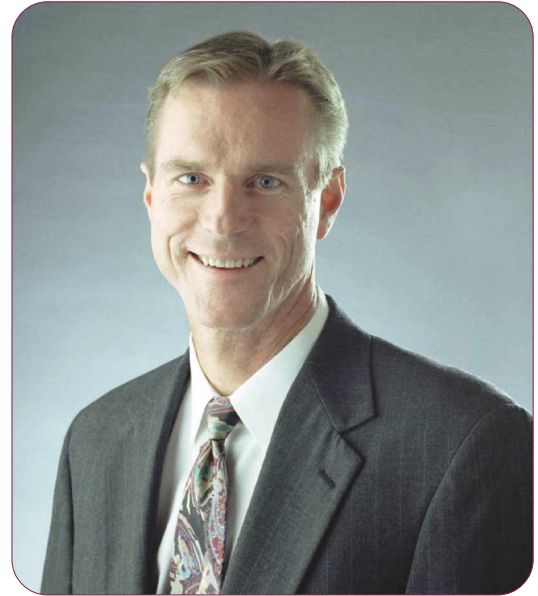




Never out of sight

Giovanni Verlini, Editor of *Satellite Evolution Asia*, spoke with Pete Gaffney, Chief Executive Officer (CEO) of Integral Systems, about the latest developments in Tracking, Telemetry and Control (TT&C).



In many ways, a satellite ground system is just as important as the satellite itself. A ground system tracks a satellite, controls it, and processes and analyses the information it gathers. In particular, cost-effective ground systems can play an important part in keeping a satellite programme economically viable.

Integral Systems is a company that focuses its expertise and energy on building products that provide system solutions for the entire satellite lifecycle. Its EPOCH Integrated Product Suite is a command and control system designed to operate any number of satellites from any manufacturer with a minimum of personnel.

Question: How would you introduce Integral Systems to the readers of *Satellite Evolution Asia*?

Pete Gaffney: Integral Systems is the world's leading provider of satellite command and control systems, interference detection and signal monitoring systems, and ground system monitor and control systems for commercial communications satellites. Just about every commercial FSS operator in the world is our customer using some portion of our EPOCH Integrated Product Suite. Our systems are also operating and monitoring all of the US Air Force's communications satellites and the US's Weather Satellites. All our systems are built around our EPOCH IPS COTS software products, which allow us to

build and deliver systems quickly and at very low cost.

Q: Can you also tell us something about your personal background and industry experience?

PG: I graduated with an Electrical Engineering degree from the University of MD in 1981. I worked for GE Aerospace on a number of satellite programmes, including the Landsat and SPOT ground systems for the Kingdom of Saudi Arabia before joining Integral systems in 1986. At Integral I worked in our Commercial Division on a number of ground system programs and eventually headed up the Commercial Division in the late 1990s when the commercial satcom business was booming and we were retrofitting and consolidating a lot of commercial systems onto our EPOCH based command and control system. I then ran our product group for a number of years, rolling out our first Windows based User Interface and eventually EPOCH V4. In 2005 I became Chief Operating Officer and ran our Government business before becoming CEO in April 2006.

Q: If I am not mistaken, your company was founded in 1982. How has business changed over the years for Integral Systems?

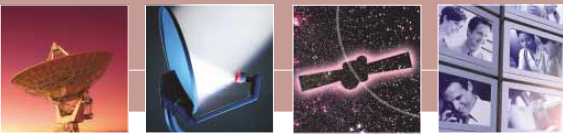
PG: We started out doing custom real-time ground processing systems like a lot of other

companies. Most of our business was with the US Government. After seeing a lot of different ground systems, we realised that we could build a database driven software product that could operate any satellite with little to no software modifications. So, in the early 1990s we developed the EPOCH product line and it took off in the commercial industry. By 2001 more than half of our business was commercial. Then we started building EPOCH based systems for the US Government and now our business is 20 per cent commercial and 80 per cent US Government. All of our business is now based on building systems around our product line and our subsidiary's products.

Q: What do customers ask you for?

PG: Our customers mostly ask for turnkey systems built around our products and many times integrated with our subsidiary's products to provide them with a total solution for satellite control, monitoring, and signal processing. They also like our customer support model, where we offer a software support subscription. With such a large install base of our products, we can offer reasonable rates to support their system software





Integral Systems HQ. Photo courtesy of Integral Systems

by spreading our support costs over many customers.

Q: I believe your products support different missions such as communications, science, meteorology, and earth observation. But are there specific requirements depending on the type of mission?

PG: Yes. The core requirements for command and control are pretty much the same. However, there are usually mission unique requirements that are very different for each mission type. For example, some communications satellite customers operate large fleets of satellites and want capabilities that allow them to monitor and control many satellites from a single operator console. We do not see that with the science and meteorology customers. Instead, these customers usually have specific processing needs for on board sensors. For these mission unique processing requirements, we offer a fairly comprehensive API (Application Programming Interface) into our software which allows them or us to develop that mission unique processing integrated with the core system.

Q: What about satellite fleets and constellations in different orbits (GEOs, LEOs, HEOs)? Are there specifics that you need to address?

PG: Yes there are. For the GEO customers, the system is started, the satellite databases are loaded, processing begins, and then the system runs for weeks or months without any changes. For LEO satellites, the system needs to prepare for each pass by loading in the correct database, tracking information, and prepared commands and spacecraft loads. Then, when the pass occurs there are only a few minutes to execute the commands and loads and capture the telemetry data. Much of the analysis occurs after the pass. And, the system may have to get ready for the next pass which might be for a different satellite with a different database. It's a constant cycle of preparation and execution. Much of it is automated, allowing the pass

plans for a number of satellites and passes to be downloaded ahead of time and the system will just execute one after the other.

Q: Integral Systems is active in the commercial satellite arena as well as in the government satellite environment. Are these two markets different in any way? Do you need to 'adjust' to deal with clients from these two sectors?

PG: Yes, the markets are very different. The commercial customers are very cost and schedule conscious, while the government emphasizes the process to achieve the end result. The commercial customers actually drive a lot of the innovation in the industry because we are always looking for ways to

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lower their acquisition, operations, and support costs to be competitive.

Automation and the ability to support lights out operations are a couple of examples. The commercial and science operators are also more likely to integrate their own applications or third party applications to our system through our APIs. The government customers want a completely turnkey system. So we have to offer the API capability and the services to be able to support both customers.

Q: What are the benefits for a satellite operator when using a COTS (Commercial Off-the-Shelf) software product for satellite command and control?

PG: For starters, the acquisition costs are lower and the delivery schedules are shorter. Since the software has already been developed and is operational in a number of other installations, the probability of programme success is very high. The quality of the system will be much higher too since the software has been proven in many operational facilities already. Sustainment costs are also quite a bit less through our software support subscription where the community of users contribute to our support costs for the software which allows us to charge less than what we would have to charge for a custom system.

Q: Another area of interest is carrier monitoring and interference detection. In particular, the problem of interference has been increasingly making the headlines over recent years. How bad is the problem? What can be done for this problem to be minimised if not avoided.

PG: Unintentional interference is the most common cause of interference. There is always going to be a rate of unintentional interference caused by leaving carriers up when not in use, antenna pointing errors, etc. A good signal monitoring system with a database of users and signal characteristics makes identification of possible sources of interference much easier and quicker. An industry support and maintained database would help this problem a lot.

Q: What is the latest trend in Tracking, Telemetry and Control (TT&C) as far as technology is concerned?

PG: The signal processing for the satellite uplinks and downlinks are mostly performed by DSP technology at this point. Analogue receivers, demodulators, bit syncs, and frame syncs have given way to all DSP solutions. And the DSP technology is continually moving toward higher and higher frequencies as the sampling hardware and processor speeds increase. So we will see the DSP solutions continually reach into the higher frequency units in the processing chain. DSP signal processing also makes spread spec-



The company's products currently fly satellites from every major manufacturer in the United States, Europe, Asia, and Latin America. Photo courtesy of Integral Systems.

trum ranging techniques much easier to perform and we may see this become the standard at some point.

Q: What trends are there in the market at large? What can we expect in the future in terms of new products?

PG: The trend in the market at large is a move toward COTS based systems for all satellite ground systems functions. The COTS based system must be compatible with all manufacturer's satellites so that a single system can operate a fleet of mixed satellite types. I think we will see new products that provide more ground system automation and will help operators manage their fleets of satellites more autonomously. This will require better integration of all the prod-

ucts used in the ground system which is what we continually strive for.

Q: Finally, what can we expect from Integral Systems? Where do you think the company will be in, say, five-year time?

PG: I think we'll have a much broader range of products and solutions that may integrate previously disparate operations functions such as bus control, payload control, payload monitoring, etc., all in an effort to improve the satellite operator's quality of service, safety of operations, and efficiencies.

I think Integral Systems will also have quite a bit more government business as the government moves more toward COTS systems to take advantage of the cost savings it offers. ■

Integral Systems awarded contract for Taiwan's NSPO ground segment

Integral Systems, Inc. has been awarded a sole-source contract to upgrade Taiwan's NSPO's (National Space Organization's) existing mission operations system to simultaneously operate the NSPO's new Argo satellite and the existing FORMOSAT-2 and FORMOSAT-3/COSMIC spacecraft.

Integral Systems also will support the NSPO in training operations and maintenance personnel, as well as support integration, testing, and simulation activities related to the launch and early orbit operations of the Argo mission.

"We're proud to have been involved in NSPO's space program since its inception with ROCSAT-1 (FORMOSAT-1)," said Stuart Daughtridge, Executive Vice President of the Commercial Division at Integral Systems. "The sole-source award is a nice vote of confidence from the NSPO in our products and our services. We look forward to the NSPO continuing to be the Asian showcase for our LEO constellation control capabilities."

The contract calls for Integral Systems to provide all of the software required to fly Argo and FORMOSAT-2 and -3, including commanding, telemetry processing, orbit analysis, scheduling, and tracking station automation, using one single command and control system. The core software is based on Integral Systems' EPOCH IPS (Integrated Product Suite) with some customized add-ons.