



VSAT 系統於海巡署之應用

The Coast Guard Administration's VSAT System

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前言

電訊網路的質量和普及率需求，雖自 1847 年發明電話以來，已逐漸蓬勃發展，但在已開國家需大容量的網路運用時，也僅限於有限且固定的區域，使得大多數發展中國家對於專屬網路（VPN）及偏遠地區高品質通訊需求，仍不斷尋求發展。本世紀八十年代起開發的 VSAT 技術不僅能提供非實體線路可用的區域服務，在性能、業務種類、可用度、傳輸成本、擴容成本等方面均具有與實體線路相抗衡的競爭力。

一、VAST 技術介紹

VSAT 是 Very Small Aperture Terminal 的縮寫，直譯為“小型孔徑地面終端站”，因 VSAT 系統中地面站設備的天線口徑較小，通常為 0.3m - 2.4m。VSAT 是八十年代中期利用現代技術開發的一種新的衛星通信系統，此類系統進行通信具有靈活性強，可靠性高，成本低，使用方便以及小站可直接裝在用戶端等特點，藉由 VSAT 用戶數據終端可直接利用衛星通道與遠端伺服器進行通連，完成數據傳遞、文件交換或遠程處理，以改善地面站台訊號中繼問題，因此，在地面網路基礎建設不完備、通訊線路品質不良或無高速傳輸網路的偏遠地區，運用 VSAT 系統將可改善上述問題。

Introduction

Though the prevalence and quality of telecommunication networking has undergone leaps and bounds since the telephone was first invented in 1847, yet the adaptation of large-capacity networking in developed countries remain rather limited and in certain fixed areas, which has turned the majority of the developing countries to continue searching for solutions through VPN and remote area high-quality communications applications. The VSAT technology that begun in the 90s not only serves to provide regional services through intangible wiring routes but also provides comparable competitiveness in functionality, service types, accessibility, transmission cost, expansion cost and so forth when compared with tangible wiring routes.

1. Introduction of the VSAT technology

VSAT, the acronym of very small aperture terminal, signifies a “small-diameter ground terminal” in straight interpretation, deriving from the fact that the wiring diameter of a VSAT system's ground tends to be smaller, usually between 0.3m and 2.4m. A new satellite communications system developed in the mid 90s utilizing the modern technology, VSAT systems come with characteristics of a dynamic flexibility, dependability, low cost, easy to use, and a direct linkup to the user through a local station. Whereby a VSAT user terminal can link up directly to a remote server through satellite channel to complete data transmission, document exchange or even remote processing to resolve the problem of ground station signal interruptions. In light of which, in remote spots where the ground networking-infrastructure may be less than perfected, the quality of communications wiring may be poor, or in the absence of a high-speed transmission networking, the adaptation of the VSAT system would poise to improve the foresaid problems.

二、VSAT 系統特性

VSAT 網路架構由數個 VSAT 小站與一個主站 (Hub) 協同工作，共同構成的一個廣域網路 (站多，各站業務量小) 的衛星通信網路。與地面站台通信網路比較，VSAT 通訊網路具有以下九項特點：

- (1) 訊號涵蓋範圍大。
- (2) 可對所有地面站提供相同的業務種類及寬頻服務品質 (包括錯誤位元率及傳輸時延等)。
- (3) 具良好擴充性，擴充成本低，建立新的通訊站台所需時間短，天線口徑小，系統架設及維護容易。
- (4) 靈活性良好 (多種業務可於同一網路中併用，並提供不同業務種類、分配頻帶和服務品質等級等可動態調整之性能)。
- (5) 具「點對點」、「一點對多點」、「多點對多點」之良好通訊能力，用戶可直接與用戶通訊，不需透過地面台轉接。
- (6) 因可作為用戶專有之通訊網路，不須受制於通訊網路業者，故其獨立作業性能優良，另除固定型設備外，尚有移動型設備。
- (7) 不同通訊協定標準的用戶可利用不同的地面站台於同一個 VSAT 網路中進行通訊，具有良好之互操作性 (Interworking)。
- (8) 通訊品質良好 (具較低之錯誤位元率與較短網路響應時間)。
- (9) VSAT 系統具有智慧型 (含操作智慧化、介面智慧化、支持業務智慧化、頻道管理智慧化等) 功能，可無人操作，節省作業人力。

2.Characteristics of the VSAT system

A VSAT networking framework comprises of several small VSAT substations and a main hub working together to constitute a wide-area networked (of a multi-station configuration of smaller substation workload) satellite communications network. Compared with a ground station communications network, a VSAT communications network offers the following nine characteristics:

- (1) Its signals cover a far-flung area;
- (2) It is able to provide to all ground stations the identical service types and broadband service quality, including error bit rate, transmission delay, etc.;
- (3) Offering fine expandability with low expansion cost and a relative short time for installing new communication stations of smaller diameter antenna, and easy system launching and maintenance;
- (4) Offering fine flexibility, where a multiple of services can be combined in a single network and provide varied service types, with adjustable feature for bandwidth allocation and quality grade;
- (5) Offering fine communication capability of point to point, one point to multiple points, multiple points to multiple points, whereby the user can communicate with other users without routed through the ground station;
- (6) As a user designated communications network, it is not confined by the telecommunications provider, hence warranting an outstanding independent operability, and besides fixed equipment, there are choices of mobile equipment;
- (7) Offering fine inter-working capability for users on varied communications protocols can communicate through the same VSAT network using different ground stations;
- (8) Offering fine communications quality, with lower error bit rate and shorter networking response timing;
- (9) A VSAT system offers intelligent functions, i.e. intelligent operations, interface, IT supportive operations and frequency management) to allow man-less operations to conserve operating manpower.



三、VSAT 系統發展分為下列三個階段

(一) 初期階段：此階段概於 1980 年前後採以 C 波段為主要通訊頻道，惟僅限於提供單向接收及低速傳輸之數據業務。

(二) 中期階段（第一代）：於 1983 年至 1988 年所研發之設備，除開發新的多址通連方式外，另以 Ku 頻段以及星狀網路結構做為數據傳輸之主要特色。

(三) 近期階段（第二代）：第二代的 VSAT 已由單純數據傳輸型態轉型為以數據、語音、圖形等綜合業務的方向為主，並採用網狀通訊結構，時間概為 1988 年到 90 年代中期。

自 90 年代中期起，VSAT 已朝步向第三代功能發展，其特色是加強網路管理及控制的能力，也就是以軟體控管 VSAT 系統作業。目前，VSAT 系統正朝向硬體及軟體的標準化方向發展，以使 VSAT 設備具備基層網路的基本作業平台，並可依據用戶的需求藉由模組型態的硬體設備及作業軟體的增加而提升 VSAT 系統本身網路交換與傳輸功能。

四、VSAT 系統應用

除專屬寬頻業務外，VSAT 衛星通訊網路可支援現有通訊業務，包括語音、數據、傳真、LAN 互連、視訊會議系統、低速圖像、採用 FR 介面的動態圖像和電視、數位音樂等。具體的業務種類及典型應用（如圖示）。

3.The VSAT system development is divided into the following three phases

(1) Initial phase: This phase pertains to that around 1980, when C band is used as the primarily communication channel, and is limited to digital services of one-way reception and low-speed transmission.

(2) Intermediary phase (first generation): Of equipment developed during 1983 and 1988, which cover not only newly developed multi address linkup but characterized by a Ku band and satellite-configured networking framework in digital transmission.

(3) Near phase (second generation): Second generation VSAT is now being transformed from a simple digital transmission mode to an integrated digital/voice/graphic service orientation, together with a networking communication framework, which covers the timeline of roughly from 1988 to the mid 1990s.

Since mid 90s, VSAT has begun broaching towards third generation function development, which is characterized by a stepped-up management and control capability, meaning using software to control a VSAT system operations.

At present, the VSAT systems are broaching towards the direction of standardized hardware and software, allowing VSAT equipment to provide a rudimentary operating platform function in essential networking, and that the addition of module configured hardware equipment and operating software, made to the user requirements, can further enhance a VSAT system networking exchange and transmission functions.

4.The VSAT system applications

Besides designated broadband operations, a VSAT satellite communications network also supports the existing operational services, such as voice, digital, fax, LAN linkup, Audiovisual teleconferencing system, low-speed graphic transmission, FR interface-based interactive graphic prompting, television and digital music services; some of its tangible operational categories and typical applications are as charted below,

業 務	應 用
廣 播 和 業 務 分 配	
數 據	數 據 庫、氣 象、新 聞、倉 庫 管 理、通 控、金 融、商 業、遠 地 印 刷 品 傳 遞、報 表、零 售 等
圖 像	傳 真 (Fax)
語 音	單 向 新 聞 廣 播、標 題 音 樂、廣 告 和 空 中 交 通 管 制
電 視	
TVRO (電 視 單 收)	接 收 文 娛 節 目
BTV (商 業 電 視)	教 育、培 訓 和 下 行 資 訊 業 務
收 集 和 監 控 業 務	
數 據	新 聞、氣 象、監 測、管 線 狀 態
圖 像	圖 表 資 料 和 凝 固 圖 像
視 頻	高 壓 縮 監 視 圖 像
雙 向 交 互 型 業 務 (星 形 拓 撲)	
數 據	信 用 卡 核 對、金 融 事 務 處 理、銷 售 點 數 據 庫 業 務、集 中 庫 存 控 制、CAD/CAM、預 訂 系 統、資 料 檢 索 等
雙 向 交 互 型 業 務 (點 對 點)	
數 據	CPU-CPU、DTE-CPU、LAN 互 連、電 子 郵 件、用 戶 電 報 等
語 音	專 線 語 音 及 急 緊 語 音 通 信
電 視	壓 縮 圖 像 電 視 會 議

五、VSAT 網路架構

VSAT 網路架構係由 VSAT 小站、主站及衛星轉頻器所組成，現以數據傳輸為主的星狀架構來說 VSAT 衛星通訊網路架構（如圖示）。

（一）主站（HUB）：

主站是 VSAT 網路的中心，與一般地面站台一樣使用大型天線，直徑約為 3.5m ~ 8m（Ku 波段）或 7m ~ 13m（C 波段）。應用於數據業務的 VSAT 主站是業務處理中心也是網路控制中心，同時在主站內另有一網路控制中心（NCC）負責對網路內各項設施進行監測、管理、控制和維護。用於語音業務 VSAT 之控制中心可與業務中心置於同一站台，也可不在同一站台，另為便於裝備拆卸與組合，主站通常會採用模組化結構，通訊時採用高速區域網路的方式與各小站間互連。

（二）VSAT 小站：

VSAT 小站係由小口徑天線、室外單元（ODU）和室內單元（IDU）等三項設備所組成。於相同環境下（如相同的頻段、相同的轉發頻器等）語音 VSAT 網路的小站為進行小站之間的直接通連，其天線設計會明顯大於只與主站通信的數據 VSAT 小站。

（三）衛星轉頻器：

第一代 VSAT 網路中採用 C 頻段轉頻器，自第二代 VSAT 起，即採用 Ku 頻段為主。至於採用的波段並非取決於 VSAT 設備本身，而是決於衛星本體上是否有可用之轉頻設備之資源。

VSAT 衛星通訊架構圖

5.The VSAT networking framework

(1) Main hub

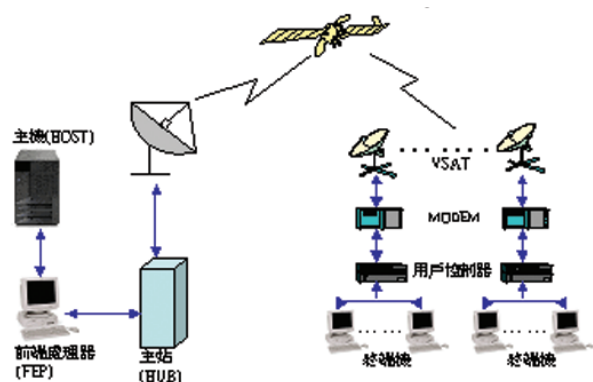
The main hub serves as the central nerve of a VSAT network, and operates on large-scale antenna same as the general ground stations with a diameter measuring approx. 3.5m to 8m (on Ku band) or 7m to 13m (on C band). When applied in digital services, a VSAT main hub serves as the processing center and also the networking control center, where at the same time the main hub is equipped with a networking control center (NCC), which is responsible for monitoring, managing, controlling and maintaining various facilities. When applied in voice services, a VSAT system's control center can be placed in the same station as the services center or in a separate station. In addition, to facilitate equipment mounting, dismounting and assembly, the main hub is usually in a modulated structured, and links up to various substations using the high-speed regional network configuration.

(2) VSAT substations

A VSAT substation is comprised of three elements – the small diameter antenna, outdoor unit (ODU) and indoor unit (IDU). Under identical setting, i.e. identical bandwidth, frequency projector, etc., a voice VSAT network's substations serve to provide direct linkup between the substations, and whose antenna design would ominously be larger than that of the digital SVAT substations that only communicate with the main hub.

(3) Satellite attenuator

First generation VSAT network operates on C band attenuator, and second generation VSAT and onward are largely operating on the Ku band. As to the operating bandwidth, it has not been tied to the equipment but rather whether the satellite itself comes with the resources of frequency conversion equipment.





六、VSAT 於 LAN 中的應用

採用 VSAT 系統運用於區域網路 (LAN) 間可提昇網路與網路間的可靠度，自八十年代中期起，VSAT 系統已從支援串列介面到能與 LAN/MAN 的一個主網路節點介面。使用 VSAT 網路進行 LAN 間之通訊，可採用直接方式或透過幀中繼的方式。當用 VSAT 系統直接與 LAN 構連時，可採用橋接器、路由器或集線器等三種不同的方式。採用不同的通連方式對 VSAT 系統的通訊協定、頻寬利用、靈活性等方面都有不同的影響。現用的 LAN 協定有 TCP/IP、SNA、DECnet、IPX 等。

七、VSAT 系統運用於海巡署構想

本署偏遠地區 (外、離島) 通訊品質普遍不良，肇因於中華電信公司於偏遠地區寬頻網路基礎建設不足所致 (如海巡 ADSL)，因應解決改善偏遠地區寬頻通訊問題，以 VSAT 系統應是較佳的方案，以本署所轄單位較具需求者以東、南沙地區為最，現概括描繪運用 VSAT 系統於東、南沙地區之構想圖 (如次頁圖示)。

運用 VSAT 系統整合 VOICE、DATA、VIDEO 等多媒體訊號是時代趨勢及本署業務連繫之需，除收容島上各軍種單位之訊號外，當回傳至台灣本島後可藉由南巡局、海岸總局，甚或海巡署對外鏈路與國防部等島上有駐守人員所屬上級單位連繫，題供島上全方位及多媒體之通訊品質，未來希望運用 VSAT 系統推及政府各部會派駐外、離島人員之共同區域網路，以改善現階段通訊品質不佳問題。

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6.VSAT's LAN applications

Given that the adaptation of a VSAT system in regional networking (LAN) helps to enhance the dependability between networks, since mid 90s, the VSAT systems are able to support serially connected interfaces to a LAN/MAN network knot interfaces. Communications between a VSAT network and LAN can either be in a direct mode or an intermediary mode. When communicating directly with LAN using a VSAT system, there are three options of using a bridge device, router or streamliner, and varied linkup methods would produce varied effects in VSAT system communications protocols, bandwidth utilization and flexibility. Some of the prevailing LAN protocols include TCP/IP, SNA, DECnet, IPX and the like.

7.Concept for the Coast Guard Administration's adapting the VSAT system

A predominant poor quality of communications at the administration's remote areas, namely at offshore and coastal islands, has stemmed from Chung Hwa Telecommunications Company's insufficient broadband networking infrastructure for remote regions, such as the Coast Guard's ADSL linkup. In search of resolving and improving remote regions' broadcast communications issue, the VSAT system emerges as an optimal solution. In the case of the Dong Sha and Nan Sha regions that fall under the administration's jurisdiction that are in dire need of improvement, a conceptual drawing is hereby presented depicting the adaptation of a VSAT system in the Dong Sha and Nan Sha regions as showed below,

Adopting the VSAT system for integrating voice, data and video multimedia signals is not only a current trend but best support the administration's communication needs, as it serves more than receiving and accommodating signals of various defense units on the island, and signals transmitted back to the Taiwan main island would allow Southern Regional Patrol bureau, General Coastal Patrol Agency, or even the Coast Guard Administration to contact the superior units at the Defense Department on islands that are manned by defense troops through the administration's external linkup circuits, offering the islands a comprehensive and multimedia communication quality. It is highly anticipated that the VSAT system can be prompted as a shared regional network for all outpost personnel stationing at offshore and coastal islands under various government departments that would poise to improve the current phase's poor communication problem.

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