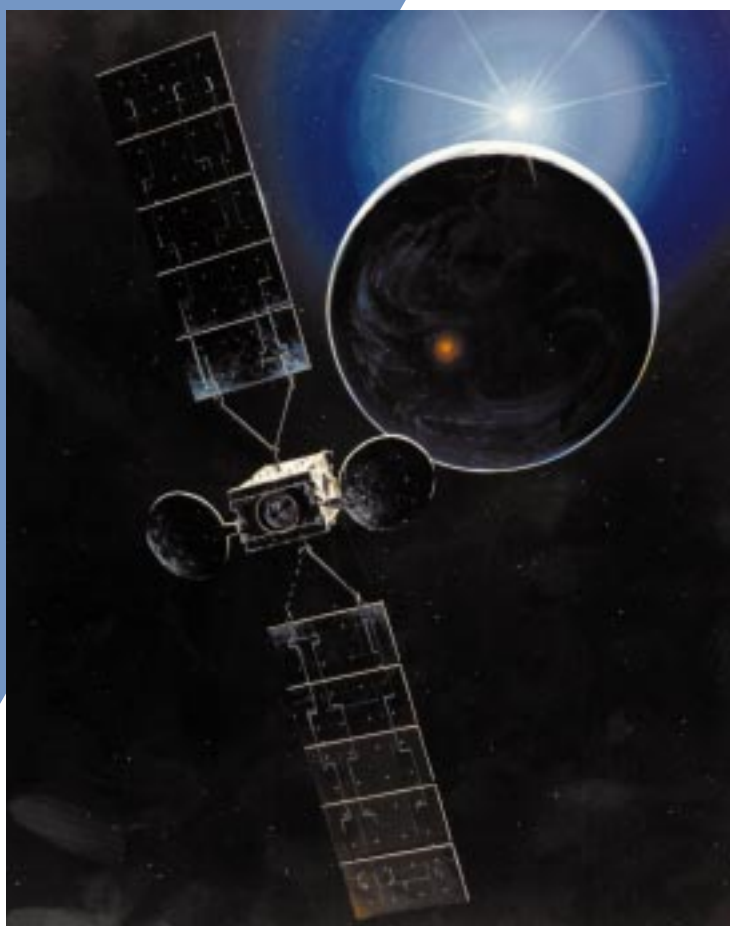
Telesat Report

TELESAT CANADA SATELLITE COMMUNICATIONS NEWSLETTER SUMMER/1999

# Canada's first direct broadcast satellite is beaming.... and so is Telesat



At 4:30 a.m. on May 21, 1999, amid a thundering explosion of smoke and flame, a Proton rocket roared from its launch pad in the Republic of Kazakhstan and rose skyward, a dense white tether tracing its speedy ascent. Aboard the rocket was Canada's first direct broadcast satellite, Nimiq.

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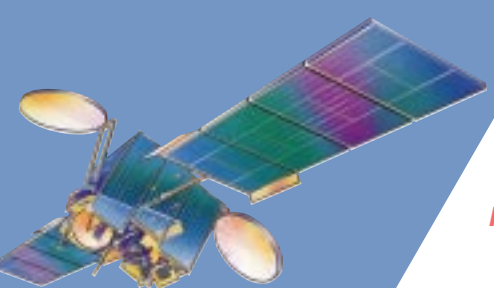


Approximately four hours later, Lockheed Martin mission control engineers captured Nimiq's first signals—an electronic thumbs up from space—thus ending an historic chapter that had started more than two years earlier.

"Despite a delay of almost 8 months due to problems with the travelling wave tube amplifiers (TWTAs), Nimiq was launched only 26 months after Telesat signed a contract with Lockheed Martin," says Roger Tinley, director, satellite systems. "This is the fastest delivery for a Telesat satellite program, showing the benefit of selecting the same basic design as two previous U.S. DBS satellites."

A core team, comprising 10 engineers from the programs, systems, bus, payload, satellite engineering and product assurance groups in Telesat's satellite systems division, was responsible for monitoring the procurement and in-orbit testing of the satellite. The team made significant contributions to the program, resulting in design and hardware changes to Nimiq, and their work was fully appreciated by Lockheed Martin.

A payload and bus engineer went to Lockheed Martin's Sunnyvale construction facilities to provide on-site support. "They worked closely with the Lockheed Martin team," says Trevor Lewis, manager, space programs group with Telesat. "This arrangement allowed them to resolve any issues quickly, which was a necessity for such a short program."

Other Telesat representatives from headquarters in Gloucester, Ontario traveled to California for certain major test phases, design reviews, technical interface meetings, program reviews, and audits.

## *Technical precaution postpones initial launch*

Nimiq passed all its final tests in August 1998 and was subsequently shipped to the launch site at the Baikonur Cosmodrome, east of the Aral Sea in the Republic of Kazakhstan a month ahead of schedule. But during final preparations for the launch, Lockheed Martin received word that some of the TWTAs on Nimiq's in-orbit cousins had failed—the same versions that were to power Nimiq's signals for their 36,000 kilometre journey to earth.

"As these TWTAs were used in many satellites, there were industry wide implications" says Mr. Tinley. "Although our own TWTAs had successfully passed all tests, Telesat fully supported a conservative approach to solving the problem rather than looking for a quick fix."

The Nimiq TWTAs were removed and sent to their manufacturer in Germany where they were redesigned, rebuilt, and re-tested. Lockheed Martin re-installed the TWTAs on Nimiq around the beginning of March 1999, paving the way for another round of tests before the satellite was again shipped to Kazakhstan in April.

"Postponing the launch was a big disappointment," says Mr. Lewis. "But it was fortunate that we discovered this potential problem before launch."

## *…3-2-1 Liftoff!*

Nimiq was the first Telesat satellite to be put into orbit on a Proton—a remarkably reliable launch vehicle. Manufactured in Moscow, Proton rockets have flown more than 200 missions since 1970, earning an enviable 92.5 per cent success rate. On the launch pad, the four-stage Proton that housed Nimiq casts an imposing shadow: it stands 61m high (the length of a hockey rink) and weighs almost 700,000 kg or 1.5 million lb.

A Telesat engineer traveled with Nimiq on the Antonov 124 aircraft during its transportation from California to Baikonur and three other Telesat engineers were in Baikonur for a month to monitor the launch preparations.

At 6:30 p.m. EST on 20 May 1999 (4:30 a.m. on May 21 Baikonur time), Nimiq blasted into space. During the first 10 minutes after liftoff, each of the first three rocket stages ignited in turn and subsequently separated from the vehicle, handing propulsion duties to the next stage, much as a relay runner passes a baton to a teammate. Two strategically timed "burns" or rocket bursts put the last stage (the Block DM), which carried the satellite, into a transfer orbit. Once separated from the Block DM, the satellite performed three main apogee burns that placed it into its geostationary orbit.

The launch was very accurate and, as a result, Nimiq has over twenty years of stationkeeping fuel remaining.


## *In-orbit Delivery*

Traditionally, Telesat has bought its satellites on the ground and then performed its own missions. Lockheed Martin, which has a bulk-buy arrangement with Proton, had already procured the launch vehicle for this satellite, so Telesat bought Nimiq "in orbit," an arrangement that has become the norm in the commercial satellite industry.

Although all our subsequent launches will likely be in-orbit deliveries, Telesat will continue to purchase the launch vehicle on many future programs and will continue to buy insurance because of advantageous rates due to its reputation in the industry.

Following a perfect launch, Nimiq's antennas and solar panels deployed successfully. Tests conducted from Telesat's Allan Park Telemetry, Tracking & Command facility have shown the satellite to be in full working order, providing excellent performance over all of North America. After completion of the in-orbit tests, Nimiq's first customer started test transmissions on June 15, as scheduled. Telesat became the owner of Nimiq on June 21, 1999.

# *Nimiq expands frontiers of Canadian home entertainment*

Telesat has christened its first direct broadcast satellite "Nimiq," an Inuit word for any object or force that unites things or binds them together. Nimiq is already living up to its name, uniting television fans across Canada in celebration: Bell ExpressVu, Nimiq's first customer, is preparing to use the satellite to broadcast some 200 video and audio channels throughout the country, forever changing the face of television in Canada.

"The launch of Telesat's Nimiq satellite marks a major milestone in the history of Canadian broadcasting," said Larry Boisvert, Telesat's president and CEO. "Nimiq will ensure that our nation enters the 21st century with a satellite broadcasting system that's second to none."

The first direct broadcast satellite launched in Canada, Nimiq differs from its more traditional counterparts like Telesat's Anik E satellites. "Nimiq is extremely high powered," says Trevor

Lewis, manager, space programs group, with Telesat. "This high power allows DBS subscribers to use small and inexpensive antennas—one of the key attractions of modern DBS service." Nimiq's muscularity also allows its signals to slice easily through fog, rain, and snow, making it ideal for Canada's notoriously harsh climate.

In addition, Nimiq is a "single payload" satellite, which means that all 32 of its channels broadcast in one frequency band, in this case Ku. In comparison, Telesat's Anik Es and the pending Anik F series are dual-band satellites: they carry both Ku-band and C-band transponders.

"Nimiq's footprint covers both Canada and the U.S.," says Mr. Lewis. "If a customer wants to provide full North American coverage we are prepared."


Manufactured at the Lockheed Martin Commercial Satellite Center in Sunnyvale, California, Nimiq is designed to last at least 12 years and will contain enough fuel to operate for two decades. The satellite's modular design decreases the number of moving parts, which simplifies construction, increases reliability, and reduces weight and cost.

## Nimiq at a glance

| | |
|---|---|
| **Satellite type:** | **Lockheed Martin A2100AX** |
| **Weight:** | **3600 kg** |
| **Transponders:** | **32 Ku-band** |
| **Launched:** | **May 20, 1999 (EST)** |
| **Vehicle:** | **Russian Proton D-1-e** |
| **Orbital slot:** | **91 degrees West** |
| **Service life:** | **12 years** |

# Bell ExpressVu bullish on Nimiq
## *A million customers sought by 2002*

Although Bell ExpressVu has attracted almost a quarter of a million direct-to-home satellite subscribers since its inception in September 1997, the best is yet to come. With the successful launch of Nimiq, Canada's first direct broadcast satellite, Bell ExpressVu expects its direct-to-home service to shift into high gear this July.

Operating to date on Telesat's Anik E2 satellite, Bell ExpressVu has currently leased 17 of Nimiq's 32 transponders and will take over another nine on November 1, 1999. Nimiq will offer Bell ExpressVu customers a number of new conveniences and programming benefits, heralding a new era in direct-to-home service in Canada.

Telesat Report spoke recently with Paula Thompson, director of communications with Bell ExpressVu, and discussed the significance of Nimiq's arrival.

*TR: What's the mood around Bell ExpressVu now that Nimiq has been launched successfully?*

PT: We're elated with both the success of the launch and the tests to date. We're very pleased with the ultimate outcome and fully expect that Nimiq is going to operate perfectly when we start broadcasting on July 1st.

*TR: How will Nimiq impact your service and your customers?*

PT: It enables us to dramatically expand our programming and to add new services. We offer around 130 video channels now, and Nimiq will allow us to get up to 200 video channels and expand our music as well. In total, we're probably looking at 250 national video and audio channels by November of this year.


In addition, because Nimiq is such a powerful satellite, customers will now need only 18-inch (45-cm) dishes to pick up our programming, which helps make the ExpressVu units even more simple to install. And customers will hardly notice the dishes because they're so small and unobtrusive.

*TR: What sort of programming do you intend to add?*

PT: We'll add a combination of Canadian and U.S. specialty channels and some additional local channels, but our focus will be on large pay-per-view offerings like major sporting events, Hollywood movies, concerts, and other special events. We'll also add an Internet service called DirecPC, which will be Canada's only Internet service available via satellite.

*TR: How will Nimiq help you reach your sales goal of one million subscribers by 2002?*

PT: We're going to aggressively market our expanded programming and tout the advantages of our 18-inch dishes. A lot of people still don't realize that there is a real alternative, and our job is to make the market aware of the many benefits that Bell ExpressVu offers.

*TR: Will your existing customers have to make any adjustments to get Nimiq programming?*

PT: In about 80 per cent of cases, we'll simply have to re-point the existing dishes and replace the LNBs (low noise block converters). It's really that basic. A small percentage of customers will have to replace their dishes with our new 18-inch models. Once antennas have been re-pointed and LNBs replaced, customers will simply click on their TVs and they'll be up and running on Nimiq.

To help customers, we're paying for the hardware and labour to move them to the new bird. Customers who make the changes themselves will earn a $50 programming rebate.

*TR: Are you going to overlap service on Nimiq and Anik E2?*

PT: Yes. We're going to start broadcasting on Nimiq in early July, and we'll still be operating on Anik E2. Over the summer we'll shift existing subscribers to the new service, which should take about three months.

*TR: ExpressVu is an all-digital service. What does that mean to customers?*

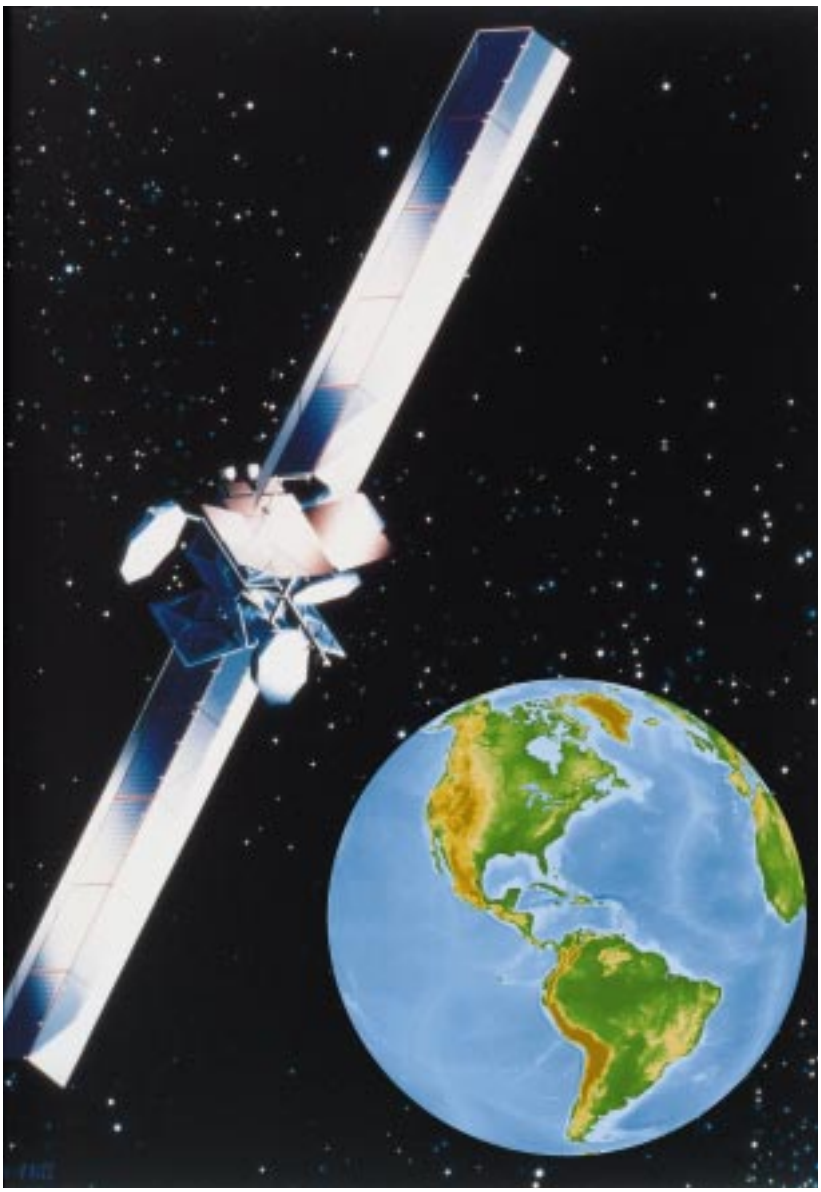
PT: It allows customers to easily customize their programming. For instance, our pay-per-view service is called "Impulse Pay-Per-View." If you want to watch a movie, you simply push a button on your set-top box and you've got it. Or if you don't watch as much TV in the summer as you do in the winter and want to temporarily scale back your programming, you can do that just as easily. Also, if you want to cancel your service while you're on vacation, you can, and you don't pay while you're away.

*TR: What's the greatest challenge that ExpressVu faces now?*

PT: Spreading the gospel. We've got a great product and a great satellite. Now we've got to get the word out and create some real excitement.

# Anik F1 to boost Telesat's international reach

## *Powerful satellite blends toughness with savvy new technology*



Streaking through space at more than three kilometres every second, subjected to drastic temperature swings—from a scorching 130°C to a frigid -170°C—and continually soaked with radiation from the sun, geostationary satellites have to be as tough as tanks.

Mike Minhas, program manager with Telesat, is in charge of ensuring that Telesat's next satellite, the Anik F1, has what it takes to thrive despite its inhospitable environment. Scheduled for launch in 2000, Anik F1 will be the largest, most powerful, and farthest reaching communications satellite that Canada has ever put into space.

"Anik F1 will be 150 feet long when fully deployed; it's a huge spacecraft," says Mr. Minhas. "The market wants lower and lower satellite delivery costs, so that's pushing satellite designers to come up with innovative ways to equip satellites with more channels."

### *And they're doing it.*

Hughes Space and Communication Co. in El Segundo, California, is manufacturing Anik F1, an HS 702 spacecraft, the most powerful commercial satellite available today. Weighing in at a hefty 4700 kg (over 10,000 lb)—1700 kg more than the Anik E satellites—Anik F1 will carry 84 transponders or channels and cover all of North and South America, allowing Telesat to expand services well south of its traditional Canada-U.S. market.

Anik F1, the 12th in a long succession of Anik satellites, will serve North America with 32 Ku-band and 24 C-band transponders and cover South America with 16 Ku-band and 12 C-band transponders—augmenting the Company's space segment in South America beyond the current Anik C1 capacity. Four special extended Ku-band "global" transponders will actually link the two continents.

Now under construction, the spacecraft is on schedule for its mid-year 2000 launch from Kourou, French Guiana. An Ariane rocket will carry Anik F1 into orbit.

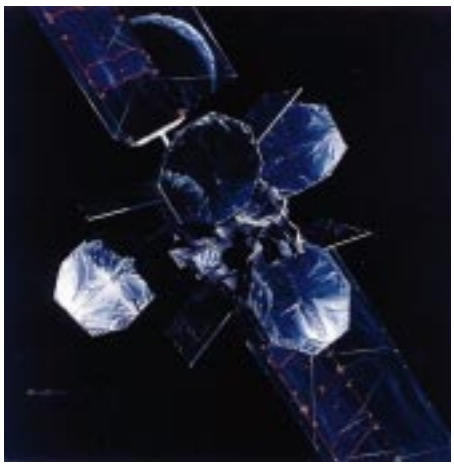
### *Technological ingenuity a hallmark of Anik F1*

Traditionally, whisper-like bursts from small chemically-powered rockets kept geosynchronous satellites in their orbital slots. Anik F1, however, will maintain its position with a xenon ion propulsion system (XIPS) that is 13 times more efficient than conventional liquid fuel thrusters. This new fuel-stingy propulsion system produces thrust by ionizing inert xenon gas and expelling it through an electrified grid.

The XIPS thrusters collectively need only 7 kg of fuel annually, roughly 20 per cent of the weight that a comparable chemical system

consumes, contributing significantly to Anik F1's 15-year life expectancy.

Communications satellites use solar arrays to collect light from the sun and turn it into electrical power. The more transponders, the greater the satellite's electrical needs. Anik F1 will need some 16,000 watts of power to operate



its thrusters and its communications systems, and Hughes engineers devised an ingenious design. They equipped Anik F1 with solar panel concentrators, angled reflector panels that form a shallow trough along both sides of the winged arrays and reflect the sun's rays onto the primary solar panels. These concentrators increase radiation exposure and help produce more power—without increasing the size of the arrays.

Given that the bulk of Anik F1's North American capacity has already been leased, Telesat will soon turn its attention to the specification and procurement of Anik F2. Anik F2 will be ready for launch in mid 2002.

# *Telesat and Hughes enjoy partnership that dates back to early 70s*

**Telesat and Hughes Space and Communications Company, the world's leading manufacturer of commercial communications satellites, go back a long way. Hughes built the three Anik A series satellites, the first of which Telesat launched in November 1972. These pioneering birds carried only 12 C-band transponders and had just 300 watts of power. Hughes would go on to manufacture three Anik C spacecraft and two Anik Ds as well. Anik F1 is the ninth Hughes satellite that Telesat will have launched.**

**"We have a very good working relationship with Hughes," says Mr. Mike Minhas, Telesat Anik F1 program manager. "We're working with what I think are the best people in their company, and that makes for an extremely strong team."**

**Telesat and Hughes: a legacy of satellite success**

| Satellite | Launch Date | Ku-band Channels | C-band Channels | Power (watts) | Weight (kg) |
|---|---|---|---|---|---|
| Anik A1 | 9 November 1972 | 0 | 12 | 300 | 560 |
| Anik A2 | 20 April 1973 | " | " | " | " |
| Anik A3 | 7 May 1975 | " | " | " | " |
| Anik C1 | 12 April 1985 | 16 | 0 | 900 | 1160 |
| Anik C2 | 18 June 1983 | " | " | " | " |
| Anik C3 | 11 November 1982 | " | " | " | " |
| Anik D1 | 26 August 1982 | 0 | 24 | 1000 | 1240 |
| Anik D2 | 9 November 1984 | " | " | " | " |
| Anik F1 | Scheduled for July 2000 | 48 | 36 | 15,000 | 4700 |

# CRTC Decision Signals the Transition to Competition

On May 25, 1999, the CRTC issued its landmark decision on the regulatory framework which will see Telesat through the transition from a fully regulated environment to a competitive market in fixed satellite services. In Telecom Decision CRTC 996 (Telesat Canada –Transitional Regulatory Framework and Forbearance for Fixed Satellite Services), the Commission has accepted Telesat's proposal, which was developed in consultation with a variety of satellite customer groups. In fact, the CRTC stated that it "shares the positive view of most parties that the proposed transitional regime is a creative approach that is responsive to the direction given by the Commission in PN 9840."

Without a doubt, this decision is a win-win for customers and for Telesat. For satellite customers, it provides certainty going forward on the availability of state-of-the-art satellite capacity, and at prices which are competitive. For Telesat, it means having the much-needed flexibility to tailor services to individual customer needs and meet the competition head-on.

The new framework was developed in response to the CRTC's direction in December 1998 to propose a framework which would allow Telesat to benefit from more flexibility in a competitive market but which would also address the Commission's concerns that some customer groups might not have access to immediate competition in satellite services when the Canadian market is liberalized March 1, 2000.

Behind the scenes in the latter half of 1998, however, Telesat was busy working with its customers in the development of contracts for service on Anik F1. This followed several months in which Telesat had explored the design requirements with its customer groups to take advantage of the latest technologies available and incorporate them into Anik F1. As a result, when the CRTC asked for a transitional framework, Telesat was able to propose to the Commission a plan which was already favourable to a large number of customers.

Nine submissions were filed by customers and industry groups during the proceeding, all of them being positive. It is rare for the CRTC to be handed an application where there is such a level of consensus that everyone is a winner. Telesat is extremely pleased that the CRTC was satisfied that adequate safeguards were in place to protect customers, while allowing Telesat to prepare for full competition.

In general terms, Telesat's price ceiling applies to unprotected, preemptible whole RF channel service with a minimum term of five years. All other services, such as Partial Channel and Occasional Use capacity, will be forborne from tariff regulation and certain other requirements, with the price being governed by market conditions. The ceiling prices for service on the Anik E satellites from March 1st to December 31st, 2000 are the current rates as found in Tariff CRTC 8001. From January 1st, 2001, the ceiling is raised to $170,000 per month. For the same service on Anik F1, the ceiling of $170,000 per month applies from its launch date, expected to be in the second quarter of 2000. This ceiling is very competitive with similar services on U.S. and other satellites. As a further safeguard, a price ceiling at current rates is also applicable to other Anik E services from March 1st to December 31st, 2000.

The CRTC also agreed that the Order Priority List ("OPL") would no longer be necessary after December 2000, as new satellite capacity is expected to be sufficiently available to accommodate all users.

This decision is positive news for Canadian satellite customers and for Telesat. It means that, as the Canadian market prepares for full liberalization, customers and service providers can tailor their services with the flexibility which a competitive market requires. Ultimately, this means that the consumer benefits. It also allows Telesat to work with customers to develop unique and innovative applications which meet their individual needs.

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