Getting ready for the Argos Downlink

Michel Taillade

CLS-Argos General Manager, Toulouse France

Argos system enhancements

May 2001:

After the launch of NOAA L in 2000 and NOAA M in 2001, three satellites will be flying second-generation Argos instruments.

Frequency spreading will be introduced for platform transmissions. In particular, bandwidth will be reserved for low-power platforms in order to take advantage of the spaceborne instrument's increased sensitivity.

System capacity will increase fourfold, thus allowing more data to be transmitted.

November 2001 +:

A new second-generation Argos instrument will be launched on ADEOS II.

This launch will mark the beginning of a new partnership with Japan and bring a major new innovation by providing downlink messaging capability.

Downlink messaging will allow Argos users to dialog with their platforms.

It will also provide a new transmission mode called interactive data collection, which may be used instead of or as a complement to random-access data collection.

This major enhancement will be added on to standard Argos functions so that users can continue operating their platforms as before or switch progressively to downlink messaging.

1) System development strategy

The Argos system's future development must take the following factors into account.

a) Certain users investing in platforms over the long term do not want any changes. Conversely, others using platforms with very short operating lifetimes expect Argos to provide continuous performance enhancements.

b) New satellites will be launched over a period of several years, so service enhancements will be phased in progressively.

c) Enhancements and changes to the Argos system must not compromise stability and continuity of service.

2) System development strategy

Maintain upward compatibility

System upgrades must continue to support existing operating modes.

For users who are satisfied with the current service or do not see any need to upgrade, Argos will evolve but remain compatible with their platforms.

For example, users will not be obliged to switch to downlink messaging. Users will be able to continue operating platforms without receivers or to fit certain platforms with a receiver to take advantage of downlink messaging and interactive data collection.

Give users a choice

The system will be developed by adding on new functions that users may choose to adopt or not, depending on their requirements.

For example, if users decide to switch to downlink messaging, they do not have to use it all the time. They may choose to switch on their platform receivers periodically (say, 12 hours per week). At all other times, platforms could operate in transmission-only mode. Users may switch between interactive data collection and random-access data collection at any time.

3) System development strategy

Gradual evolution

The system will evolve gradually by flying Argos instruments on a number of satellites at the same time.

Each new satellite will thus offer new features that will not be exploited fully from the outset, since they will be available initially on one satellite only.

Users will be able to experiment with new functions or use them operationally in combination with existing functions by switching between satellites. Platforms will be designed to revert automatically to existing operating modes to minimize the risk of failures when using new functions.

For example, interactive data collection will only be available to begin with on ADEOS II. This mode will improve performance when ADEOS II is within view, but platforms will operate in random-access mode with the four other satellites.

System evolution will therefore be a gradual process, ensuring graceful degradation in the event of a failure to maintain the system's operational capability

Platform terminals

A platform may be fitted with two kinds of terminal:

- **a platform terminal transmitter (PTT)**, comprising a transmitter and associated logic circuitry. A PTT communicates with the satellite one way (uplink) and operates in random-access data collection mode;

- **a platform messaging transceiver (PMT)**, comprising a transmitter, a receiver, and associated logic circuitry. A PMT communicates with the satellite two ways (uplink and downlink).
It can operate in random-access or interactive data collection mode, and can receive downlink messages from the user.

The Argos system operator considers PTTs and PMTs as complete units that must be certified by an organization approved by the Argos Operations Committee before they can operate within the Argos system.

Platform Messaging Transceiver (PMT)

Downlink messaging

Downlink messaging is an enhancement requested by Argos users that will offer a great many potential new applications for the Argos system.

Downlink messaging will allow users to perform actions within a closed loop, provided they have properly understood the capabilities and limits of the service.

With downlink messaging, platforms fitted with a suitable transmitter will be able to:

- receive messages from users for closer control over scientific and technical parameters;

- receive messages from the Argos system operator to optimize performance, i.e.:
  . general information such as the time (UTC), Argos constellation status, satellite orbit parameters, etc.;
  . specific information such as platform positions.

However, we must take care to manage the increased degree of complexity Downlink Messaging will entail, at the risk of damaging Argos's reputation as a system that is easy to use, robust, and reliable.

Data collection

When downlink messaging enters service two data collection modes will operate in parallel:

Random-access data collection mode

This mode has proven simple, robust, and able to function in difficult conditions; it operates one way only, i.e., platforms uplink messages to the satellite, so there is no protocol or dialog between platform transmitters and the spaceborne Argos receiver.

However, it does have some drawbacks. In particular, there is a limit of 800 bits of useful information that can be uplinked on each satellite pass.

Interactive data collection mode

Interactive data collection only works with satellites carrying an Argos instrument with downlink messaging capability.

The Argos instrument checks each message sent by a platform and responds with an acknowledgement if the message checks out OK. On receiving the acknowledgement, the platform then sends the next message. If it receives no acknowledgement, it resends the message.

Interactive mode differs from random-access mode in that it:

- confirms if messages have been successfully sent and received; this represents a significant change for Argos;
- sends more useful messages during each satellite pass, since only messages not acknowledged by the Argos instrument are resent.

Put simply, a satellite communicating with a platform in interactive mode offers a transmission capacity equivalent to three satellites operating in random-access mode (in fact, given that the number of successfully sent messages is known, the actual gain in capacity over random-access transmission strategies may be even higher).

How random-access and interactive modes will co-exist:

Both modes will operate in parallel all the time.

Satellites without downlink messaging capability will operate in random-access mode only, whereas those with the capability will offer users the choice between the two modes.

Plug-in Receiver

Service Argos Strategy for Argos Downlink Messaging Function development

1) Downlink Messaging Function general promotion

Présentations, Documentation
Explore different types of application in contact with users
Service opening strategies
Tariffs

2) Distribute and explain PMT Receiver technical specifications

Promotion of the receiver development by several manufacturers

3) Line production of a "Plug In " receiver during the transition period before the launch of the first satellite equipped with the Downlink Messaging Function and two years after

Close contact with manufacturesr to integrate the receiver in their PMT
Documentation, Technical help
Development of Simulation Equipments of the Downlink function and the receiver to develop PMT
Management of the production line

4) Development of PMTs

Select potential applications (Floats, Drifting buoys, Fishing vessels ...)

Discuss and Write adapted specifications

Develop a complete PMT for one or several application (same strategy than for the receiver)

5) Service Argos participation to the Qualification of the Downlink Function in close contact with CNES

Proposition of different types of test according to User potential applications

6) Early Entry Program

Joint projects between Users, Manufacturers and Service Argos to develop and test different type of applications

Short term Agenda

Downlink Function Development short term Agenda	September	October	November	Décember	January	February	March	April
"Plug-in" Receiver line development								
Simulation equipment		Tests	Ready					
6 prototypes								
50 PMTs line production								
150 PMTs line production								
Documentation								
Technical Specifications	Ready							
Simulation Equipment Doc.								
PMT Functional Description								
Contats with Manufacturers					To be convened			
PMT development								
Application analysis and specifications				Start				
Contacts for use of "Plug-in "receiver					To be convened			
CLS PMT Development						Start		