

# GIS Industry Outlook

## 1998—The Dawn Of A

### New Decade

很难想象，在 1998 年，GIS WORLD 就要庆祝 10 周年庆了。这是不平凡的 10 年，地理学科技工业有了显著的进步。回顾这些使得我们的编辑人员想要知道下一个 10 年将会发生什么。因此我们认为这将会是个最好的机会来让我们的编辑顾问部门成员们好好观察一下他们的“水晶球”，并尽可能准确地推测今后 10 年这个工业的方向。诚然，有很多东西需要去考虑。但是考虑到我们的部门成员是一些在这个工业界中最具创新性人物的事实，因此看起来一种合理的实现方式便是发动一场关于当今领先的空间技术的长期讨论与辩论。以下便是他们的回应。

Joseph H. Astroth Jr., vice president, GIS Market Group, Autodesk Inc., San Rafael, Calif.

当今 GIS 软件最根本的转变将在 2000 年成为 GIS 的基础。到那时，这些具有革新精神的工业领导者们的推动社会的变革将成为整个 GIS 软件的“胶合剂”。结果，GIS 将会发生大“爆破”，从一个“自动控制的小岛”转变成贯穿企业应用的具有重要使命的应用。

在 10 年中，GIS 软件将会存在于每一个的桌面上，易学易用，对那些偶尔使用，握有权利的用户来说很有吸引力，同时还能使用户平衡数据投资。如今，伴随着基于 Windows-NT，允许用户无需转换便可读取各种标准 GIS 数据格式的革新软件工业的种子正在被播下。

It's hard to believe, but *GIS WORLD* will celebrate its 10<sup>th</sup> anniversary in 1998. It's been an amazing 10 years, considering the remarkable advancements made in the geographic technology industry. Thinking about it made our editorial staff wonder what the next 10 years holds. So we thought this would be a prime opportunity to ask our Editorial Advisory Board members to look into their crystal balls and take their best shot at predicting where the industry will be 10 years from now. Granted, it's a lot to think about. But considering the fact our board members are some of the most innovative people in the industry, it seems an appropriate exercise to spark discussion and debate involving the long-term future of today's leading spatial technologies. Here are their responses.

Joseph H. Astroth Jr., vice president, GIS Market Group, Autodesk Inc., San Rafael, Calif.

Today's radical transformations in GIS software will be the cornerstones of GIS in the year 2000. By that year, changes that innovative industry leaders are pushing today will be cemented throughout all GIS software. As a result, GIS will have exploded from an island of automation into a mission-critical application used throughout the enterprise.

In 10 years, GIS software will be on every desktop. It will be easy to learn and use, appeal to casual and power users, and let users leverage their data investments. The seeds are being sown with today's introduction of innovative software that's Windows/NT-based and allows users to read and write a variety of standard GIS data formats

以前的基于 UNIX 工作站式的 GIS 将会为那些使用标准计算机环境（比如如今的 MS Office），并且在 GIS 中直接使用“一体化核心编程语言（比如 VB）”所整合的技术让路。

另外，新的网路计算环境将让每个人拥有“机构”层次的视野，并以一种高效，低成本的地理上下文形式查询和汇报信息。在 10 年中，网络就是计算机。由如今突破性技术所领衔，GIS 软件将充分发挥 Internet 的优势，彻底的通过 Internet 的结构建立，允许每个人在网络的任何地方，以一种快速，易于维护和配置的瘦客户端来访问数据。

Peter M. Batty, vice president of applications development, Smallworld Systems Inc., Englewood, Colo.

2007 年，城市和管理已经由机构与个人进行了改革，它可以通过无线通讯对不同数据库的复杂数据进行交互访问。

Anne 正在向前驾驶，突然她的车对她说，“你应该在下一个交叉路口向右拐，因为一组水设施员工将要在 10 分钟内在 First 和 Oxford 开展一些主要的工作。你可以改道到 Bill Gates 体育场。”她的儿子 Jimmy 问道，“究竟 Bill Gates 是谁？”她答道，“当电脑用来填充你的公文包，并且还不好用时，他一直掌管着一家大型的软件公司。”你不应该仅仅像刚才那样与他们谈话。

without conversion. The historically UNIX workstation-based GIS will give way to one that's integrated with the standard computing environment (such as Microsoft Office today), and incorporates key programming languages directly into the GIS (such as [Visual Basic for Application] today).

In addition, the new network computing environment will let every person in an organization view, query and report information in a geographic context with peak efficiency and at a low cost. In 10 years, the network will be the computer. Led by today's breakthrough technology, GIS software will take full advantage of the Internet by being built from the ground up for the Internet's architecture, allowing anyone to access data anywhere on the network using a fast, thin client that's easy to maintain and deploy.

Peter M. Batty, vice president of applications development, Smallworld Systems Inc., Englewood, Colo.

It's the year 2007. The operation of cities and utilities has been revolutionized by organizations and individuals with interactive access, via wireless communications, to complex data in each other's databases.

Anne is driving along, and suddenly her car says to her, "You should take right at the next intersection, as a water utility crew is going to start some major work at First and Oxford in 10 minutes. You can take Fourth down to Bill Gates stadium instead." Her son Jimmy asks, "Who was Bill Gates anyway, mom?" She replies, "He used to run a big software company in the days when computers used to fill your briefcase and they were really difficult to use." You couldn't just talk to them like you done now.

一位设施施工工人在一个杆子上连接了一个新的变压器。他对他的手表说，“OK，我完成了。”那个手表，是带有全球定位系统和无线通讯系统的，它从变压器的条形码中读取了其所有的相关信息，然后向主要的设施计算机系统发送了信息。在办公室中的一个管理员在 3-D 的虚拟现实的屏幕上观看场景，并且看到了变压器的出现。他看到施工工人在地上，他的精确位置为 GPS 确定。电脑对他说，“我应该恢复网络的这部分工作吗？”视图放大，远处一个户外沿街的开关闪现出来。“当然，”管理员说道，然后开关再一次自动闭合了。

在 Jack's Bar 里，当地的人们看着电视的新闻。电力公司的主管正在滑雪坡上做一个陈述，通过内嵌在他的手表中的视屏电话播送，描述了当前的电力故障范围以及修复时间。随着他的讲话，电子地图从他的手表中播送着，以阐明他的观点。一位老者坐在 bar 中对着店主说道，“如今真是个小世界啊，不是吗？”他答道，“是啊，我惯于独自沉醉在软件中，但是最近几年事务已经变得太多了。”

Donald F. Cooke, president, Geographic Data Technology Inc., Lebanon, N.H.

在 2007 年，商业地理将表现出以一种柔和方式嵌入到管理系统——我将它称作“无形地图”的应用的特色。用户将被吸引，嵌入到地图和空间计算的复杂桌面制图和 GIS 系统仅仅会在紧密相关的垂直市场的决策支持和管理系统优化中需要。我们逐步看到了端倪，用户能够在 VB 开发中使用像 ESRI 的 MO 类似的软件嵌入地图。

A utility construction worker finishes connecting a new transformer on a pole. He says to his wristwatch, “OK, I’m done.” The watch, which includes a Global Positioning System (GPS) and wireless communication system, read all the relevant information about the transformer from the electronic equivalent of a bar code and sends a message back to the main utility computer system. An operator back at the office looks at a 3-D virtual reality view of the scene and sees the transformer appear. He sees the construction worker down on the ground, his exact position given by GPS. The computer says to him, “Shall I reactivate that section of the network?” The view zooms out, and an open switch farther along the street flashes. “Sure,” says the operator, and the switch is closed again automatically.

Down at Jack's Bar, the locals are watching the news on TV. The president of the electric company is making a statement from the ski slopes, broadcast via the video phone built into his watch, describing the scope of the current power outages and how soon they'll be fixed. As he talks electronic maps are broadcast from his watch to illustrate his points. One of the old guys sitting at the bar says to the proprietor, “It's a small world these days, isn't it?” He replies, “Yes. I used to be in the software industry myself, but things have changed a lot during the last few years.”

Donald F. Cooke, president, Geographic Data Technology Inc., Lebanon, N.H.

Business Geographic in 2007 will be characterized by GIS technology embedded in operational systems in an unobtrusive manner-what I call “invisible map” applications. Users will have gravitated away from feature heavy, complicated desktop mapping and GIS systems to embedding maps and spatial calculations only as needed in decision support and operational systems optimized for tightly defined vertical markets. We're seeing the beginning of this already in the case with which users can embed a map into a Visual Basic application using software like ESRI's MapObjects.

作为国家空间数据基础结构,美国政策将空间数据集作为了一种公共商品,从而牟取利益,我期望对联邦预算施压来进行挤榨,尽管得不到妥协。就像美国地质勘测已经将大部分数字正摄影像产品出租给私人承包商一样,我怀疑这会对像出租【拓扑完整地理编码与参照】文件维护的人口调查局等的中介有意义。这仅会在像包括私营部门在内的部门提高公共领域数据质量,并戏剧性的降低这一计划的花销时才会发生。我确信,高质量低成本将会在 2007 年得意实现。

Jack Dangermond, president, Environmental Systems Research Institute Inc., Redlands, Calif.

如果我们想要回忆 10 年前 GIS World 诞生时的 GIS 是什么样,没有什么人能够预测到从 1987 年到现在所发生的令人难以置信的变化。再向前看,我们可以期待更大速度的变化,以前对 GIS,科学,社会的强力冲击与深刻影响。

根据摩尔定律,每 18 个月翻倍,硬件性能将会继续提升。这意味着标准处理器将会在 10 年内提高将近 1000 倍。这不仅意味着大型数据库的闪电性能,它同样意味着在可使用性上的重大提高(声控用户接口和触摸屏)。基于组件技术的 GIS 软件将会使 GIS 成为主流计算机应用的一部分。传统的数据和应用定制瓶颈将会由于先进的数据采集能力(一个全球定位系统设备与所有具有发送位置与状态数据能力的设备相连接),和特殊目的应用大量削减对定制的需求,得到最大程度的解决。

GIS 不会消失,但是会将它的焦点从技术上转移到科学和社会热点。GIS 的前途是光明的。

As for the National Spatial Data Infrastructure, I expect relentless pressure on federal budgets to squeeze, though not compromise, the U.S. policy of providing spatial datasets as a public good for copying costs. Just as the U.S. Geological Survey has farmed out most digital orthophoto quad production to private contractors, I suspect it will make sense for agencies such as the Census Bureau to farm out [Topologically Integrated Geographic Encoding and Referencing] file maintenance. This will happen only if such private-sector involvement improves the quality of public-domain data and dramatically reduces the cost of such a program. I'm convinced that better quality at lower cost will be achieved by 2007.

Jack Dangermond, president, Environmental Systems Research Institute Inc., Redlands, Calif.

If we try to remember what GIS was like 10 years ago when *GIS world* started, few of us would have been able to predict the incredible changes that have taken place since 1987. Looking forward, we can expect an even greater rate of change and some profound impacts on GIS, science and society.

Hardware performance will continue to improve according to Moore's law, doubling every 18 months. This means that the standard processor will be approximately 1,000 times faster in 10 years. Not only will this mean lightning performance for even large databases, it also will allow significant advances in usability (voice-based user interfaces and touch screens). GIS software based on component technology will allow GIS to be part of mainstream computer applications. The traditional bottlenecks of data and application customization will be largely resolved because of advanced data collection capabilities (a Global Positioning System device associated with all assets capable of broadcasting positional and status data) and because specific purpose applications largely will remove the need for customization.

GIS will not disappear, but will change its focus from technological to scientific and societal issues. The future of GIS is bright indeed.

Bishop Dansby, chief executive officer, American Cadastre Inc., Harrisonburg, Va.

正在进行的对高分辨率影像及 GPS 技术的论证将会对未来十年 GIS 本质产生重要影响。

这些技术将有效去除 GIS 数据与处理的类似的，手工的和硬拷贝问题。

具有 1 米或者更高分辨率的地理参照空间影像将对被认为是 GIS 的大部分应用的基础地图发展占据优势。矢量地图和各种其他的派生物将无需人类干涉便可从影像中自动的生成。将来，需要矢量或派生信息的分析将会经常通过潜在的影像数据库“无须加工”的，透明的创建派生数据来实现。甚至，地产权或者边界数据一开始就是数字化的，就像契约和测量过程将以数字格式建模，使用由 GPS 技术获得的坐标。

当地与国家政府对于地理信息和 Internet 的实用性的广泛需求将会导致大部分地理数据名义上的易用，（信息自主法案）对公众的等级费用。将来仍旧会有许多机会来向数据添加数值，但是大部分都将成为属性数据，作为异样地理要素，来符合某种特殊需求。

大部分 GIS 处理和数据开发将会由各个机构，使用 GIS 工具，在“桌面”上完成。GIS 的供应商将会聚焦于进行处理与分析的复杂软件的开发，提供 GPS 相关技术与空间影像。

Charles H. Drinnan, executive consultant, Logica Inc., Houston, Texas

我预测在 GIS 工业接下来的 10 年中将会发生如下的变化。

1、GIS 将会变成组件对象技术。这些对象将会在能力上一直进行提高，直到 GIS 被用户与开发人员所接纳。

Bishop Dansby, chief executive officer, American Cadastre Inc., Harrisonburg, Va.

Ongoing improvements to high-resolution space imagery and Global Position System (GPS) technology will have a major impact on the nature of GIS in 10 years.

These technologies will effectively remove most of the last shreds of analog, manual and hard-copy aspects of GIS data and processing.

Georeferenced space imagery with resolutions of 1 meter or greater will dominate base map development for almost all applications that would be thought of as GIS. Vector maps and various other derivatives will be produced automatically from the imagery with little human intervention. Further, analyses that require vector or derivative information often will be done by creating the derivative data “on the fly” and transparently from the underlying imagery database. Even cadastral or parcel boundary data will be digital in the first instance, as deeds creation and surveying practices will become modernized in digital format, with coordinates produced from GPS technology.

The expansive need of local and state government for geographic information and the availability of the Internet will result in most geographic data being readily available at nominal, (Freedom of Information Act) level costs to the public. There still will be many opportunities to add value to the data, but that will be mostly in the form of attribute data, as opposed to geographic features, to suit a specialized need.

Most GIS processing and data development will be done on the “desktop” by the organizations using GIS tools. GIS vendors will focus on developing sophisticated software for processing and analysis, providing GPS-related technologies and space imagery.

Charles H. Drinnan, executive consultant, Logica Inc., Houston, Texas

I predict the following changes will occur in the GIS industry 10 years hence:

1. GIS will become component, object technology. These objects will increase in capability until GIS is taken for granted by the user and the developer.

2、巨型，整合的 GIS 数据库将会以消费者的价格层次出现而被容易使用。用户用他们的指尖就可以得到大比例尺地图和设施数据，并且事实上访问也是直接的。分布式技术，大存储量能力，高带宽，高速网络，新兴 GIS 数据库技术，以及面向应用的访问将会结合起来为用户提供可承受的费用数据。

3、一种“直观的”范例将从应用，对象，先进的用户接口以及人工智能专家系统技术的融合中出现。GIS 用户接口仍旧是源于过去的架构，并且对于野外或者一般用户而言是不适用的。在以后的几年中，用户将会陷入混乱的无组织数据和系统的沼泽。完整的用户范例将会朝着用户方向和高度直观的知识接口来改变。结果会更像我们所设想的，而不是我们的系统所组织的那样。

4、新技术功能的同化还要花些时间，但是新兴应用的步伐却在加速。最后的十年已经告诉我们，大的改变慢慢来临了。现代的用户接口衍生于 Mac 与更早的 XEROX。在 GIS 也有了这些接口后，我们还会在为客户服务器各自的优点争论 20 年。我期望 NT 操作系统能够成为以后可选的操作系统。从现在起的 10 年，我们仍将为空间标准，对象整合与真正的分布式系统而工作吗？我怀疑是这样的。

5、成功的企业们将会由高度的企业和系统网络相互依赖性而合作共存。敏捷，可伸缩，可靠性和完整性将会成为这些企业的特点。不懂得合作共赢的企业将会由于用户不愿意接受高费用没有附加值，其他供应商不愿意在无利益的商业环境中浪费时间，以及一个不可宽恕的行业的情况下，被远远的落在后面。在一个快速变化的环境中，企业将不得不去获取他们的商业，并且证明这些事务的价值。

2. Huge, integrated GIS databases will be readily available at consumer price levels. Users will have large-scale map and facility data at their fingertips, and access will be virtually immediate. Distributed technology; massive storage capabilities; large-bandwidth, high-speed networks; new GIS database technology; and application-oriented access will combine to bring data to all users at affordable desktop costs.

3. An “intuitive” paradigm will emerge from the amalgamation of applications, objects, advanced user interfaces and artificial intelligence/expert system technology. GIS user interfaces still are derived from the architectures of the past and are inappropriate for field or general users. In the next few years, users will be swamped with the chaos of unorganized data and systems. The entire user paradigm will change toward a user-directed, highly intuitive learning interface. The result will be more like we think than the way our systems are organized.

4. Assimilation of new technical features will take years, but the pace of new applications will accelerate. The last decade has taught us that major changes come slowly. Modern user interfaces are derived from the Macintosh and the earlier XEROX capabilities. We're still arguing the merits of client/server 20 years after GIS embraced it. I expected the NT operating system to be the operating system of choice years ago. Will we still work on spatial standards, object integration and truly distributed systems 10 years from now? I suspect so.

5. Successful companies will coexist cooperatively in highly interdependent networks of companies and systems. Nimbleness, flexibility, reliability and integrity will be the hallmark of these companies. Companies that don't learn to work in cooperative win-win environments will be left behind by customers unwilling to accept higher costs for no added value, by other vendors unwilling to waste their time in unprofitable business environments and by an unforgiving industry. In a rapidly changing environment, companies will have to earn their business and prove their worth on a daily basis.

Michael J. Fisher, director, Spatial Business Unit, Oracle Corp., Nashua, N.H.

我无法想象出“GIS”这一术语在下一个 10 年的存在。因此我们改叫带有这种特性的发行物为什么呢？为什么它有价值，在 Oracle 我们相信“空间”一词很好的归纳了它。引导我们发现空间技术的阶段是很迷人的。富有创造性的应用关注于省时的信息递送，它将会成为主要的代理，从而成功的将空间技术整合到我们的文化中。无论你驾驶你的车或者船，在洲际休息站点搜索旅馆或者餐馆，在一个地方为了生活工作而购物，在 WWW（这在家里，电视或者电话都将是可用的）冲浪或者向你的孩子简单的解释马达加斯加岛的位置，访问空间数据以及操作这些信息对于现在的非 GIS World 读者来说是不令人高兴的。

简而言之，意识到向大众传播空间概念和技术的梦想可能不会使我们成名，但是它将改变我们快节奏的生活方式，改变科技社会的管理，并且感激我们三种最珍贵的“日用品”中的两个：时间和空间。

Michael Goodchild, National Center for Geographic Information and Analysis, University of California, Santa Barbara, Calif.

现在 GIS 软件工业带来的变革将会对 GIS 教育带来冲击。在 10 年中，带有地理信息的工作的能力将不再需要所谓的“GIS”独特的软件包的处理，而是需要对地理现象的数字表示是如何组织的，信息是如何在巨大的分布式环境中组织和处理的，以及信息怎样才能自由的从一个环境传递到另一个环境的理解。我们已经看到了这些未来环境的前兆了，它们是以 Internet，数字图书馆和互操作性的组织形式的地理信息。

Michael J. Fisher, director, Spatial Business Unit, Oracle Corp., Nashua, N.H.

I can't imagine the term "GIS" surviving for another 10 years. So what do we call the publication hosting this feature? For what it's worth, we at Oracle believe the term "spatial" sums it up. The steps leading to where we find spatial technology will be intriguing. Creative applications focused on delivering information that saves time will be the primary agents to successfully integrate spatial technology into our culture. Whether navigating your car or boat, searching for a hotel or restaurant at the interstate rest stop, shopping for a place to live or work, surfing the World Wide Web (which will be available to you via the home computer, television or telephone) or simply explaining to your child where Madagascar is located, access to spatial data and manipulating this information will be relatively unexciting to present non-GIS WORLD readers.

In short, realizing our dreams of introducing spatial concepts and technology to the populous probably won't make us famous, but it will change the way our fast-paced, technological society manages and appreciates two of our three most precious commodities: time and spaces.

Michael Goodchild, National Center for Geographic Information and Analysis, University of California, Santa Barbara, Calif.

The changes now under way in the GIS software industry are going to have major impacts on GIS education. In 10 years, the ability to work with geographic information will have less to do with possession of a unique software package called a "GIS" and much more to do with an understanding of how digital representations of geographic phenomena are constructed, how information can be assembled and processed in massive distributed environments, and how information can be passed freely from one environment to another. We're already seeing the first signs of these future environments for geographic information in the forms of the Internet, digital libraries and the move to interoperability.

为这些新环境准备的人们将会有与教育一样多的培训要做。特殊产品的培训将会由教育机构和私营软件供应商间的新合伙来提供。通过 WWW 和远程学习，将会有更多的教育和培训机会，允许那些正值事业期的人们能不间断事业而继续接受他们的教育。

孩子们将会在早期就碰到 GIS 原理，并且对数字地理信息在他们日常生活所扮演的角色很熟悉。教育的角色将会根据经验来合成这些原理，并且通过为完全不顾家庭环境的人提供技术来划分领域。

Bill Goran, chief, Land Management Laboratory, U.S. Army Construction Engineering Research Laboratories, Champaign, III.

GIS 已经改变了专业访问，评估，虚拟化和管理空间数据的方式，然而 GIS 技术仅仅开始改变对于我们的行为与方针的公众理解和处理空间与时间分支的方式。

举个普通例子。一家公司考虑搬到一个地方，建立一个高科技的工业设施，在未来 5 年提供 1000 个新的工作。环境组织警告会损失可居住地，降低空气质量，造成交通与洪灾问题，而与此同时，商业组织鼓励当地政府应该提供一系列鼓励政策来与该公司正考虑的其他地区进行抗衡。其他团体的呼声则猛烈攻击涉及已经拥挤的学校，以及对于维持高质量教育系统所需的更高收入。政府则被要求出台激励政策，包括一所新学校支持计划。农场团体反驳这一观点，涉及主要农田的损失和其他人想卖个高价格。

Preparing people for these new environments will have as much to do with education as with training. Training in specific products will be provided by new partnerships between educational institutions and the private sector's software vendors. There will be more educational and training opportunities through the World Wide Web and distance learning, allowing mid-career professionals to continue their education without career interruption.

Children will encounter GIS principles in the earliest years, and will be familiar with digital geographic information's role in their daily lives. Education's roll will be to synthesize principles from this experience, and to level the playing field by providing technology for all-regardless of the home environment.

Bill Goran, chief, Land Management Laboratory, U.S. Army Construction Engineering Research Laboratories, Champaign, III.

GIS has transformed the way professionals access, evaluate, visualize and manage spatial data, yet the technology is just beginning to transform the way the public understands and processes spatial and temporal ramifications of our actions and policies.

Take a common example. A company considers moving to an area, opening a high-tech industrial facility that will provide 1,000 new jobs during the next five years. Environmental groups warn of critical habitat loss, decreasing air quality, and traffic and flooding problems, while business groups suggest that the local government should offer a package of incentives to successfully compete with other locations the company is considering. Other community voices wade in with concerns about already overcrowded schools and the need for more revenues to sustain a quality educational system. The state is asked to chip in with incentives, including a new school support package. Farm groups debate the issue, with some concerned about loss of prime farmland and others seeing an opportunity to sell at a profit.



在接下来的几十年间，1000 个新工人在一个区域，那将是个怎样的情景？将有多少主要农田将会转变成郊外的临地以及大型购物中心？在这些新的大型购物中心衰落前，更大区域被铺上混凝土需要多久？增加的公路交通和维修将会是怎样的，增长的开发会对公园与幸存的野生动物迁移走廊造成什么影响？这个新设施的劳动力将会多分散，并且对于当地政府实体的资源损耗与收入增长会是怎样的？当地的分水岭会受到怎样的影响？当下一个百年一遇的暴风雪出现时将会发生什么？哪些附加的财产会遭受损失，并且多少生命会因为漫滩的工程开发，减少水渗透区域和增加分水岭冲积物而遭受生命危险？空气质量在不同场景下是怎样的？

现在我们仅仅能瞥见这种复杂，相关的难题的蛛丝马迹。的确，企业和团体与这个行为相关的决定远比当前看到的事实更复杂，但是我们还没有能力来画出动态事实曲径和描绘与理解方式的各种行为一起的结果。GIS 独自提供静态的空间信息。目前的 GIS 没有能力或连接新工具加载到空间数据库；插入空间，时间，经济，气候，社会进程和实体间的动态关系；捕获潜在情节；以及让结果为各种投资人的回顾，讨论，改变和再次运行提供实时的多画面或多通道的视屏。

What are the landscape dynamics, during the next several decades, of 1,000 new workers in an area? How much prime farmland will be converted into suburban neighborhoods and shopping malls? How long before these new shopping malls go into decline, to be replaced by even larger areas of paved concrete? What about increased road traffic and repairs, and how will the increased road traffic and repairs, and how will the increased development affect wildlife movement corridors between neighboring preservers and parks? How dispersed will the workforce be for this new facility, and what will be the likely resource strains and revenue increases for local government entities? How will local watersheds be affected? What will happen when the next 100-year storm occurs? What additional properties will be damaged, and how many lives might be endangered because of projected development in the floodplains, decreased areas for water infiltration and increased runoff across watersheds? And what will the air quality dynamics be under various scenarios?

Now we can only glimpse a few pieces of this complicated, interrelated puzzle. Certainly the company and community decisions associated with this action are more complex than a simple unbiased look at the facts, but we're miles from having the capacity to draw the maze of dynamic facts and likely results of actions together in ways we can portray and understand. GIS alone offers static spatial information. No current GIS has the capacity or linkages to load the new facility into the spatial database; insert the dynamic relationships between spatial, temporal, economic, climatic and social processes and entities; capture potential scenarios; and then animate the results in real time over split-screen or split-channel video for various stake-holders to review, comment, alter and run again.

GIS, 由一组健壮的, 在一个合作的计算和通讯环境中以一种通用建模框架相互影响的动态模型组合, 能够更便利, 更好的理解如今计划的未来含义, 以及将不同的声音和观点混合成一个对未来一般见解的框架。虽然这是 GIS 技术演变的方向之一, 但是把所有这些片断连接起来可能需要不止一个十年。

Lawrie E. Jordan III, president, Erdas Inc., Atlanta, Ga.

技术革新的速度使对未来 2-5 年的预测变得困难。保险的说, 会有非凡的潜力发生几个令人振奋的革新。在短期, 我们在 ERDAS 预知到的对空间技术工业冲击最大的是地理影像和用户通过 Internet 实时访问数据的解决方案。

由于它真正的特性, 遥感工业依赖着影像数据。在最近几年, 关于高分辨率数据增加的可用性, 没有改变什么。直到最近, 10 米是可用的最好的空间数据 (来自 SPOT 卫星, 10 年前发射)。现在, 随着 Indian 遥感卫星 (5 米分辨率) 和俄罗斯数据来源 (2 米分辨率), 新的分辨率标准建立起来了, 虽然例行公事的获取数据是很困难的。为什么基于 WWW 访问影像变得更加重要? 首先, 使用影像将变得更加常规, 因为使用影像将使非远程传感器精确合作, 及时更新他们的数据库变得更加容易。第二, 作为它所包含的影像分辨率, 使影像成为无价的组件来处理问题。网络和影像压缩技术的速度将比从前有所提升, 并且新的商业高分辨率卫星供应商也将很快开始提供。

GIS, blended with a robust set of dynamic models that interact in a common modeling framework across a collaborative computing and communications environment, can facilitate a better understanding of the future implications of today's plans, and a framework for blending diverse voices and viewpoints into a common glimpse of the future. Although this is one of GIS technology's unfolding directions, putting all these pieces together may require more than just one more decade.

Lawrie E. Jordan III, president, Erdas Inc., Atlanta, Ga.

The speed of technological change makes it difficult to look further than the next two to five years. It's safe to say there's extraordinary potential for several exiting changes to take place. In the short term, the critical elements we at ERDAS foresee having the biggest impact on the spatial technologies industry are the resolution of geographic imagery and the real-time accessibility of data by users via the Internet.

By its very nature, the remote sensing industry depends on image data. Little has changed during the last few years regarding increased availability of high-resolution data. Until recently, 10 meters was the best space-borne data available (from SPOT, launched 10 years ago). Now new resolution standards have been established with the launch of the Indian Remote Sensing satellites (5 meters) and the Russian data sources (2 meters), although obtaining data routinely can be difficult.

Why will World Wide Web-based access to imagery become more important? First, using imagery will become more routine, because using imagery will make it easier for non-remote sensors to incorporate accurate, up-to-date information into their database. Second, as an image's resolution it contains, making imagery in invaluable component to the problem-solving process. The speed of the Web and image-compression techniques will improve the former, and the new commercial high-resolution satellite vendors soon will begin to provide the latter.

在以后的几年间，人们使用影像工作的方式将会改变。有可能你将能够从网络上获取影像处理服务，并且把它交给服务器完成影像处理，只返回你所需要的结果。你使用它将会与最近使用基于网络的地图软件的方式一样，但是取代输入你所需要的地图的地址，你将会告诉系统地图上你所需要的地方，然后获取这个地方。你不再需要购买影像和软件，而自己完成工作，你只需要“租借”影像和软件，然后通过网络将结果返回给你。

随着期盼的技术革新，还需要我们对影像的认识有一个转变。影像确实是另一种类型的地图，以不同的方式存储。随着计算能力的增强，矢量和栅格处理的不同将会消失。影像和地图将会在 GIS 中共存，地理影像会是一个关键组件。因此，任何在 GIS 市场上的改变都将会应用到影像中。

David Linden, president, DSL Consulting, Fort Collins, Colo.

从现在起 10 年时间 GIS 工业会走到哪里？让我们考虑一些不同的工业部门：

**遥感。** 历经许多耽搁与失败的尝试后，一些“小卫星”公司最终使他们的卫星进入了轨道。在多年的价格战和令人失望的销售后，小卫星公司的数量将会减少到一个。这个存活下来的公司然后将会与 NASA 结合来互助地管理民用遥感卫星。（这不就是 1990 年 EOSAT 的契约吗？）

**GIS 数据库整合。** GIS 数据结构现在将会受到大部分商业数据库的支持成为一种标准数据元素。这些数据库（比如 Oracle, Sybase, Informix, SQL Server 等等）的底层模型不再是严格的关系型，而是扩展到更加面向对象结构，比如 GIS。

During the next few years, the way people work with imagery will change. It's possible you'll be able to dial up an image processing service on the Web and task it to process imagery on the server, giving you only the results you need. You'll use it the same way you currently use Web-based mapping software, but instead of typing in the address you want and getting a route map, you'll give the system your land cover mapping needs and get a land cover map. You won't need to buy imagery and software, and then do the work yourself, you'll just "rent" imagery and software, and have the results fed down to you via the Web!

With the expected technological changes, there also needs to be a shift in how we think about imagery. Imagery is really just another type of map, stored in a different way. As computing power increases, the differences between raster and vector processing will disappear. Images and maps will coexist within GIS, with geographic imaging as a key component. Therefore, any changes in the GIS marketplace will apply to imagery as well.

David Linden, president, DSL Consulting, Fort Collins, Colo.

Where will the GIS industry be 10 years from now? Let's consider some different industry sectors:

**Remote Sensing.** After many tries with many delays and failures, some of the "smallsat" companies finally will get some of their satellites in orbit. After a few years of price wars and disappointing sales, the number of smallsat companies will be reduced to one. This remaining company then will work a joint deal with NASA to mutually operate the civilian remote sensing satellites. (Isn't this the way things were in 1990 with the EOSAT contract?)

**GIS Database Integration.** GIS data structures now will be a standard data element supported by most of the commercial databases. The underlying model of these databases (such as Oracle, Sybase, Informix, SQL Server, etc.) no longer will be strictly relational, but extended to include more object-oriented structures such as GIS.

**GIS 数据可用性。**将会有过剩的高质量, 便宜的, 容易访问的可用政府数据。全美国将会以能够在 Internet 上自由可用的数字正摄影像所覆盖。Internet 连接将会比现在快 20 倍, 使其成为交换 GIS 数据的主要媒体。

GIS 软件供应商, ESRI 将会继续以事实上的 GIS 软件标准领导 GIS 工业。其他供应商的成功将依赖于他们能够为自己的产品找到一种特别的小环境。许多新的供应商将通过嵌入 GIS 技术而取代自己开发的方式进入市场。

Jean-Baptiste Monnier, vice president, geoengineering, Bentley Systems Inc.

地球十年相当于 Internet 至少 30 年, 但是作为地理工程在将来的爆发, 我们在 Bentley 能够做出一些预测。

“企业级计算将吞掉 GIS?” GIS WORLD 编辑 John Hnghes 在 1997 年二月他的 “From the Editor” 专栏中问道。我预言是结合。

信息技术是当今三层客户端\服务器端结构, 仓库存储和 Internet 服务器的驱动因素。但是 IT 变得在 GIS 中无处不在, 使数据整合如此自然, 我们将看到为 GIS 用户和地理工程提供价值的有用的地理处理应用后的转换。

空间革命将会很快结束。今天, 在它的初始推动下, 相关的革新结束了 (你无法买到一个非关系型的数据库)。空间革命现在已经很好的进入了轨道, 大部分的数据管理系统供应商已在其中。从此往后的三年, 我预测没有谁会不用空间组件来完成数据库查询。

**GIS Data Availability.** There will be a plethora of high-quality, inexpensive, easily accessible government data available. The entire United States will be covered by digital ortho quads that are freely available on the Internet. Internet connections will be 20 times faster than they are today, making it the primary medium for exchanging GIS data.

GIS Software vendors. ESRI will continue to lead the industry as the de facto standard for GIS software. The success of other vendors will depend on them finding a specialized niche for their product. Many new vendors will enter the market by embedding existing GIS technology instead of developing their own.

Jean-Baptiste Monnier, vice president, geoengineering, Bentley Systems Inc.

Ten Earth years are at least 30 Internet years, but as geoengineering blazes into the future, we at Bentley can make some forecasts.

“Will Enterprise Computing Swallow GIS?” asked GIS WORLD Editor John Hughes in his February 1997 “From the Editor” column. I predict marriage.

Information technology (IT) is the driving factor in today’s three-tier client/server architectures, warehousing and Internet servers. But as IT becomes omnipresent in GIS, making data integration so natural, we’ll see the focus shifting back to the useful geoprocessing applications that provide value to GIS users and geoengineers.

The spatial revolution will be over soon. Today, 10 years after its initial impetus, the relational revolution is over (you can’t buy a nonrelational database). The spatial revolution is already well into its course now, with most database management system vendors in the game. Three years from now, I don’t foresee anyone making database queries without a spatial component.

George Gilder 预测一个“带宽浪潮”，一个戏剧性的通讯带宽价格降低和可用性的增强。这将打破 GIS 数据容量限制的锁链。这一浪潮将很快来到，并且它将重新定义我们办公的限制。特别的，实时卫星影像将会随处可见。

此外，“外部网络”，Internet 领域的扩展，将变成地理工程的工作马力。移动电话带宽会使地理工程野外团队（构建和维护）能够便利。

Glenn Montgomery, president and CEO, UGC Consulting, Englewood, Colo.

GIS 和信息技术在近十年发生了戏剧性的变化，接下来的 10 年将会看到空间信息技术在开发，市场和配置的转变方式。基于现在公众和设施部门包含 GIS 的大型系统整合工程，我们 Convergent Group 看到了几个确定的趋势，那就是到 2007 年会有不同方式的来管理空间信息。

我们的顾客如今都有如水般的商业推动力，从而迫使他们在他们相应的市场中变得更加富有竞争力和高度的响应力，无论他们是购买精神服务的顾客，或是要求更快，更好的访问信息的民众。这使得他们对于他们获取和整合的技术有了更高的期望。包含对异类数据存储，不一致格式和数据结构的整合地理信息的需求将变成重要任务。因此，互操作性屏障将有必要被消除。

George Gilder predicts a “bandwidth tidal wave,” a dramatic drop in cost and increase in availability of communication bandwidth. This will break the chains of GIS data volume restraints. This wave will arrive soon, and it will redefine the limits of our offices. In particular, real-time satellite imaging will be everywhere.

Furthermore, the “Outernet,” the extension of the Internet into the field, will become the work horse of geoen지니어ing. The bandwidth for mobile computers empowers field teams who are the doers (construction and maintenance) of geoen지니어ing facilities.

Glenn Montgomery, president and CEO, UGC Consulting, Englewood, Colo.

Just as GIS-and information technology in general-has changed dramatically in the last decade, the next 10 years will see dramatic shifts in the way spatial information technology is developed, marketed and deployed. Based on the large systems integration projects we’re involved with today for the public and utility sectors, we at Convergent Group see several definitive trends that point to a different way of managing spatial information by the year 2007.

Our clients have serious business drivers today that are forcing them to become more competitive and more responsive to their respective markets, whether they’re customers purchasing energy service or citizens demanding faster, better access to information. This is causing them to have much higher expectations of the technologies they procure and integrate. The need to integrate geographic information contained in heterogeneous data stores, incompatible formats and data structure will become mission-critical. Thus, interoperability barriers will be eliminated by necessity.

随着这些的出现，类似 GIS 的空间技术可能会以一种独立的工具而消失。而为之取代的是，空间数据管理功能将以一个核心功能嵌入到其他广泛多样的系统中，很像文字处理和电子表单功能事实上是当今许多标准办公软件产品的组件一样。比如，该功能可能变成一个能源分布式系统中的一个标准应用，该系统内嵌了 GIS，工作管理，损耗管理，以及移动工作力管理和派遣。

市场需求将触发更加诡异的“来自数据的地图”产品，使用更加诡异的算法和“学习”程序增加地图输出质量。用户将能够以一种通用的数据库地理报表功能获得较好的“地图”展示，这种功能和如今的表格报告处理机一样通用。这些商业可用计划将允许用户从一个标准数据库中选择地理展示类型的所有特性。

GIS 全体数据将迁移到多用途，基于坐标的数据库存储，而不管是对象型的或是关系型的。在处理和通信技术的优势将消灭为大型系统而作的特殊图形存储的性能优势，很像高级预言已经去除了对多样化目的应用的汇编语言需求。就眼前来说，空间标注将通用（Oracle 8 和 SDO）。长期来看，对象标准（SAIF 和 OGIS）的驱动力将使 GIS 工具对于终端用户可通用。在 10 年中，GIS 应用将会在所有的数据库上工作，和我们当前使用所有拥有对象数据库管理系统的数据库生成报表一样简单。

As this happens, spatial technology like GIS probably will disappear as a standalone tool. Instead, spatial data management functionality will be embodied within the core functionality of a wide variety of other systems, much like word processing and spreadsheet functionality is a de facto component of so many of today's standard office software products. For example, the functionality may become a standard application within an energy distribution system that embodies GIS, work management, outage management, and mobile work-force management and dispatch.

Market demands will trigger more sophisticated products for "maps from data," increasing the quality of map output with sophisticated algorithms and "learning" programs. Users will be able to obtain superior "map" displays as a common database georeporting function-as common as tabular report generators are today. These commercially available programs will allow users to select all the characteristics of the type of geographic display wanted from a standard database.

GIS corporate data will migrate to general-purpose, coordinate-based database stores, whether object or relational. The advances in processing and communications technology will wipe out the performance advantage of specialized graphic stores for these larger systems, much as higher level languages have eliminated the need for assembly language for general-purpose applications. In the short term, spatial standards will be commonly available (a la Oracle 8 and SDO). In the longer term, the drive to object standards (SAIF and OGIS) will make the GIS tools commonly available to end users. In 10 years, GIS application will work on "any" database as easily as we currently use "any" database for reports with an object database management system.

当然，GIS 信息将通过 WWW 更加广泛可用。很明确，在线地理分析服务将会和现今各种城市地图和地理黄页可用一样通用。价值将以巧妙的“搜索引擎”能力附加，这也是从一体化空间选择标准与 2000 年人口普查提供的人口数据发展而来。

David Nale, president, Aerial Data Reduction Associates Inc., Pittsburgh, Pa.

短短 10 年前，GIS 的概念仅仅出现在财政富裕或者科技上敢于冒险的市政当局和国家。如今，事实上从小镇和区到大城市和国家的所有政府要么雇佣，实现或者规划 GIS。事实是，如果一个政府不采用 GIS 会被认为对于自己的市民不负责任。

GIS 的绊脚石一直是它的费用，包括建造和维护数据的花费，也就使其继续停留在技术曲线中。在下一个 10 年，GIS 获得的模型将完全改变。易用高分辨率卫星影像和世界范围数字正面图数据将从本质上降低建造和维护重要的 GIS 陆地数据集的费用。强大的，带有自动特征抽取的摄影测量工作站将允许划算的矢量获取和更新。在短期内，陆地制图将像编织物一样贯穿全国进行编织。当地政府只不过租借 GIS 数据对他们的责任地理区域进行管理。

因为内在的 GIS 运作存在选择，使用 Internet 技术和标准 GIS 处理的广大区域的网络可能允许许多 GIS 应用的总体外部采购。一个与家庭和办公安全系统类似的获取模型，带有安装通讯硬件与一个五年服务和维护合同的一次性花费，可能会形成。

Of course, GIS information will be even more widely available via the World Wide Web. Definitely, online geoanalysis services will be as common as the various city map and geoyellow pages are available today. Value will be added as smarter “search engine” capabilities evolve that incorporate spatial selection criteria and the new demographic data provided by Census 2000.

David Nale, president, Aerial Data Reduction Associates Inc., Pittsburgh, Pa.

Ten short years ago, the concept of GIS was embraced only by financially affluent or technologically adventurous municipalities and counties. Today, virtually all governments from townships and boroughs to major cities and counties are either employing, implementing or planning for GIS. The fact if that a government not undertaking GIS activity could be considered irresponsible to its citizens.

The stumbling block to GIS always has been its cost, both in real dollars for building and maintaining the data as well as staying on that steep technology curve. During the next 10 years, the procurement model for GIS will change completely. Readily available high-resolution satellite imagery and worldwide digital elevation data will radically reduce the costs of building and maintaining the all-important GIS landbase dataset. Powerful photogrammetric workstations with automatic feature extraction will permit cost-effective vector capture and updating. In a short period of time, a fabric of landbase mapping will be woven across the nation. Local governments simply will lease the GIS data necessary to manage their geographic area of responsibility.

As an alternative to internal GIS operations, wide-area networking using Internet technologies and standardized GIS processes may permit total outsourcing of many GIS applications. A procurement model similar to home and office security systems, with a one-time cost for installing communications hardware and a five-year service and maintenance contract, may emerge.

底线是任一方式，在下一个 10 年中的 GIS 将从百万花费到一种常规，可管理的每月支付。

David Nystrom, chief information officer, National Capital Planning Commission, Washington, D.C.

在 2007 年，正当我享受我的退休时，两个 GIS 的思路进入脑海。首先，我将考虑一下在 Washington, DC 的 GIS 的现状。我和同事以及合作伙伴把全部的精力都投进了公众\私有的华盛顿地理信息系统 (WGIS) 的开发之中了，我期望它能成为现实并获得成功。WGIS 将以公众\私有合作形式运行，这一形式为地区和联邦政府，私营部门及公众适时的提供了定制的产品和服务。这种公众\私有企业将为地区和联邦政府代理商，以及对公众的定制产品和服务，提供大范围的项目应用和服务。WGIS 合作伙伴将在一个企业计算环境中，以 Internet 和 Intranet 连接访问的方式共享数据，地图，影像和数据分析。全球定位系统 (GPS) 掌控的影像和数据给所有 WGIS 用户提供环境，交通，土地使用，经济开发，人口，规划等数据。对 WGIS 合作伙伴和公众适时的产品和服务将成为现实。

第二，由于令人振奋的新的基于 WWW 地理空间\GIS 的需求，提高的信息管理，更加容易的访问，更好的输送装置和更有活力的应用工具，我将在我的家庭电脑上拥有令人难以置信的 GIS 能力。表列数据，数据库，杂志和新闻文本，影像，照片，电视数据等，将键入到地图中的地区并且在一个全球影像信息系统的企业计算环境中不停的更新。这些 GIS 能力将允许非技术用户区操作地理空间数据，来完成比如购物，旅游和许多其他本地需求的服务。感谢 GIS 工业！

The bottom line is that either way, GIS during the next 10 years will migrate from million dollar procurements to a routine and manageable monthly expense.

David Nystrom, chief information officer, National Capital Planning Commission, Washington, D.C.

As I'm enjoying my retirement in the year 2007, two GIS thoughts will come to mind. First, I will think about the state of GIS in Washington, D.C. With all the energy that I, colleagues and partners have put into the development of the public/private Washington Geographic Information System (WGIS), I expect it to be a reality and a thriving success. The WGIS will be run by a public/private partnership providing timely/custom products and services to district and federal governments, private-sector concerns and the public. This public/private enterprise will provide a wide range of program applications and services to district and federal government agencies and a variety of custom products and services to the public. WGIS partners will share data, map, images and data analysis within an enterprise computing environment, accessible by Internet and intranet connections. Global Positioning System (GPS)-controlled image and data will provide environmental, traffic, land use, economic development, population, planning, data etc., for all WGIS users. Timely products and services to WGIS partners and the public will be a reality.

Second, because of exciting new geospatial/GIS World Wide Web-based requirements, improved information management, easier access, better delivery mechanisms and more robust application tools, I will have unbelievable GIS capabilities on my home computer. Tabular data, databases, magazine and newspaper text, images, photographs, television data, etc., will be keyed to areas in a map and will be updated constantly within an enterprise computer environment from global imaging information systems. These GIS capabilities will allow nontechnical users to manipulate geospatial data for such activities as shopping, traveling and many other services with locational requirements. Thank you GIS industry!



Preetha Pulusani, executive director of marketing, Infrastructure Division, Intergraph corp., Huntsville, Ala.

十年前,谁能想象到我们今天看到的 GIS 景象?

我们以加速的脚步快速驶入未来。有两件事物将在 GIS 开放系统和 WWW 的重新定义我们的共有未来中占据一大部分。

在我们工业界一些最好的头脑已经定义了 OpenGIS 互操作规范——在我们工业重大进展中的一个开端。随着这一成就的前进,作为结果,供应商解决方案将开放之前不可及的数据和信息。这真正意味着什么?这意味着多年来的关注焦点将会在多样和革新的 GIS 技术应用上。GIS 将会忍受一群我们到现在也无法完全理解其范围的用户。

联合起来就是 Web。新的分布式对象技术将强烈的冲击着我们使用 Web 的方式。访问地理信息将会是简单透明的。并且大部分我们现在担心的 GIS 问题将确实的变成职责之后的任务了。

我期盼着其他人做的预测,并且肯定在 10 年间重新阅读这些观点。

Carl Reed, technical officer, Genasys Inc., Fprt Collins, Colo.

到 2007 年,我们今天所知道的 GIS 将会消失。空间数据将会成为所有数据管理系统供应商所支持的一种抽象对象类型。空间处理环境将会是子配置和“智能”的。任何人在任何地方将访问和使用空间数据。巨大的空间和相关属性数据仓库将全部可访问。用户将通过 Internet 访问和使用这些数据。这些用户将会通过他们的选择行为被提供地理服务。

我所看到的水晶球漂亮简洁。

Preetha Pulusani, executive director of marketing, Infrastructure Division, Intergraph corp., Huntsville, Ala.

Ten years ago, who could have envisioned the GIS landscape we see today?

We're speeding into the future at an ever-accelerating pace. There are two things that will play a big part in redefining our mutual futures in GIS open systems and the World Wide Web.

Some of the best brains in our industry have defined the OpenGIS Interoperability Specification (OGIS)-the beginning of one of the most significant developments in our industry. As this effort progresses, the resulting vendor solutions will unlock data and information that previously were untouchable. What does this really mean? It means the focus in years to come will be where it rightly belongs-on the diverse and innovative application of GIS technology. GIS will tough a population of users whose breadth we don't all fully understand even today.

Hand in hand with this is the Web. New distributed object technologies will heavily impact the way we user the Web. Accessing geographic information will be simple and transparent. And most GIS issues we worry about today will strictly become back-office tasks.

I look forward to the predictions made by others, and certainly to rereading this issue in 10 years.

Carl Reed, technical officer, Genasys Inc., Fprt Collins, Colo.

By 2007, GIS as we know it today will have disappeared. Spatial data will be an abstract data type supported by all database management system vendors. The spatial processing environment will be self-configuring and “intelligent.” Anyone anywhere will have access to and will use spatial data. Huge warehouses of spatial and related attribute data will be accessible by all. The user will access and use these data via the Internet. The user will be provided geoservices by their chosen behavior.

Pretty terse by my look into the crystal ball.

GIS 工业在最近 10 年间走了很长的一段路。然而，下一个 10 年可能是最好的。我们将看到在消费者层面上 GIS 技术被主流所接受。我相信随着 GIS 对于每个人都是工具，对于一般公众将会有低成本，用户友好的 GIS 软件可选。这可能确实震动了软件供应商。许多公司抵抗革新可能发现自己陷入空难的境遇。

将会有更加精确的现货供应的可用数据。这些数据的精确度没有与技术保持同步。这将在下个十年中发生改变，将会有更多关注数据的有效性。

通过一个用户笔记，我相信大部分 GIS 用户将在他们的系统上持有许多种数字影像。卫星工业能否始终如一的提供低成本，高分辨率的影像到那时就能够决定了。如果真的出现了，那么将会讨论精确分辨率（6 英尺或者更高）影像了。

Jim Skog, GIS program manager, Hewlett-Packard Co., Fort Collins, Colo.

下个 10 年的技术演变将会比近 10 年的更大。计算能力，图形成像，通讯，地理空间测量的集中使发生巨大变化更加容易。小型化，可访问的数据量将创造出许多新的论点冲击我们在家，游戏和工作（假设这和前两个不同）的生活。信息时代将继续加速“有”和“没有”的分化，并造成对秘密进退两难的选择。如下的故事可能幽默的阐明了这个大胆新世界的一些方面：

我最终在午饭的时候赶上了我 18 岁的儿子。我们打算在 Vail 一起划一天的雪的，但是在我们检电梯票后实际上这是我们第一次见面。想想他在这个特别的星期六邀请我。“你不想见我？”我问道，我想知道我们怎么会整个早晨都没见面。

The GIS industry has come a long way during the last 10 years. However. The next 10 years probably will be the best. We'll see mainstream acceptance of GIS technology on a consumer level. I believe there will be low-cost, user-friendly GIS software choices for the general public as GIS becomes a tool for everyone. This may actually shake up the software vendors. Companies resisting change may find themselves in a difficult situation.

There also will be more accurate data available off the shelf. The accuracy of off-the-shelf data hasn't kept pace with the technology. That will change during the next decade. There will be more focus on data availability.

On a user note, I believe most GIS users will have some kind of digital imagery on their system. Whether the satellite industry can provide low-cost, high-resolution imagery consistently over time will be decided by then. If that happens, there will be talk about precise-resolution imagery (6inches or higher).

Jim Skog, GIS program manager, Hewlett-Packard Co., Fort Collins, Colo.

The next 10 years of technological evolution will be even greater than the last 10 years. The convergence of computational power, graphical imaging, communications, geospatial measurement and facilitate tremendous change. Miniaturization and access to volumes of data will create many new issues impacting our lives at home, at play and at work (if it's different than the first two). The information age will continue to accelerate the division of "haves" and "have nots," and create new dilemmas about privacy. The following story may humorously illustrate some aspects of this bold new world:

I finally caught up with my 18-year-old son at lunchtime. We were supposed to be skiing together at Vail for the day, but this was the first time I'd actually seen him since our lift tickets were scanned. And to think, he invited me this particular Saturday. "You avoiding me?" I ask, wondering how we can miss each other all morning.

“不是啊，只是你在那些老的滑雪橇上太慢了。你知道的，你肯定是唯一一个还用两条滑板的人。”

“什么在哔哔响？”我打断道。

“我的 DT370，”他答道。

“哦，就是想 Dick Tracy 过去给用户用的那些像表一样的计算机？”

“是的，你是怎么知道 Dick Tracy 的？”他问道。

“没关系的，”我答道，然后发誓要在这个 DT370 上找到点信息。“你的 DT 表告诉你什么？”

“它告诉我 Jennifer 下了电梯，正冲着我们的方向下斜坡呢，”他说道。“如果你觉得可以就在呆在这里等她。”

“哦，这个 Jennifer，她给了你她的 PLA（个人位置访问）？你们这些孩子都有 APE（高级个人管理）？”我问道？

“嗯，我们中的部分有工作或者有意义的允许来拥有它们，而不像我的。并且我不能泄露她的 PLA。”他强调道。

“她不知道你能追踪她在哪？那难道不是入侵？”我问道。

“不，好吧，可能，但是她一直开着它。”他答道。

然后我听到唧唧声的警告信号，然后我儿子对着手腕讲到“密码 2244 访问 2 级。”

“那是什么？”我问道。

“我要走了。”他答道。

“Amber 刚刚做电梯到这了，并且 Jennifer 可能已经取下滑板了。我刚调整了我的 PLA 安全等级，这样我就能够甩掉 Amber。”

“哦，”我应道，“他们不是朋友？”

“是的，爸爸，但是你知道的，他们不知道我让他们两个下周出来。”

“好吧，为什么你把你的 PLA 调到安全等级 2？现在你只能位于紧急的时候啊。”

“因为，”他说道，然后转了一下眼睛，就好像我是从古代出生似的。“Bill 和 Dave 将会看到 Amber 和 Jennifer 正在同时向我汇聚。”

“这有问题吗？Bill 和 Dave 是你最好的朋友，不是吗？”我傻傻的问道。

“No, you're just too slow on those old skis. You know, you must be the only one still using two skis.”

“What's that beeping?” I interrupt.

“My DT370,” he answers.

“Oh, one of those watch-like computers like Dick Tracy used to user?”

“Yeah. How do you know about Dick Tracy?” he asks.

“Never mind,” I answer, vowing to look up more information on this DT370 device. “What's your DT watch telling you?”

“It's just telling me Jennifer is off the lift and coming down the slope toward us,” he says. “You can only stay and meet her if you promise to be good.”

“Oh, this Jennifer, she gave you her PLA (Personal Locator Access)? And do all you kids have APEs (Advanced Personal Executives)?” I ask.

“Well, some of us with jobs or a meaningful allowance, unlike mine, have them. And don't let on I snatched her PLA,” he insists.

“She doesn't know you can keep track of where she is then? Isn't that invasion?” I ask.

“No-well, maybe, but she's the one who keeps it on,” he says.

Then I hear a chirping-like warning signal, and my son says to his wrist “code 2244 access level 2.”

“What's that about?” I ask.

“I gotta get going,” he says.

“Amber just got on the lift up here, and Jennifer is probably taking off her board already. I just adjusted the security level on my PLA so I can lost Amber.”

“Oh,” I respond, “they're not friends?”

“Sure dad, but you know, they don't know I asked both of them out next week.”

“Well, why did you turn your PLA to security level 2? Now you can only be located in an emergency.”

“Because,” he says, rolling his eyes like I was born in the dark ages. “Bill and Dave will see that both Amber and Jennifer are converging on me at the same time.”

“And that's bad? Bill and Dave are your best friends, aren't they?” I ask innocently.

“爸爸，他们的 APE 有简单的专家系统，即便是这样，他们也能预知到可能的场景，”他说。

“另外，Bill 喜欢 Jennifer 并且没有她的 PLA。如果他发现我把我的给她了，他会找 Amber 的麻烦，你明白吗？”他滑稽的看着我，然后添道，“顺便地，请取掉你的老式袖珍保护吗？”

“你是说我的 CalcKard？”我问道。“关它什么事？”忽然我有点明白了，“哦，你和你的朋友现在有我的 PLA 了我猜。”

“对不起爸爸，”他裂口笑道。“仅仅是想让你丢的太远。”

“CalcKard 密码 0077，”我说，“访问等级 3。”我想知道青年们的逻辑。

一会，一个令人侧目的漂亮桔黄头发的年轻女孩接近桌子，然后坐在我旁边，或者更精确的说，是我儿子旁边。我儿子事实上很有礼节，正式的介绍，然后我趁着机会离去。当我的离开后，我听到了我的 CalcKard 的鸣叫。这是从我儿子电脑的代理那里发的消息。“如果在两分钟内你在电梯顶碰到 Amber，你儿子就会将一小时后和你碰面并一起滑雪，”它陈述道。“不用担心，”它附加道。“你能够在任何时候至始至终的位于安全等级 1。”

我说了谢谢，然后跟着提示立刻回去，试着在新的 LaserJet 滑到上滑雪，因为当前额定蓝 2.7，没有电梯等待。我的代理添加道，在一个老的采矿地区和确定的山腰地区，当我们横穿滑雪，它允许这一历史观点。

可能我正在变老。可能我是少数穿着滑雪板的人。可能我不知道怎样偷取 PLA 或者程序设计专家系统代理。可能我一直开着 CalcKard，因为我害怕失去联系。我模糊的记着在十几岁时，很确定的觉着父母很无能。然而，若干年后当孩子长大，你不能失去窍门，因为他们更高，更快，年轻的成年人。“嗨，Amber，”我打招呼道。“你最近看到我的儿子了吗，我要取 LaserJet。要一起过来吗？”

“Dad, their APEs have primitive expert systems, but even they can anticipate a potential scene,” he says. “Besides, Bill likes Jennifer and doesn’t have her PLA. If he finds out I gave her mine, he’ll stir up trouble with Amber, you know?” He looks at me funny and adds, “By the way, can you turn off your old pocket protector please?”

“My CalcKard you mean?” I ask. “Why would it matter?” Suddenly it dawns on me, “oh, you, and by now your friends, have my PLA I bet.”

“Sorry dad,” he grins. “Just didn’t want you to get too lost.”

“CalcKard code 0077,” I say, “access level3.” And I wonder about the logic of youth.

Looking up, a young woman with strikingly beautiful orange hair approaches the table and sits down next to me-or, more accurately, my son. My son actually manages a well-mannered, formal introduction, and I fell the hint to vacate. I hear a warble on my CalcKard as I get outside. It’s from my son’s computer agent, delivering a message to me. “If you’ll meet Amber at the top of the lift in two minutes, then your son will meet you in an hour to ski together,” it states. “Don’t worry,” it adds. “You can be located at any time all the way down to security level 1.”

I speak a quick thanks and almost immediately get the response back with instructions to try skiing on the new LaserJet run, as it’s currently rated blue 2.7 with no projected wait for the lift. My agent adds that it would allow an interesting historical perspective to ski over an old mining area and identify the geology of the mountainside as we traverse it.

Maybe I’m getting older. Maybe I’m in the minority wearing skis. Maybe I don’t understand how to snatch PLAs or program expert system agents. Maybe I keep the CalcKard turned on because I do fear being out of touch. I vaguely remember being a teenager, and feeling absolutely certain parents are clueless. Yet, after years of looking after your child, you just don’t lose the knack because they’re taller, faster, young adults.

“Hi Amber,” I manage. “Have you seen my son lately I was just headed over to LaserJet. Want to come along?”

当我们进入树林后，我在想和我儿子一个小时后滑雪。他会在那，并且他欠我一次。

Donn C. Walklet, president and CEO, The MapFactory Inc., Walnut Creek, Calif.

GIS 工业，正如我们所知道的，从现在起的 10 年，将会成为更大工业的一个小部分。通过 Internet 的 PC 与网络的结合最终将使衍生于未加工的地理数据分布式信息切实可行。商业将被允许访问广阔的空间衍生信息，这些信息要么被自身的数据库埋没，要么隐藏在小的数据库提供者或者政府机构的货架上。新的高分辨率卫星影像来源最终将为消除了时间和冗余错误的商业地图制图提供划算的实现。

现在与从今往后的 10 年主要的区别，并非技术，而是在工业中的一种态度转变，让这个工业，让巨大的市场商业用户的利益和优先权放在舞台的中心。这个变化将逐步发生，就像现有的公司学着一起工作来解决用户问题，提供解决方案，以划算的成本来切实解决用户日常的地理信息问题。

Robert A. Wright, information specialist, Atterbury Consultants Inc., Beaverton, Ore.

很难想象 GIS WORLD 已经 10 岁了。这也提醒了我，我已经在 GIS 工作了将近两个 10 年了。它同样提醒了我，我桌上的掌上电脑已经比我一开始时的 GIS 计算机更强大，能力更强。

As we drop into the trees. I think about skiing with my son in another hour. He'll be there, and he'll owe me one.

Donn C. Walklet, president and CEO, The MapFactory Inc., Walnut Creek, Calif.

The GIS industry, as we know it, will be a small part of a much larger industry 10 years from now. The combination of PC power and networking through the Internet finally will make the distribution of information derived from raw geographic data feasible. Businesses will be given access to a wide array of spatially derived information that was either buried in their own corporate databases or hidden on the shelf of a boutique database supplier or government agency. New sources of high-resolution satellite imagery finally will provide cost-effective "reality" to business mapping, removing the errors of time or omission.

The primary difference between today and 10 years from now, other than the technology, will be an attitude adjustment within the industry, putting the industry, putting the interests and priorities of the mass market business customer at center stage. This change will occur gradually, as existing companies learn to work together to solve customer problems, or dramatically as an "upstart," a la Microsoft, provides solutions that really solve customers' daily problems in a cost-effective manner with geographic information.

Robert A. Wright, information specialist, Atterbury Consultants Inc., Beaverton, Ore.

It's hard to believe that *GIS WORLD* is 10 years old. It reminds me that I've been working in GIS for nearly twice that long. It also reminds me that the palm-top computer on my desk has much more power and capacity than the GIS computer I started on.

那意味着我们在 10 多年中会在哪里？根本的改变将会是我们如何看和使用“GIS”。它将变成和我们的电脑其他部分一样普通，就像文字处理器和电子数据表。对于大部分用户来说，GIS 将会像以前使用的老的地图一样明晰。“GIS”术语可能会消失。计算机将会更小型化，也更友好。大多数计算机制图将实现。主要的数据库问题将会改道，并且将会更加强调卫星影像。

挑战？在高尔夫场使用全球定位和 GIS 技术，能让 GIS 告知怎样击球吗？一个伟大的 10 年！

Walter B. Zavou, vice president, Research and Development, Etak Inc., Menlo Park, Calif.

我的 GIS 经验已经聚焦到消费者和商业，包含交通网络的数据库与应用上了。这个事实可能帮助解释在我的水晶球的特别倾斜。

当 14 年前我开始在 Etak 工作，先进的电子工业为交通导航创造了可用的技术，但是 GIS 工业还没有创造出数字地图来符合规范的需求。在最近十年，电子学继续着它们非凡的性能途径。GIS 工具制作人员和应用建造人员移向了 PC 及工作站平台，开放新的公众，商务和消费者市场。在这个行动上，主要的数据库投资已经或正在吻合导航市场的需求。

Where does that mean we'll be in 10 more years? The primary change will be in how we view and use "GIS." It will become as commonplace as the other tools on our computers, like our word processor and spreadsheet. For most users, GIS will be as transparent as the old paper atlas used to be. The term "GIS" may even disappear. Computer will be even more miniaturized and user friendly. Most company base mapping will have been completed. The major data issue will be tracking change, and this will place even more emphasis on the use of satellite imagery.

The challenge? With Global Positioning System and GIS technology now in golf carts, can GIS be taught to hit a golf ball? Have a great next 10 years!

Walter B. Zavou, vice president, Research and Development, Etak Inc., Menlo Park, Calif.

My GIS experiences have focused on consumer and commercial databases and applications involving transportation networks. This fact might help to interpret the particular slant in my crystal ball gazing.

When I started with Etak some 14 years ago, advancements in electronics were creating the enabling technologies for vehicle navigation, but the GIS industry hadn't yet created digital maps that met the required specifications. During the last decade, electronics have continued on their remarkable performance path. The GIS tool makers and application builders moved onto PC and workstation platforms, opening new public, commercial and consumer markets. With this activity, major database investments have been and are being made to meet navigation market requirements and more.

相信可用技术前进的每个理由将会继续。举几个例子。Internet 正在向无数的计算机新来者介绍地理概念。全球定位系统单位正在寻找每个推动他们的方式。高分辨率的商业卫星影像将加快制图动作。寻求对话式图表将产生新的 GIS 标新方式。强大的处理器正在从桌子上移动下来，突破包围，以更好的存储，展示和用户接口硬件方式完成。我们正在一个新的无线世界里被信息连接在一起。

给予这些能力后，下一代 GIS 应用将远远的扩展超越 70 年代企业范围制图，和 80 年代出现的导航，推动地图软件数据高精度编码需求的层次；3 米精确定位；丰富的点线要素集；世界范围的数据覆盖小型，边界，无线设备的可访问性。技术革新和他们所创造的市场将在下一个十年，在机遇和挑战中使 GIS 工业更具活力。

There's every reason to believe the march of enabling technologies will continue. Let's take some examples. The Internet is introducing geographic concepts to countless computer new-comers. Global Positioning System units are finding their way into everything that moves. High-resolution commercial satellite images will accelerate mapping activities. The gamer's quest for interactive graphics will spawn new GIS presentations. Pentium + power is moving off the desk, past the lap and into the pocked-complete with better storage, display and user-interface hardware. We're being wired for information in a new wireless world.

Given these capabilities, GIS applications for the next generation will extend far beyond the enterprise wide base mapping of the 1970s and emerging navigation of the 1980s, pushing the frontiers of map software/data requirements-high precision geocoding;3-meter positional accuracy; rich point and polygon feature sets; worldwide data coverage; currentness-to-the-day; and accessibility on small, portable, wireless devices. Technological innovations and the markets they create will energize the GIS industry during the next decade with opportunity and challenge.