a decade is a long distance to see clearly. However, looking at current trends (and with this disclaimer in mind), let's squint and see what comes into focus.

The market will be global and shaped by an explosion in the coverage, type, quality and availability of geodata. Data currently considered nonspatial will increasingly be incorporated into geospatial applications as our command of three-



消费者和商业应用的灵活性将变得无缝和复杂，因为网络连接变得普遍存在。在未来 10 期间，模拟数字景象和真实数字景象间的区别将淡出。

我们将逐步实现真实世界规划，管理，生命周期/资产/供应链管理，安全，以及无缝的突发事件响应，“摇篮到坟墓”的数字环境（所看所做像我们周围的世界）。预言的建模和模拟变成现实的工具处理日常问题，杠杆调节复杂分析与可视化要素。

与城市规划，工程，设施，结构，突发响应等配合在一起的真实世界的建模与分析将成为平凡的事。消费者市场将被更好的定义，并且开发更复杂的应用，同时我们将看到更广范围的核心商务应用整合。

未来 10 年的工业驱动力将是技术集中，革新，商业进步和工作流整合，开源，以及开放标准。由于传统的离散技术，技巧与学科侵蚀间的屏障，技术集中出现了。这正在发生，因为来自设计，建筑，遥感（例如 CAD，建筑信息模型，作为建筑模型，LIDAR 指出不足）的更加丰富的信息与工具正增长性的被用来扩展和丰富地理空间应用与分析。这很有可能延伸并加速。

像以前的 Linux，OSGEO 正在论证一个结构，接近开源的设计中心，能够拥有巨大的影响，就像数万个地理空间专业下载和实现开源软件。随着 OSGEO 探究开源与开放标准间的普遍协同，与 OGC 的相互影响将增加，加速实现和采纳开放标准。反过来，这将推动广大应用与领域范围开放标准的增殖。再次的，这一进程已经开始了。

four- (time) and five-dimensional (cost) data improves.

Mobility for consumer and business applications will become increasingly seamless and sophisticated as network connectivity becomes truly ubiquitous. During the next 10 years, the distinction between a simulated digital landscape and a true digital landscape will fade.

Increasingly, we will accomplish real-world planning, administration, life-cycle/asset/supply chain management, security, and emergency response in a seamless, “cradle-to-the-grave” digital environment that looks and behaves like the world around us. Predictive modeling and simulation become realistic tools to address daily problems, leveraging sophisticated analysis and visualization features.

Real-world modeling and analyses that tie together urban planning, engineering, utilities, architecture, emergency response and more will become commonplace. Consumer markets will become better defined and develop more sophisticated applications, and we’ll see broader integration with core business applications.

The industry drivers for the next 10 years will be technology convergence, innovation, business-process and workflow integration, open source, and open standards. As barriers between traditionally discrete technologies, techniques and disciplines erode, technology convergence occurs. This is happening today as richer information and tools from design, construction and remote sensing (e.g., CAD, building-information models, as-built models, LIDAR point clouds, etc.) are increasingly used to extend and enrich geospatial applications and analysis. This is likely to expand and accelerate.

Like Linux before it, OSGEO is demonstrating that a structured, project-centric approach to open source can have enormous impact as tens of thousands of geospatial professionals download and implement open-source software. As OSGEO explores the natural synergy between open source and open standards, the interplay with OGC will increase, accelerating implementations and the adoption of open standards. This, in turn, will drive

它们为那些愿意接受风险，并克服不可避免的，成功革新所依赖的失败的人，创造出革新与机会的肥沃土壤。

Ken Clay, segment director, Enterprise & Public Sector, Tele Atlas

**Where will the geospatial industry and technology be in 10 years?**

多年来，许多意外已经预测出来地理空间工业的终结，认为它将变得更加广阔并失去意义。然而没有什么比事实更长远。

“地理空间”术语以前涉及到 Internet 应用了吗？它围绕着移动设备吗？这些仅仅是两个新的技术，由地理空间信息所激活。随着工具与技术进一步的发展，我们可以期望他们将被地理空间技术与终端需求所加强。很确定的是，Internet 帮助推动了地理空间工业成为主流，并将继续扮演一种重要的角色。随着 Internet 从只读到读写的发展，我们开始认识到，每一样东西，甚至是在网络上，都存在着地理组件。Internet 的每一面将完全被 GIS 整合，不仅仅是数据建模，还有处理。

随着我们的设备对于功能性与连接性变得更加完整，我们将能够进一步连接到技术与设备上。由于移动设备的使用与革新应用的增加，我们一直预想一个这样的世界：在这个世界中我们依靠我们的设备轻松寻找并与其他我们感兴趣的人，地方和事物互动。

地图将变得如此固有，每份数据都将变得位置可用。时间将不会久远了，每个人都是 GPS，GPS 是标准的袖珍三重唱：钥匙，皮带与移动设备。

the proliferation of open standards across an increasingly broad range of applications and domains. Again, this process has already begun.

All of this creates a fertile landscape for innovation and enormous opportunity for those willing to accept the risk and overcome the failures that are inevitably tied to successful innovation.

Ken Clay, segment director, Enterprise & Public Sector, Tele Atlas

**Where will the geospatial industry and technology be in 10 years?**

For years, some contingencies have predicted the end of the geospatial industry, saying it would become too broad and less meaningful. Yet nothing is further from the truth.

Did the term “geospatial” previously refer to Internet applications? Did it encompass mobile devices? These are just two newer technologies that have been richly enabled by geospatial information. As tools and technologies further develop, we can expect that they will be enriched by geospatial technology and ultimately require it. Certainly, the Internet helped push the geospatial industry into the mainstream and will continue to play a significant role. As the Internet evolved from read-only to read-write to “community,” we began to realize that everything, even on the Web, has a geographic component. Every aspect of the Internet will become fully integrated with GIS, not just in terms of data modeling, but also processes.

As our devices become more integrated for functionality and connectivity, we will be more connected to other technologies and devices as well as other people. With the increase in mobile-device usage and innovative applications, we already envision a world in which we rely on our devices to easily find and interact with the people, places and things we’re most interested in. Maps will become so intrinsic that every piece of data will become location-enabled. The time is not far away when everyone will be a GPS—not with chips implanted, but by carrying a GPS in the standard pocket trio: keys, wallet and mobile device.

同样有对广告的含意，但不仅仅是传统的 B2C 认知：可能我们可以对目标公司营销自己，超越了个性化，并颠倒了规范。

其他的呢？通过必要的合并数据来支持高级驾驶助理系统，我们可能会离我们的梦想更进一步：汽车能够自己开动。

未来十年将见证，新的，令人振奋的基于地图的应用帮助我们找到我们想要的，并提供我们需要见多识广，基于位置选择的输入，这一面纱的揭开。随着地图继续在功能性方面的发展，我们可以期望他们在一个广阔的范围，以新的，带有高级制图数据基础的动态方式，丰富个人与公众的生活。

### **Does neogeography help or hurt the geospatial industry?**

Internet 的一种重要的角色是它的鼓励公众的能力。地理空间团体最近正探索如何最好的平衡用户产生的内容。如今，地理数据市场以指数增长，因为更多的应用正在整合地图——从 Internet，移动和导航应用，到商业解决方案，到小环境混搭。作为一个团体，新地理工作者正在帮助推动地图革命。

随着数字化时代的开始，地图成为了统一的工具，被许多（比如政府部门与企业）所使用。在社会计算时代，地图按照需求和在固定与移动世界中数十亿人的选择才裁减成不同的工具。

因为地图与依赖应用很有用，他们必须基于可靠的，丰富的，实时更新的信息。对于正在进行的地图从工具的，超越引导“帮助寻找”的转变来说，这就是关键。对于数字地图与系统开发者显著的收入机会来说，这也是一个必要的先驱。一个应用用户的团体——如今的新地理工作者——能够帮助解决一个地理学者的重要问题：帮助尽可能快的更新一个巨大的数据集。

There also are implications for advertising, but not just in the traditional B2C sense: perhaps we can begin marketing ourselves to target companies, going beyond personalization and turning the model upside down.

What else? By incorporating the data necessary to support Advanced Driver Assistance Systems, perhaps we could get closer to what we've been dreaming about: cars that drive themselves!

The next 10 years will witness the unveiling of new, exciting map-based applications that will help us find what we want and provide the input we need to make informed, location-based choices. As maps continue to evolve in functionality, we can look forward to them enriching the lives of individuals and communities in a broad array of new, exciting and dynamic ways, with superior mapping data as the foundation.

### **Does neogeography help or hurt the geospatial industry?**

One of the Internet's great characteristics is its ability to foster communities. The geospatial community is one currently exploring how to best leverage user-generated content. Today, the market for geographic data is growing exponentially as more applications are integrating maps—from Internet, mobile and navigation applications to business solutions to niche mashups. As a community, neogeographers are helping to drive map evolution.

With the onset of the digital era, maps became uniform tools used by many (e.g., government officials and enterprises). In the social-computing era, maps are tools tailored to the needs and preferences of billions of individuals in fixed and mobile worlds.

For maps and dependent applications to be useful, they must be based on reliable, rich and up-to-date information. This is a key to the ongoing transition of maps from tools that go beyond guiding to “helping to find.” It's also a necessary precursor to significant revenue opportunities for digital map application and system developers. A community of application users—today's neogeographers—can help solve one of the geographers' major problems: helping to update a

幸好用户不都是地理空间专家。事实上，这是仍旧保持独立的团体民主化的一方面。当 GPS 最近在功能性上的提高，用户能够更新他们的地图并直接给数据供应商提供那些改变时，GPS 正变得更加主流。这种信息可以包括各种东西，从道路网的改变到新的兴趣点。

工业正拥抱着动态信息，同时新地理工作者正在创造定制的导航体验。由于个性化，连通性与公众制图不断发展，工业的领导者正在走进挑战：递送设备与带有比以前基于位置信息更加丰富的服务。使地理空间技术更加普遍存在将使工业受益，并帮助推动进一步的应用开发。

**Peter Batty, president, Spatial Networking**

**Where will the geospatial industry and technology be in 10 years?**

以找出我们周围世界信息的方式，在未来 10 年里，我们将看到非凡的改变。正如我刚所说的，我们将能够实时的，在发达世界的任何地方，通过难以置信的多媒体体验，看着所发生的一切。

各个地方都将有视屏摄影机——从每辆车，人们眼镜里的小型摄影机，在固定的位置，操作摄影机查看各个方向。这些摄影机可以随意开关，当然，视屏流仅能与其他时间选定的人共享。但是，在实时的点下，这些摄影机的大多数将把流数据无线传到电脑空间中，从而被所有人看到。

这些数据流将与摄影机位置和方向，3-D 模型（创建真实世界虚拟实时拷贝，人们能够像今天的视屏游戏一样航行其中）精确信息相连接。想想当今的技术，比如 Google Street View 与 Photosynth，带有不同来源的实时视屏而非静态

vast dataset as quickly as possible.

It's OK that users aren't all geospatial experts. In fact, this is one of the democratizing aspects of the community that may help it remain self-sustaining. GPS is becoming more mainstream while concurrently improving in functionality, due in part to users who now can update their maps and provide those changes to data vendors directly. This information can include anything from changes to the road network to new points of interest.

The industry is embracing dynamic information, and neogeographers are creating custom navigation experiences. As personalization, connectivity and community mapping continue to evolve, industry leaders are stepping up to the challenge of delivering devices and services richer than ever before in location-based information. Making the geospatial technology more ubiquitous will benefit the industry and help drive further application development.

Peter Batty, president, Spatial Networking

**Where will the geospatial industry and technology be in 10 years?**

We will see extraordinary changes in the way we find out information about the world around us during the next 10 years. From wherever we are, we will be able to see what's happening in real time, anywhere in the developed world, via an incredibly immersive multimedia experience.

There will be video cameras everywhere—in fixed locations, multiple cameras looking in all directions from every car, miniature cameras in people's glasses. These cameras can be turned on and off as appropriate, of course, and the video streams can be shared just with selected people at other times. But, at any given point in time, the great majority of these cameras will be wirelessly streaming data into cyberspace, which can be viewed by anyone.

These data streams will be combined with precise information about camera location and orientation, and fused with precise 3-D models of the world, to create a virtual real-time copy of the real world, which people can navigate just like today's video

图像，这将是未来的线索。

在这个世界中，我们将拥有这样的技术：总是知道每个人，每个事物在哪里。我们也将拥有一个复杂可信的系统，它将决定谁能获得什么信息，以及何时（比如，特殊工作同事可能能够在业务时间看到你的位置，但是出了这个时间就不行了）。

智能软件代理将帮助组织建立起许多基于我们当前位置的生活的诸多方面，还可以组织将来的一些详细计划。举个例子，他们将帮助我们在这样的情况下遇见朋友：我们之前不知道他们接近了；以多种新的方式组织交通，共享排序，以坐标的形式而非以前的可能性，无缝连接到公交和火车；并且基于我们喜好的详细信息预定正餐与娱乐活动。实时位置将成为我们生活的一个深入部分。

### **Does neogeography help or hurt the geospatial industry?**

新地理压倒性的帮助了工业。将会继续有几个特殊的任务需要由“GIS 专业人员”去完成。但是许多“保守派”不认可的，或者不想要接受的，是大部分有用的使用地理空间数据的工作将由那些不是地理空间的专业人员，无权使用“传统 GIS”软件的人来完成。

扩展我以前用过的比喻，大部分使用数字数据的有用工作不是由数学家完成的。这不是为了引起惊慌或者敲打数学家（发生过）。它的意思是，作为一个社会，我们能够平衡数字信息的能量，通过数量级的人而非仅仅有大批“数学专家”中坚分子来工作。正式替代“地理学”或者“地理空间”为合适的词来准确的反映我们工业现在的情况。

games. Think of current technologies such as Google Street View and Photosynth, but with real-time video from many different sources instead of static images, and this will be a hint of what's to come.

In this world, we will have the technology to know where everyone and everything is all the time. We also will have a sophisticated trust-based system that determines who can receive what information and when (e.g., specified work colleagues may be able to see your location during business hours, but not outside of those times).

Intelligent software agents will help organize many aspects of our lives based on our present location as well as a detailed knowledge of our future plans. For example, they will help us meet friends in situations in which we previously wouldn't have known of their proximity; organize transportation in many new ways, with shared taxis seamlessly connecting with buses and trains in a more coordinated fashion than was possible before; and book dinner and entertainment based on a detailed knowledge of our likes and dislikes. Real-time location will be a pervasive part of our lives.

### **Does neogeography help or hurt the geospatial industry?**

Neogeography overwhelmingly helps the industry. There will continue to be several specialized tasks that will need to be done by “GIS professionals.” But what many of the “old guard” still don't realize, or don't want to accept, is that the great majority of useful work done with geospatial data will be done by people who aren't geospatial professionals and don't have access to “traditional GIS” software.

To extend an analogy I've used before, most useful work with numerical data isn't done by mathematicians. This isn't scary or a knock on mathematicians (I happen to be one). It does mean that, as a society, we can leverage the power of numerical information by orders of magnitude more than if only a small elite clique of “certified mathematical professionals” were allowed to work with numbers. Substitute “geographical” or “geospatial” as appropriate in this statement to translate this to the current situation in our

在一个讨论中我发表了主题为是否“地理空间是特殊的”，有人辩论道，它至少也是和影像一样特殊，而我认为有另外一个很类似。当然，你能够用影像做极其复杂的工作。但是你也能够在大部分你所访问的网页上找到影像，每个人都有设备来创造影像数据（摄影机），许多人的手机可以创造影像数据，并且许多人能够使用在线服务与朋友共享创造的影像数据。因此我看到了地理空间数据的许多类似处；影像在普遍性深入方面稍稍领先，但也不多。

我认为革新在传统地理空间市场很长一段时间里是相对缓慢的，因为市场的许多方面他们有了本质上的垄断，使得人们革新的，打破确定的模型并获得成功的想法变得困难。但是现在我们拥有资源和最新的想法，像 Google 与 Microsoft，以及“新地理工作者”团体延伸的许多会员，我们正看到工业中更多的革新，并且我相信这将继续。

Rajesh Kalra, managing director, RMSI

**Where will the geospatial industry and technology be in 10 years?**

地理空间工业的主要改变是将见证未来 10 年里，地理空间工业从一个小部分转变成一项技术，它将遍及每天的生活，并变成时空系统。

基础数据将变得自由访问并可用，同时高价数据也将变得平凡。在发展中国家，数据可用性将聚集充足的推动力，并可在最小的人口统计尺度下得到。在表达，分析与更新方面提升的可访问性与应用将意味深长。

industry.

In a discussion I had on the topic of whether “geospatial was special,” someone argued that it was at least as specialized as imagery, and I think there’s another good parallel here. You can do extremely complex work with images, of course. But you also find images on almost every Web page you access, everyone has devices for creating image data (i.e., cameras), many people have a phone that can create image data, and many people can share created image data with friends using online services. So I see a lot of parallels here with geospatial data; images are a little further ahead in terms of being completely pervasive, but not by much.

I think that innovation has been relatively slow in the traditional geospatial market for a long time, because there has essentially been a monopoly in many parts of the market, making it difficult for people with new and innovative ideas to break the established mold and be successful. But now that we have the resources and fresh ideas of the likes of Google and Microsoft and the many members of the extended community of “neogeographers,” we’re seeing much more innovation in the industry, and I believe this will continue.

Rajesh Kalra, managing director, RMSI

**Where will the geospatial industry and technology be in 10 years?**

The major change that the geospatial industry is going to witness during the next 10 years is moving from a niche sector to a technology that will pervade everyday life and morph into spatio-temporal systems.

Base data will become freely accessible and available, and higher-value data also will be commoditized. Data availability in developing countries will have gathered sufficient impetus and will be obtainable at the smallest demographic scale. Improved accessibility and applications for presentation, analysis and update will simplify significantly.

这些趋势将出现，贯穿于地理空间工业/互助会转换为日用品/服务提供者，以及少数特殊用户制作高度特殊化然而及其用户友好的其中。

工业部门将在如今的萌芽主题（例如气候变化）和工业纵向上外围设备占据中央舞台的基础上经历显著的革新。面向碳管理与贸易的应用将超越传统的范围。类似的，对时空技术进入非传统部门的灌输，例如娱乐业，价值革新将继续创造潜力领域。

另一个需求重要高端时空的部门，是土地管理与任何其他空间切实的有形财产。地方性的企业将变成信息共享与数据合并，应用与使用的症结，同时它将被用来科学规划，设计，建筑，维护和运转团体。

### **Will industry consolidation continue at its present rapid pace?**

我们看到的合并就像一个商业，最终以市场为基础。并购与合并趋势增长和收缩了工业，但是不经常出现中立工业。

在收缩工业方面，合并总有一个不可避免的终点，没有合并是可能的。我们相信地理技术仍经成长，没有必要一个最终点去合并。这是由于新公司的形式是基于新技术的。如果新技术强迫新公司变成收购或合并的候选，那么这个循环将不确定的继续。

合并能够影响公司给更大的技术公司提供服务和产品。举个例子，如果公司 A 与公司 B 正在考虑合并，这可能影像外部采购合作伙伴。

These trends will happen through the geospatial industry/fraternity translating into commodity product/service suppliers and micro-specialized players making highly specialized, yet extremely user friendly, “bleeding-edge” applications.

The industry sectors will have undergone significant change with today’s burgeoning topics (e.g., climate change) and peripheral initiatives (e.g., weather impact-assessment studies, calamity-mitigation measures) taking center stage as industry verticals. Applications targeted toward carbon management and trading also will move beyond the traditional scope. Similarly, value innovation will continue to create potential areas for infusion of spatio-temporal technology into non-conventional sectors such as entertainment.

Another sector that will require significant high-end spatio-temporal requirements is the management of land and any other spatially tangible assets. The municipal enterprise will have become the crux of information sharing and collaborating on data, applications and uses, and it will be used across disciplines to plan, design, build, maintain and operate communities.

### **Will industry consolidation continue at its present rapid pace?**

We see consolidation as a simple fact of business, ultimately predicated on market needs. Acquisition and consolidation tend to happen in growing and shrinking industries, but less often in growth-neutral industries.

In shrinking industries, consolidation always has an inevitable end point, beyond which no consolidation is possible. We believe that geotechnologies are still growing, and there isn’t necessarily an ultimate end point to consolidation. This is because of the formation of new companies based on new technologies. If the new technology is compelling, the new company becomes a candidate for acquisition or consolidation, and that cycle can continue indefinitely.

Consolidation can affect companies that provide services and products to the larger geotechnology companies. For example, if Company A and Company B are considering a merger, this may impact outsourcing partners. In the event of a

在一个成功合并的事件中，一个或者很多外部采购合作伙伴可能发现他们自己在外边观望。但是如果公司 A 与公司 B 撤回了合并，然后各自新的商业计划可能实际上要求更多的外部采购合作伙伴。

在 RMSI，我们预测了这个工业中的合并速度将继续，但是要面对一年年的变化与偶尔一个几乎没有合并的情况。

Ron Lake, CEO and chairman, Galdos System Inc.  
**Where will the geospatial industry and technology be in 10 years?**

断言未来是个困难的任務，经常是通过回顾过去实现的——正式 Marshall McLuhan 所谓的“后视镜主义”。虽然这充满难度，但是它可以帮助我们判断我们正在经历的革新的步伐。

粗略是 10 年前（1998），我开始了 GML 工作。这项工作的目的是革命性的，并简单的反应在全部司法边界中尽可能透明的整合地理信息的需求。

知道 2000 年，OGC 有了它的第一个重要试验床（WMT 1），同时数据服务（随后的 WFS），目录，地理数据连接，地图风格与应用架构的角色是所有确定的概念——巨大的，因为先前其他形式的概念。

现在，在 2007 年，我们奋斗于许多相同的问题与挑战。然而有一些重要的不同（来自未来我们建立的断言）。

一些重要的事在最近十年里发生了，包括数据编码（GML）与表现（KML, SVG）的开放标准，允许地理空间事物与数据访问（WFS, WCS）的开放标准，以及最为重要的，基于开放标准与商业供应商的商业规范。1998 年的概念现在完全成了广泛可用的组件。

successful consolidation, one or a number of outsourcing partners may find themselves on the outside looking in. But if Company A and Company B back away from the proposed merger, their respective new business plans may actually call for more robust outsourcing partnerships.

At RMSI, we anticipate that the rate of consolidation in this industry will continue, but with some variance from year to year and the occasional year with almost no consolidation.

Ron Lake, CEO and chairman, Galdos System Inc.  
**Where will the geospatial industry and technology be in 10 years?**

Predicting the future is a difficult task often done by looking at the past—what Marshall McLuhan referred to as “rear-view mirrorism.” Although this is fraught with difficulties, it may help us judge the pace of change that we’re experiencing and reduce the overshoot or undershoot of our projections.

Roughly 10 years ago (1998), I began working on Geography Markup Language (GML). The objectives of that work were in no way revolutionary and simply reflected the desire to integrate geographic information as transparently as possible across all jurisdictional boundaries.

By the year 2000, the Open Geospatial Consortium (OGC) had its first major testbed (WMT 1), and the roles of data servers (later WFS), catalogs, geographic data linking, map styles and application schemas were all established concepts—largely because the concepts pre-existed in other forms.

Now, in 2007, we’re struggling with much of the same issues and challenges. There are, however, some significant differences that constitute “progress” from which we can build a prediction for the coming decade.

Some significant things have transpired in the last decade, including the emergence of open standards for data encoding (GML) and presentation (KML, SVG), open standards enabling geospatial transactions and data access (WFS, WCS), and, most importantly, commercial implementations of these by open-source and commercial vendors. What were concepts in 1998 now are fairly widely available components.



同样也有重要的商业变革。GIS 工业已经由单一的公司 (ESRI) 主导了, 然而同时, 该工业正处于消失的边缘, 从而作为合并到现存工业的地理信息与信息处理的独特实体。

在开放标准的出现与对信息整合的深层次推动, 包括增加的城市复杂性, 涉及安全与气候变化的恐吓, 这个转换已经被部分提示了。

GIS 首字母将不会消失, 我们也不终止发展技术来处理坐标参照, 要素集合及其他描述我们周围世界的方法。然而, 中立 GIS 软件组件的想法将很大程度上成为历史。以城市基础结构设计与管理, 广告, 娱乐等的产品的一部分, 地理信息创造, 操作和管理的机制, GIS 将成为嵌入式技术。

在开发开放标准后, 通过不同的权限, 供应商技术及学科, 一个基本原理已经便利了现有世纪信息整合, 我想这个目标将在未来十年完成——不是 GIS 网络, 而是一个宽松的应用系统网络连接。

开放标准就像 IP 与 HTTP 对于 Internet 一样更加隐藏。我们将认识到未来十年地理网络, 但是它很大程度上是不可见的——除了它让我们在应用级别上所实现的。

关于建筑环境的全球管理, 地理网络整合将尤其重要。除了世界一些区域外, 城市与乡村间的边界将很可能消失。我们将使用整体分析来设计/建设/管理由地理网络推动和被推动的事物。

There have been significant business changes as well. The GIS industry has come to be dominated by a single company (ESRI), while, at the same time, the industry is on the verge of disappearing as a distinct entity as geographic information and information processing merge into existing industries.

This shift has been partially prompted by the emergence of open standards and deeper drivers for information integration, including increasing urban complexity, concern for security and the threat of climate change.

The GIS acronym won't disappear, nor will we cease to develop technology that deals with coordinate referencing, feature geometry and other means of describing the world around us. The idea of independent GIS software components, however, will largely be history. GIS will be an embedded technology with the mechanisms for geographic-information creation, manipulation and management being just parts of products for urban-infrastructure design and management, advertising, entertainment, etc.

One of the rationales behind developing open standards has been to facilitate the ready integration of information about the world across different jurisdictions, vendor technologies and disciplines. I think this objective will be achieved in the next decade—not as a network of GISs, but as a loosely coupled network of application systems.

Open standards will be more “under the covers” in the same way that IP and HTTP are for the Internet. We will realize the GeoWeb in the coming decade, but it will be largely invisible—other than what it will enable us to accomplish at the application level.

GeoWeb integration will be especially important with respect to the global management of the built environment. With the exception of a few areas of the world, the boundaries between the urban and rural world will largely disappear. We will take a more holistic approach to design/build/manage, which will drive and be driven by the GeoWeb.

我不期望我们将实现完全的组件整合透明。标准将带着我们部分上路，而其他的将会是“定制劳力”。随着我们开始理解地理网络作为永久信息基础结构，它将不必成为一个完美的“Lego block”结构来有效的工作。

这也将是关于用户源信息的案例，这些信息将连同专业技术开发的信息变成一个重要组件。有效的工作将变成关键问题，胜于拥有完美的标准与标准一致。

虽然我们不会有飞行汽车，但是我认为我们将拥有相当丰富的环境挣来真实和虚拟世界。都市风景将越过“眼睛糖果”和娱乐，从而形成规划和公用决策的基础。我们的虚拟世界将使社会与政府交互的新方法可用。

### **Will industry consolidation continue at its rapid pace?**

最近两年是以可观数量的合并与收购为特征的，最令人注意的是 NAKIA 收购 NAVTEQ, Hexagon 收购 Leica, TomTom 购买 TeleAtlas, 以及 Pitney-Bowes 收购 MapInfo。

这些并购没有组成 GIS 工业的合并，但是它被吸收进了应用领域（比如长途通讯，车辆导航，后勤），在应用领域中地理信息是临界的。我预测我们将看到进一步的合并来反应这个应用领域的整合。

地理信息技术是一个许多应用领域增长价值的组件，并且这将推动在不久的未来进一步的合并整合。这可能在工程设计/建筑/管理中，像 Autodesk 与 Bentley 可能被更大的国际工程公司合并一样，预先出现。

I don't expect that we will achieve complete transparency in terms of component integration. Standards will get us part of the way, and the rest will be "custom labor and bailing wire." As we come to understand the GeoWeb as permanent information infrastructure, it won't need to be a perfect "Lego block" construction to work effectively.

This also will be the case with respect to user-sourced information, which will become an important component along with the information developed by professional technicians. Working effectively will become the key issue, rather than having perfect standards and standards compliance.

Although we won't have flying cars, I think we will have fairly rich immersive environments that integrate real and virtual worlds. Cityscapes will move beyond "eye candy" and entertainment to form the basis of planning and common decision making. Our virtual world will enable new means of social and government interaction.

### **Will industry consolidation continue at its rapid pace?**

The last two years were marked by a significant number of mergers and acquisitions, the most notable being Nokia's acquisition of NAVTEQ, Hexagon's acquisition of Leica, TomTom purchasing TeleAtlas and Pitney-Bowes acquiring MapInfo.

These acquisitions don't constitute consolidation of the GIS industry, but rather its absorption into application domains (e.g., telecommunications, vehicle navigation, logistics) for which geographic information is critical. I anticipate that we'll see further corporate acquisitions that reflect this application-domain integration.

Geographic information technology is an increasingly valuable component of many application domains, and this will drive further corporate integration in the near future. This can be anticipated in engineering design/build/management/maintenance with companies such as Autodesk and Bentley perhaps being absorbed by larger international engineering firms.

这也将成为交通与远程通讯的案例。我们也可能看到大公司在广告，娱乐，远程通讯与汽车制造这些临界的整合。

Roy Kolstad, vice president and general manager, Enterprise Americas, NAVTEQ

**Where will the geospatial industry and technology be in 10 years?**

在 10 年内，可用基础结构与内容的扩建将大部分完成，大家对于位置技术有了普遍的认识。不再有我们现在所知道的传统“GIS”工业，同时空间技术将几乎能够无缝整合到其他平台中。

同样，由当前许多地理空间专业人员定义的航线将变得更加模糊。我们看到这些了，因为犯罪调查，房地产分析和敏捷发报机正在使用相当先进的空间技术来展现他们的工作——同时像“地理编码”这样的词正在主流的技术世界变得通用。

空间技术与其他 IT 部门的整合也将逐渐成为更加有效的功能或者地理空间技术的战略优势。对于消费者，这些革新将会相当意义深刻的。人，财产与时间的跟踪将成为第二习性，并且将被那些胜于这个时代的人们所采用。

但是，大部分需要深层次技能的专业工作（可用基础机构的建设者与维护人员）将持续，并且甚至会随着一般工业持续的扩张而增长。

但是随着产生的基于位置信息的扩大，我们该做些什么呢？很多知识将在这样的架构下开始形成，并且会出现令人惊讶的可能性，从跨越时间存储位置数据到发现新的先前过于复杂而难以理解的时空模式。

This also will be the case for transportation and telecommunications. We also may see integration across these domain boundaries with larger firms in advertising, entertainment, telecommunications and vehicle manufacturing.

Roy Kolstad, vice president and general manager, Enterprise Americas, NAVTEQ

**Where will the geospatial industry and technology be in 10 years?**

In 10 years, the build-out of enabling infrastructure and content will be mostly complete, and there will be universal awareness of location technology. There will not be a traditional “GIS” industry as we now know it, and spatial technologies will become almost seamlessly integrated with other platforms.

Also, the lines defining many of the current roles filled by geospatial professionals will become more blurred. We see this already as criminal investigators, real-estate analysts and fleet dispatchers are using fairly advanced spatial technology to perform their jobs—and words like “geocode” are becoming commonplace in the mainstream technology world.

Integration of spatial technology with other IT sectors also will evolve as more work functions find efficiencies or strategic advantages in spatial technology. On the consumer side, these changes will be equally profound. The tracking of people, assets and events will be second nature and taken for granted by those born into this time period.

Nonetheless, the most specialized jobs (builders and maintainers of these enabling infrastructures) that require deeper skill sets will persist and even grow as the general industry continues to expand.

But what will be done with all of the reams of location-based information that are being generated? A wealth of knowledge will begin to form in these archives, and there will be amazing possibilities from mining stored location data across time to discover new spatial-temporal patterns previously too complex to understand.

一个很熟悉的例子是：你外出在路上，恰好是高峰时间，周围没有车，然后你想知道“车都在哪？”或者你已经对在某个周日早晨8点的高速路上能够找到一个“停车场”而感到失望，并想知道“为什么现在交通如此拥挤？”大量位置数据将帮助我们更好的理解交通和其他位置相关的，我们世界的方方面面。

### **Will industry consolidation continue at its rapid pace?**

是的，在GIS应用公司的合并将继续，但是我们将看到这些收购的数字未来会缓慢下降。地理空间技术将继续证明自己在商业与政府中，在工业持续的增长下，仍旧是一种有效的，战略性优势的来源。

许多技术发电站将会进行引人注目的投资来进行研发，同时革新也随之而来。我们也将继续看到许多小型公司在论证价值方面的成功。

同样，本地搜索与个人导航设备的广泛增长已经创建了满意的小型工业与特殊应用发展。许多小的起步已经能够确定一些位置内容或者一种引人注目的工具（例如“我在地图的哪里”）。因此合并将在短期内继续，但是这种趋势将随着这个空间开始成熟而减缓，同时收购也将变得不那么频繁了。

Vincent Tao, director, Microsoft Virtual Earth and Local Search Business Unit, Microsoft Corp.

### **Where will the geospatial industry and technology be in 10 years?**

由于地理空间信息融入了信息与通讯技术（ICT），因此它将变得不易区分。我以前用过术语，GeoICT，但是我认为“geo”部分最终将消失。

One example is a familiar story: you're out on the road at rush hour with few cars around and wonder "where's all the traffic?" Or you've been disappointed to find a "parking lot" on the expressway at 8:00 p.m. on a Sunday and wonder "why is there so much traffic now?" Massive amounts of location data will help us better understand traffic and other location-relevant aspects of our world.

### **Will industry consolidation continue at its rapid pace?**

Yes, consolidation in GIS application companies will continue, but we'll see the number of these acquisitions slowly decline in the coming years. Geospatial technology will continue to prove itself as a source of efficiency and strategic advantage in business and government, with industry growth continuing to be impressive.

Many of the technology powerhouses will invest significantly in research and development, and innovation will follow. Still, we will continue to see a lot of smaller companies succeed in demonstrating value.

Also, the wild growth of local-search and personal-navigation devices has created a cottage industry in content and specialized application development. Many small start-ups have been able to identify some location content or a compelling tool (e.g., the "where have I been map"). So consolidation will continue in the short-term, but this trend will slow as this space begins to mature, and acquisitions will become less frequent.

Vincent Tao, director, Microsoft Virtual Earth and Local Search Business Unit, Microsoft Corp.

### **Where will the geospatial industry and technology be in 10 years?**

Geospatial information will become indistinguishable as it's weaved into the fabric of information and communication technology (ICT). I previously used the term, GeoICT, but I think the "geo" part will disappear eventually.

“geospatial”一词是用来同其他工业进行区分。当“geo”在 ICT 中变成一个普遍存在的组件时，地理空间工业将会感激从整合，而非区别中的空前收益。根据 Mark Weiser，分布式计算之父，“最深刻的技术革命是那些消失了的技术。”

从一个信息观点来看，“what, where 及 when” (WWW) 是信息组织与索引的三个基础元素。基于关键词的数据库，管理和搜索技术，最初设计用来处理“what”问题，将来会被显著加强或者重构，以提供“where”与“when”尺度的查询。

从软件到平台，再到设备（例如数据库，操作系统，网络，电话，电视，小型眼镜等等），信息与通讯系统将变得更加位置智能，来直观的处理基于位置的信息。任何信息，无论空间（例如地图，影像，CAD 模型等）或者非空间（例如商务逻辑，文档，新闻，博客，邮件，声音，相片等）都能以空间的形式组织。这个想法不是新颖的，但却是真正的革命，从传统 GIS——管理地理空间信息——转移到新的范例——地理空间信息的管理信息。

从技术角度看，它需要在新的技术，比如地理标签（或地理参照）及基于位置搜索方面进行革新和投资。地理标记把信息与文档地理空间的联系在一起了。

虽然 GPS 与 RFID 定位技术已经在数据收集方面成功使用了，但是如今信息与内容的大部分还不都是地理标记的。分布式与自动化地理标签（例如基于位置的文档解析与照片匹配等）对于制作“可空间索引”数据来说是必要的。

The word “geospatial” was created to differentiate our industry from others. When “geo” becomes a ubiquitous component in ICT, the geospatial industry will appreciate the unprecedented benefits from integration, not differentiation. According to Mark Weiser, known as the father of ubiquitous computing, “The most profound revolutionary technologies are those that disappear.”

From an information viewpoint, “what, where and when” (WWW) are the three fundamental elements for information organization and indexing. Keyword-based database, management and search technologies, originally designed for addressing “what” problems, will be significantly enhanced or re-architected to accommodate queries that have “where” and “when” dimensions.

The information and communication systems, from software to platforms to devices (e.g., databases, operating systems, Web, phones, TVs, smart glasses, etc.), will become more location-intelligent to handle location-based information intuitively. Any information, whether spatial (e.g., maps, images, CAD models, etc.) or nonspatial (e.g., business logic, documents, news, blogs, e-mail, voices, photos, etc.), can be organized spatially. This notion isn’t new, but truly revolutionary, moving away from traditional GIS—managing geospatial information—to the new paradigm—managing information geospatially.

Technologically speaking, it demands innovations and investments in new technologies such as geo-tagging (or geo-referencing) and location-based search (or mining). Geo-tagging associates information and documents geospatially. Although GPS and RFID positioning technologies have been used successfully for data collection, most of today’s information and contents aren’t geo-tagged. Ubiquitous and automated geo-tagging (e.g., location-based document parsing and photo matching, etc.) is required to make the data “spatially indexable.”

基于位置的搜索解决了用户关于“where”的问题。就像今天的网络搜索，它需要一个可升级架构来处理基于位置的行进，索引和有效挖掘。我们还处在完全的，地理空间的揭开信息潜力的早期。

与技术演变平行的是，商业模式将经历一些戏剧性的改变。对于消费者市场来说，位置对于人们的生活，住宅到开车，购物和娱乐来说是一个重要元素。例如，由在线研究产生的全部购买的63%出现在线下。这表明购物很大部分是本地的。

这也说明了我们当前电子商务系统无法切断线下事务，从而出现了一个重要的鸿沟。位置能被用来跟踪用户的购物行为吗？位置能被用来结合线上与线下的活动吗？我喜欢“L-commerce”术语，并相信新的位置商务模型将在这个新的范例转换下出现。

### **Does neogeography help or hurt the geospatial industry?**

新地理的增长是令人难以置信的，因为它昭示这制图进入了非传统的用户团体，也就是大量的消费者用户。但是新地理不是合适的术语来描述这个革新。大部分用户对地理本身并不感兴趣，但是对以一种新的方式组织信息，并挖掘位置上下文知识（例如提供一个本地餐馆的评论内容或者发布异国情调的旅行照片）感兴趣。

重要的是制图变成了一个社交媒体。制图是一种媒体，就像一个电视频道。相比较内容是编辑创作的传统媒体（例如报纸，电视，收音机等）而言，社会媒体的核心观念（例如 Wikipedia，YouTube）允许用户共享内容，意见，经验及任何民主的事。给予不以任何出版形式存在的最多本地知识，社交媒体为人们分享知识（例如 Sherry Hair Salon is less crowded on Thursday”或“Dr. Doddi’s dental office is highly recommended.”）提供了一种有效的媒介。

Location-based search addresses users’ questions about “where.” Like a Web search today, it requires a scalable architecture to handle location-based crawling, indexing and mining efficiently. We’re still at an early stage in fully unlocking the potential of information geospatially.

In parallel with the technological evolution, the business model will undergo some dramatic changes. For the consumer market, location is a critical element to people’s lives, from housing to driving, shopping and entertainment. For example, 63 percent of all purchases resulting from online research occur offline. This shows that shopping is largely local.

It also shows that there’s a significant gap in our current e-commerce system in which online sites can’t take a cut from offline transactions. Can location be used to track users’ shopping behaviors? Can location be used to tie online and offline activities? I like the term “L-commerce” and trust that new L-commerce models will emerge with this new paradigm shift.

### **Does neogeography help or hurt the geospatial industry?**

The growth of neogeography is incredible, as it signals that mapping is penetrating into the non-conventional user communities, namely massive consumer users. But neogeography isn’t the proper term to describe this change. Most users aren’t interested in geography itself, but in a new way to organize information and discover knowledge with the context of location (e.g., offering the review comments of a local restaurant or publishing travel photos of an exotic area).

What’s important is that mapping becomes a social media. Mapping is a media, like a TV channel. Compared to traditional media (e.g., newspaper, TV, radio, etc.), where content is created by editors, the key concept of social media (e.g., Wikipedia, YouTube) is its ability to allow users to share content, opinions, experiences and anything democratically. Given that most local knowledge doesn’t exist in any published format, social media provides an effective vehicle for people to share such knowledge (e.g., “Sherry Hair Salon is less

在社交媒体与本地内容中存在一种组织关系。一个新的形式，所谓的“社会目录”已经在最近几年以指数形式增长了。相对于专业的收集黄页清单，这种本地内容通常是新生和丰富的，但是缺乏组织。如果你访问 [maps.live.com](http://maps.live.com)，你将看到一种新的搜索标签，在三个其他搜索标签（Business, People 和 Location）中的 Collection。现在你能够知道微软正在朝那个方面前进。

继续向前，我相信我们将依赖由专业人员与偶尔用户提供的内容来丰富我们的体验。随着用户产生的本地内容呈现指数级的增长，经常是扩散或者成片断的情况，在内容整合，聚合，索引，过滤与质量控制中出现重要的商业机会。新地理对于那些不能接受革新的人来说仅仅是一个恐吓。

William D. Goran, technical director, Engineer Research and Development Center, U.S. Army Corps of Engineers

**Extending the “reach” of geospatial knowledge:**

早前的数据地理空间能力，例如 GIS，聚焦于存储，操作，比较和分析数据的环境。这些能力产生了地理空间专业人员的增长与空间信息更有创造性的使用。最近几年，已经有了新一代的能力（例如 Google Earth 类型的环境和移动计算设备的地理数据），很好的把地理空间信息打包给用户使用。

虽然我们已经看到了地理空间能力在最近几十年的非凡优势，但是我们还没有在公众空间理解中模拟出相同的优势。这个鸿沟对我们的未来是很重要的，因为我们需要在全球社会中空间的认识公民。

crowded on Thursday” or “Dr. Doddi’s dental office is highly recommended,” etc.).

There’s an organic relationship among social media and local content. A new form called “social directories” has grown exponentially in the last few years. Compared to the professionally collected yellow-page listings, this local content is generally fresh and rich, but less organized. If you visit [maps.live.com](http://maps.live.com), you’ll see a new search tab, Collection, among three other search tabs: Business, People and Location. Now you can tell where Microsoft is heading in this direction.

Moving forward, I believe we will rely on content provided by professionals and casual users to enrich our experiences. With the exponentially increasing volume, often proliferated or fragmented, of user-generated local content, there are significant business opportunities in content integration, aggregation, indexing, filtering and quality control. Neogeography is only a threat to those who can’t adopt to the changes.

William D. Goran, technical director, Engineer Research and Development Center, U.S. Army Corps of Engineers

**Extending the “reach” of geospatial knowledge:**

Early digital geospatial capabilities, such as GIS, focused on environments to store, manipulate, compare and analyze data. These capabilities spawned the growth of geospatial professionals and more creative uses of spatial information. In recent years, there has been a new generation of capabilities (e.g., Google Earth-type environments and geodata in mobile-computing devices) that nicely package geospatial information for public use.

Although we’ve seen remarkable advances in geospatial capabilities in recent decades, we haven’t stimulated equal advances in public spatial understanding. This gap is critical for our future, as we need spatially aware citizens across the global community.

这代表了挑战，但是令人振奋，还有市场机遇。Google Earth 类型的工具已经帮助了——在没有认识大洲的形状，也不知道一个区域或者州的相关位置时，用户不能从空间中放大。另外，还经常有一个社会使用尺度，旁观者通过记录难忘的要素来帮助他们的朋友进行导航。

然而，空间学习对于许多人是个挑战，同时我们的地理空间能力应该清晰的提供与不同学习风格相连接的空间信息多样表现。对一些人，在动态模压表面，与投影交互来说明不同场景下的要素变化，学习将能够通过触觉实现。

对于其他人，交互式的声音提示，嵌入了数字数据，将帮助用户保留空间知识。对于我们的大部分来说，交互空间游戏环境将增强空间学习与保持力。包括了用户添加内容的游戏(例如新地理)对于空间学习来说将是尤其有价值的。

为了增强公众空间认知，我们需要把空间游戏环境作为学校地理体验的一部分，将游戏设计元素整合到全部人口获得的新闻信息与存储的多种媒体的选择方式。

**Sensor advances:**随着传感器的成本降低，功能与组织能力的提高，我们将怎样开拓传感器网络的可能性？如今，利用位置报告，我们使用传感器设备，跟踪交通工具在路上的位置与速度，它还可以高速我们关于预排程序的路况信息。

明天，我们的传感器网络应该能够提供动态和实时的前方路面信息，这些道路的环境情况，其他实体信息，以及沿路改变要素。

This presents challenging, but exciting, market opportunities. Google Earth-type tools have helped—users can't zoom in from space without recognizing the shape of the continents and knowing the relative location of a region or state. In addition, there's often a social-use dimension, with onlookers helping their friends navigate through "landmarks" by noting memorable features.

However, spatial learning is a challenge for many, and our geospatial capabilities should explicitly provide diverse presentations of spatial information that connect with different learning styles. For some, learning will be enabled by a tactile experience with dynamically moldable surfaces that interact with projections to illustrate feature changes under difference scenarios.

For others, interactive audio cues, embedded in digital data, will help users retain spatial knowledge. And for many of us, interactive spatial game environments will enhance spatial learning and retention. Games that include users adding content (e.g., neogeography) will be especially valuable for spatial learning.

To enhance public spatial understanding, we need spatial gaming environments to be part of the school geography experience, with game-design elements integrated into the way the entire population acquires news information and stories through various media options.

**Sensor advances:** How will we exploit some of the possibilities of sensor networks as they become increasingly capable in terms of function and organization while costs decrease? Today, we use sensor devices, with positional reporting, to track vehicle location and speed on roadways and tell us about pre-programmed road information.

Tomorrow, our sensor networks should be able to provide dynamic and real-time information about the paths ahead, the conditions on these paths, the presence of other entities and changing features along or beside these paths.



这些传感器网络将最终便利机器人导航阶段但是在近期，他们将提高驾驶体验，可能首先是路面安全情况报告。

William S. Holland, principal, GeoAnalytics Inc.

### **Where will the geospatial industry and technology be in 10 years?**

经常说道历史是未来的最好预测者。如果是真的，回顾二十年前，我们停止在地理空间工业可能带来的一切。

最近一个聚集了美国政府 GIS 领导者的会议，很多讨论集中在各种核心地理空间数据的联合与协作并购。这个数据中心的讨论把我们分为了几个等级。

第一，讨论的本质一直没有发生多大的变化。第二，可能更重要，如果我们必须抓住国家“bake sale”的等价物来投资核心数据发展与更新，那么很清楚的是，相对于其他少数人，决策制定者不会评估这些投资的。

因此作为一个工业，我们还没有足够的相关商业家合资。我们的数据与系统还没考虑过能够推动政策清晰表述和执行，反过来有义务的战略资源。

虽然这可能是一个阴暗的估价，但是我们已经看到了在精神，方法和优先权的转变了——一种从建设数据基础结构到杠杆平衡现存投资，再到帮助形成战略与运作决策的转变。我已经在实践中看到了这种精神，一些精选的政府与私有客户已经开始理解位置对于理解，执行，成果，选择和他们相关的含义来说是整体的。当握有支票本的领导看到位置是战略与运作决策不可缺少的一部分时，他们将很高兴的在数据和系统方面投资。

These sensor networks will eventually facilitate various stages of robotic navigation. But in the nearer term, they will improve the driver experience, perhaps first in the reporting of road-safety conditions.

William S. Holland, principal, GeoAnalytics Inc.

### **Where will the geospatial industry and technology be in 10 years?**

It's often been said that history is the best predictor of the future. If that's true, looking back a couple of decades, we're given to pause as to what the future of the geospatial industry may bring.

At a recent conference that brought together governmental GIS leaders from across the United States, much of the discussion focused on joint and collaborative acquisition of various core geospatial data. This data centric discussion concerned us on several levels.

First, the fundamental nature of the discussion hasn't changed much through time. Second, and perhaps more importantly, if we must hold the equivalent of a national “bake sale” to fund core data development and renewal, it's abundantly clear that decision makers currently don't value these investments in contrast to other priorities.

So as an industry, we haven't yet delivered enough relevant business value. Our data and systems aren't yet considered strategic resources that can drive policy formulation and execution and, in turn, accountability.

Although this may be a gloomy assessment, we've also seen changes in mindset, approaches and priorities—a shift of focus from building a data infrastructure to leveraging existing investments to help shape strategic and operational decisions. I've seen this mindset in practice with some select governmental and private clients who have come to understand that location is integral to understanding, performance, outcomes, alternatives and their related implications. When the leaders who control the checkbooks see location as indispensable to strategic and operational decisions, they will gladly make investments in data and systems.

因此展望未来 10 年意味着什么呢？有两条途径：

1. 我们的工业被当作“烧钱中心”，一直寻求对新数据与更新数据的投资。这种情况下，将没有相关的改变，导致现在革新与进步。

2. 空间爱你信息与系统变成了一个“利益中心”，它通过把地方分析性作为传统商业与决策支持系统的一个完整组件，创造新的商业价值与成果。

我强烈的相信后一场景。只有在那种方式下技术与组织革新将会有动力和奖赏。我们的工业与技术能以奇幻的发展与机遇变成更大技术的一个完整部分。

然而，在这种处理中，有可能“GIS”，“地理空间”等，将失去他们分离的特性——因为它们应该这样。当我们的数据与技术基础的——当它们成为在指定与评估决策支持中提供理解，上下文和智能不可缺少的一部分时，我们将实现真正的成功。

### **Will industry consolidation continue at its rapid pace?**

为了回答这一问题，必须要考虑合并的推动力。

高固定成本和经济节约能推动合并。在一些地理空间工业的尺度下（例如数据开发），固定成本是很高的，并且剩余是很少的，因为这些产品变得更加日用化了。在那种环境中，合并，收购和不正式合并（合资等）正日益合理，因为公司通过占据更大的市场份额寻求回报与利益增长。

在一个市场中，有潜力显著增长，尤其是现存市场份额聚集在少数人手里，合并也将有意义。在 GIS 软件工业，最近几年出现了高度的集中，一个主宰型公司，很少有相关的提供者。

So what does this mean looking 10 years in the future? There are two paths:

1. Our industry is perceived as a “cost center,” constantly seeking funds for new and updated data. In this scenario, there will be little change in relevance, resulting in modest innovation and progress.

2. Spatial information and systems become a “profit center” that creates new business value and outcomes by leveraging the power of place analytically as an integral component of transactional business and decision-support systems.

I strongly believe in the latter scenario. Only in that way will technical and organizational innovation be motivated and rewarded. Our industry and technology can become an integral part of the larger technological juggernaut with fantastic developments and opportunities.

In the process, however, it’s likely that “GIS,” “geospatial,” etc., will lose much of their separate identity—as they should. We will have achieved true success when our data and technologies are fundamental—when they’re indispensable to provide understanding, context and intelligence in support of making and evaluating decisions.

### **Will industry consolidation continue at its rapid pace?**

To answer this question, one must consider the impetus for consolidation.

High fixed costs and resultant economies of scale can drive consolidation. In some dimensions of the geospatial industry (e.g., data development), fixed costs are high and margins are thin as these products become more commoditized. In that environment, mergers, acquisitions and informal consolidation (joint ventures, etc.) are increasingly rational as firms seek revenue and profit growth by garnering more market share.

Where there’s potential for significant growth in a market, especially where the existing market share is concentrated in few hands, consolidation also makes sense. In the GIS software industry, there has been a high degree of concentration in the last several years, with relatively few providers and one dominant firm.

同时,虽然在公众和社会部门中存在深度的市场渗透,但是 GIS 并没有在商业部门中成为“主流”。GIS 软件潜在的市场能够增长成现在尺寸的许多倍。

面对着一个公司的主导,竞争者们将会经常通过收购寻找买方市场份额。此外,给予分析 GIS 的复杂度,许多竞争者也可能通过并购寻求购买创新。一些最近的收购反应了这些推动。

相反的,地理空间市场的潜力增长也抓住了那些不是与 GIS 传统的联系在一起的公司的注意力。他们开始在软件,数据或者更广泛的商业解决方案中竞争。

虽然这些市场进入验证空间技术的潜力,在短期可能没有多少的合并出现。更有可能的是,巨型,良好资金基础的公司将开始直接与传统软件和数据提供者进行竞争,导致合并减少,而不是增多。

同时,开源团体可能引出大量新的竞争者,他们更小,更敏捷,并且关注小环境应用和解决方案。这些竞争者可能加入更大的市场传播,而不是合并。

Xavier Lopez, director, spatial technologies, Oracle Corp.

### Where will the geospatial industry and technology be in 10 years?

在 10 年中,地理空间工业将非常不同。许多用于发布地理空间内容的技术将变成主流软件产品工具的“特征”,企业商业应用和在线服务。

过去,家喻户晓的软件,例如 Adobe, Google, Microsoft, Nokia 和 Oracle 已经在地理空间技术方面做了重要的投资。后来的像 Nintendo, SAP, Sony, Second Life 及主要的移动服务提供者都可能在未来进行投资。

At the same time, although there's deep market penetration in public and social sectors, GIS hasn't become "mainstream" in the commercial sector. The potential market for GIS software could grow many multiples of its current size.

Faced with the dominance of one firm, competitors often will seek to "buy" market share through acquisitions. Moreover, given the complexity of analytical GIS, many competitors also may seek to buy innovation through acquisitions. Some of the recent acquisitions reflect these impulses.

In contrast, the geospatial market's potential growth also captured the attention of firms not traditionally associated with GIS. They're beginning to compete in software, data and broader business solution sets.

Although these market entries validate the potential of spatial technologies, there may be much less consolidation in the short term. Rather, it may be likely that the behemoth, well-funded firms will begin to compete directly with traditional software and data providers, making for less consolidation, not more.

At the same time, the open-source community may introduce a new raft of competitors that are smaller, nimbler and focused on niche applications and solutions. These competitors likely will add to greater market diffusion, not consolidation.

Xavier Lopez, director, spatial technologies, Oracle Corp.

### Where will the geospatial industry and technology be in 10 years?

In 10 years, the geospatial industry sector will be very different. Many technologies used for publishing geospatial content will become "features" of mainstream software-productivity tools, enterprise business applications and online services.

In the past, household software names such as Adobe, Google, Microsoft, Nokia and Oracle have made major investments in geospatial technology. Newer names such as Nintendo, SAP, Sony, Second Life and the major mobile-service providers are likely to invest in the future.

补充的技术领域，像 GPS，传感器，机器景象，本地搜索，灵活性与游戏性，将扩展地理空间技术，内容和服务。另外，开源技术与商业模型将成熟，并扮演一个日益重要的角色。最终，随着空间技术变得深入，空间思想与意识可能被扩展。

简短的说，我们正在进入一个这样的时代：这个时代地理空间解决方案将由非地图接口，例如声音，姿势，文本或者表现来推动。其他解决方案将使用由自动化，多尺度数据采集革新来推动的 3-D 环境。

近期的关于管理，分析和可视化——点云，3-D 城市模型，以及地理参照视屏技术——将复兴这个工业。这些技术将引出新的数据管理，可视化和分析挑战。工业将需要融合大量的实时的，机器生成的传感器数据。

它也将需要为网络与移动平台最优化高级安全与可升级网络计算解决方案。面对这些挑战，必要的创新等着我们。

### **Will industry consolidation continue at its rapid pace?**

是的。地理空间技术给广阔种类的技术与服务公司提供了重要的区分价值。收购与合并几乎已经影响到了每个主要的独立 GIS 软件供应商。

然而，这个行为并没有限制软件。内容提供者，例如 GeoEve, DigitalGlobe, NAVTEQ 和 Tele Atlas 已经在运作了。其他的像 Hexagon (Leica) 和 Trimble 已经通过并购扩展了他们的测量与解决方案提供

Complementary technology areas, such as GPS, sensors, machine vision, local search, mobility and gaming, will broaden the uptake of geospatial technologies, content and services. In addition, open-source technologies and business models will mature and play an increasingly important role. Finally, spatial thinking and awareness are likely to expand as spatial technologies become pervasive.

In short, we're entering a new era in which geospatial solutions will be driven by non-map interfaces such as voice, gesture, text and presence. Other solutions will use immersive 3-D environments driven by automated, multi-dimensional data collection innovations.

Recent technologies for managing, analyzing and visualizing data—point clouds, 3-D city models and georeferenced video—will reinvigorate the industry. These techniques will introduce new data management, visualization and analytic challenges. The industry will need to fuse enormous amounts of real-time, machine-generated sensor data with other application data.

It also will need to optimize highly secure and scalable grid-based computing solutions for delivery through the Web and mobile platforms. The innovations necessary for meeting these challenges await us.

### **Will industry consolidation continue at its rapid pace?**

Yes. Geospatial technologies deliver important differentiating value to a broad category of technology and services companies. Already, acquisitions and consolidation have affected nearly every major independent GIS software vendor.

This activity, however, isn't limited to software. Content providers such as GeoEye, DigitalGlobe, NAVTEQ and Tele Atlas have been in play. Others such as Hexagon (Leica) and Trimble have been broadening their measurement and solution offerings through acquisitions.

通过合并产生的更大的公司将推动地理空间技术进入主流，取得比小公司更大的成功，更专业的公司能够独自去完成。同时，小公司也将继续浮现，并且在地理空间工业中培育创新。

The larger companies created through consolidation will drive geospatial technologies into the mainstream with greater success than smaller, more-specialized players can do alone. At the same time, smaller companies will continue to emerge and foster innovation in the geospatial industry.