

**An LBS Application System at Jiuzhaigou National Park**  
**--Management, Navigation, Search and Rescue**

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**Baoguo Yu**

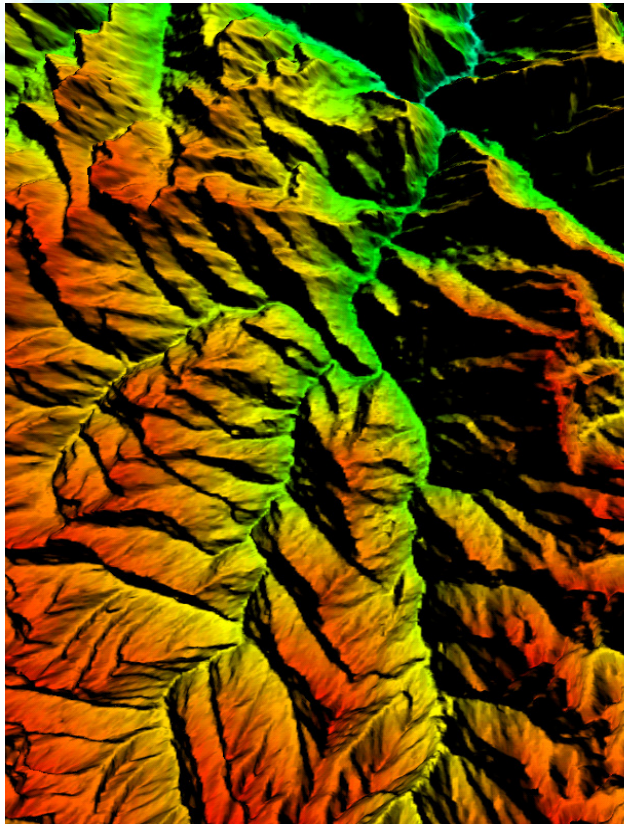
**yubg@sina.cn**

**China Electronics Technology Group Corporation**

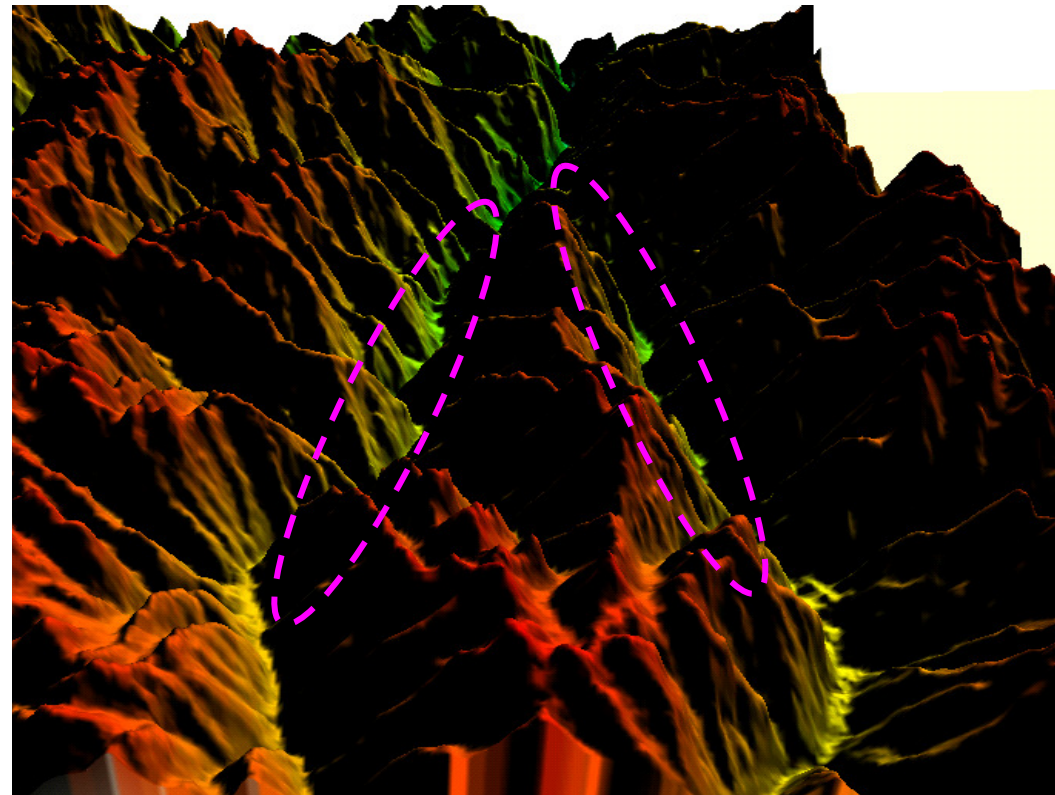
**ICG-6, Japan, 2011**

- 1. Challenges for national park management**
- 2. Proposed solution**
- 3. What services can be provided**
- 4. Summary**

## 1) Poor visibility of GNSS satellites in mountain areas

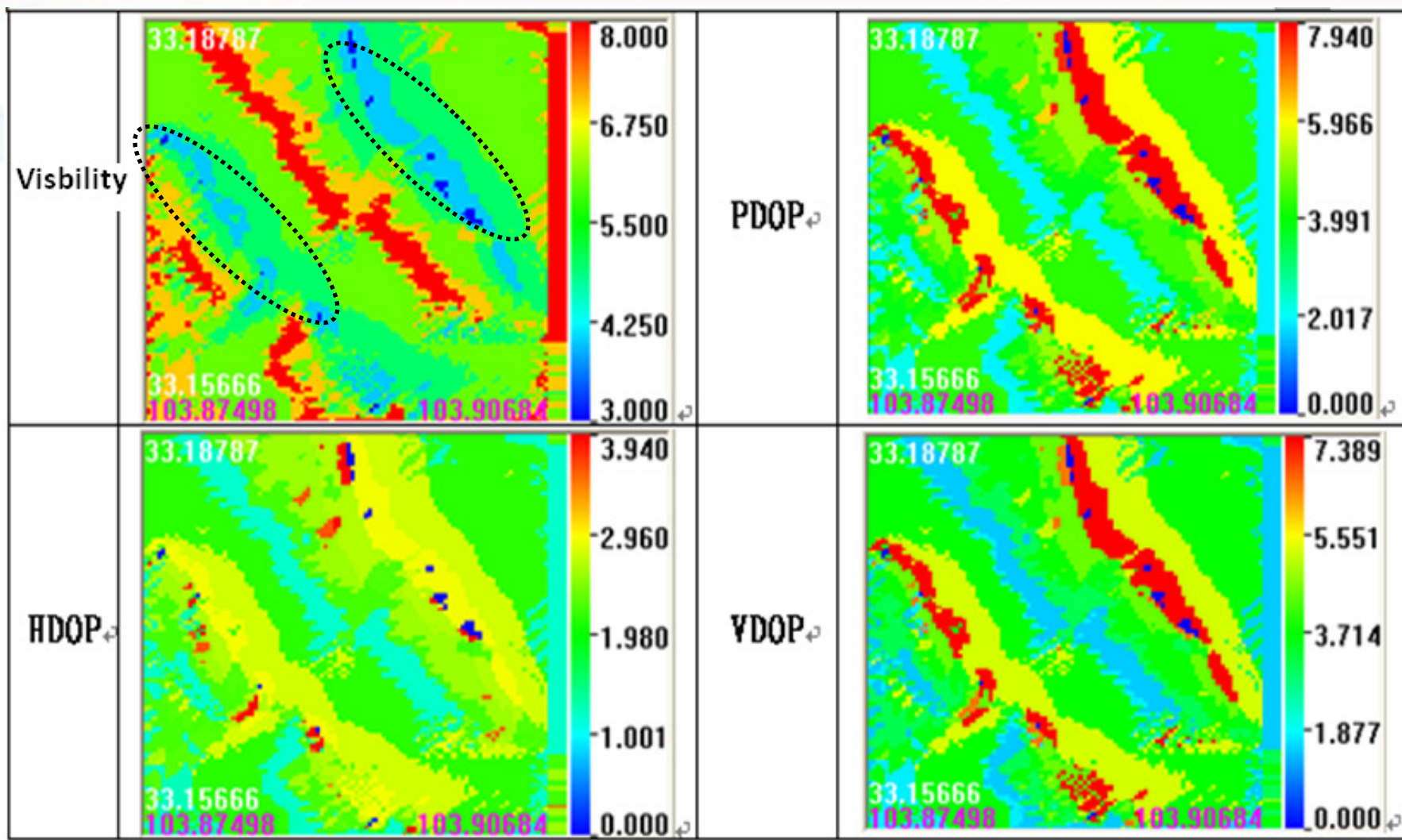


top view



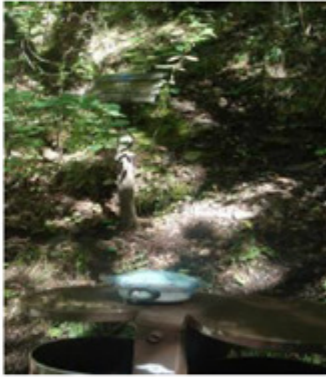


flat view

3D top and flat views of Jiuzhaigou scenic area

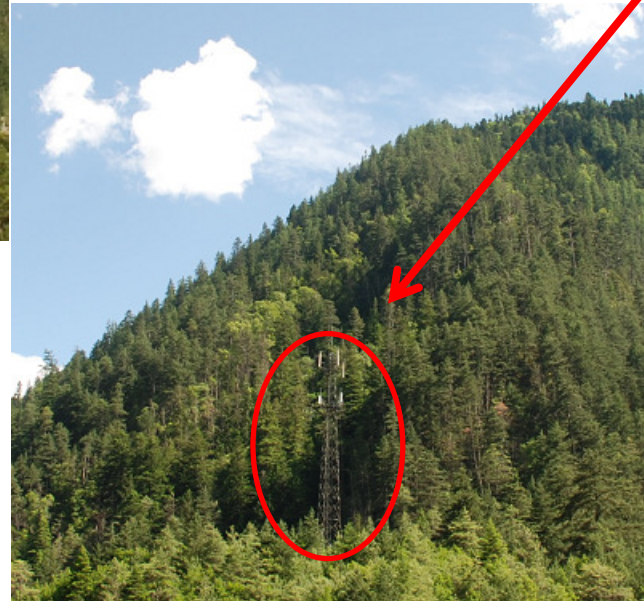


Simulation Area: Pearl Beach, Jiuzhaigou National Park

	1	2	3
			
Date	2010.10.7	2010.10.7	2010.10.7
Time	11:23:23	11:28:03	11:33:01
Latitude			33°10'05.42975N
Longitude			103°53'15.54048E
Altitude			2388.317
SV	2	2	5
SNR L1	G11:41.2	G11:42.0	G7:37.5
	G13:34.5	G13:37.7	G11:36.5
			G13:37.8
			G19:41.2
			G24:26.2
PDOP			5.8
HDOP			2.6
VDOP			5.2

- ❑ Blind spots exist within the scenic area where the number of visible satellites can not meet basic positioning requirements.
- ❑ Satellite signals at some places can be affected by geographical environment, even too low to be captured by common navigation receivers for positioning.
- ❑ Blind areas mainly distribute on plank roads where tourists stay long.
- ❑ To provide navigation, positioning, search and rescue services in the scenic area, the availability of navigation signals need to be enhanced.

## 2) Limited coverage of mobile communications network



**Mobile communications base stations can only be installed on hilltops or hillsides.**

### 3) Environmental Monitoring

For high precision environmental monitoring, decimeter-level accuracy is required, whereas wide area augmentation service network can only provide meter-level accuracy.





## 4) Tourist Management

- ❑ Tourist route tracking
- ❑ Flow control
- ❑ Sightseeing vehicle scheduling
- ❑ Search & rescue services



**□ Due to the lack of reliable methods for continuous positioning and communication, effective location service for fine management can not be provided at Jiuzhaigou scenic area using common methods currently available.**

**□ The LBS problems that Jiuzhaigou National park is facing are typical and common to most of the national parks.**

**--- Complicated environment**

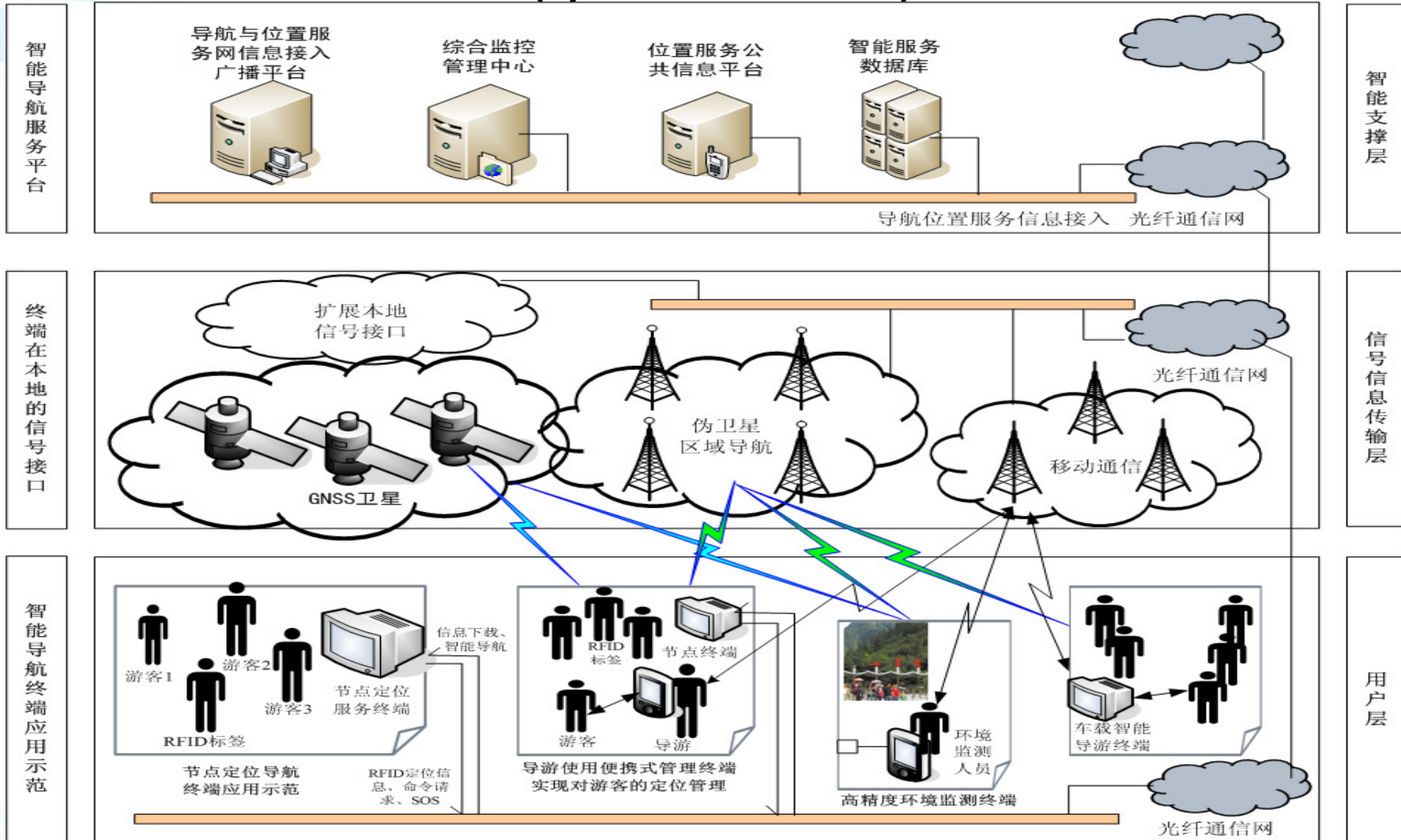
**--- Difficult to realize continuous positioning and communication**

**--- Unable to meet the requirement for high precision positioning**

**□ Based on what has been discussed before, we put forward a comprehensive solution, using Jiuzhaigou as an application demonstration. The purpose is to establish a standard LBS application system which can be used as a reference solution to regional location services for national parks or similar areas.**

## 2. Proposed solution

### Jiuzhaigou intelligent navigation, search and rescue system (System Architecture)



## Pseudolite augmentation and BeiDou/GPS multi-mode positioning

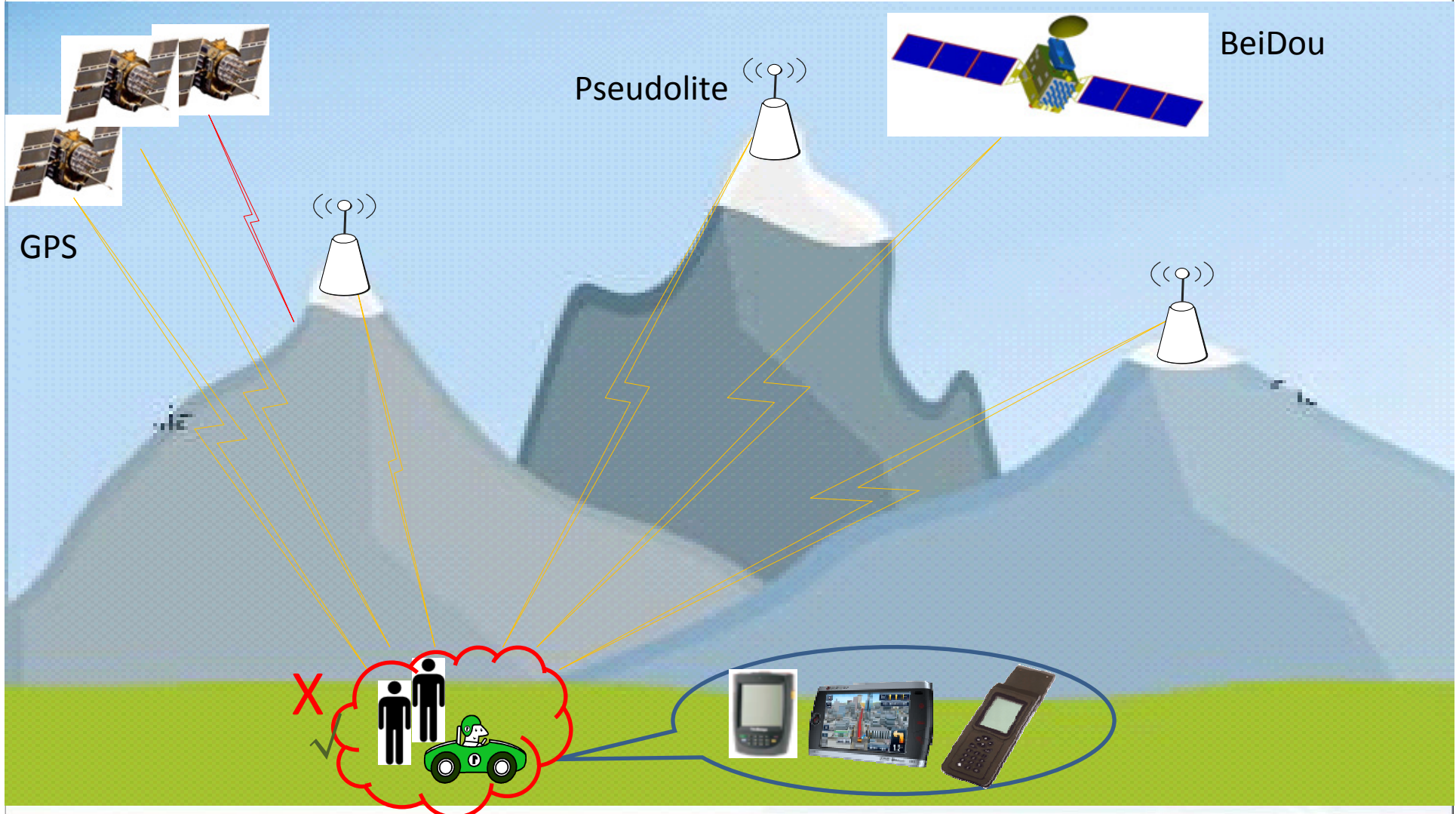
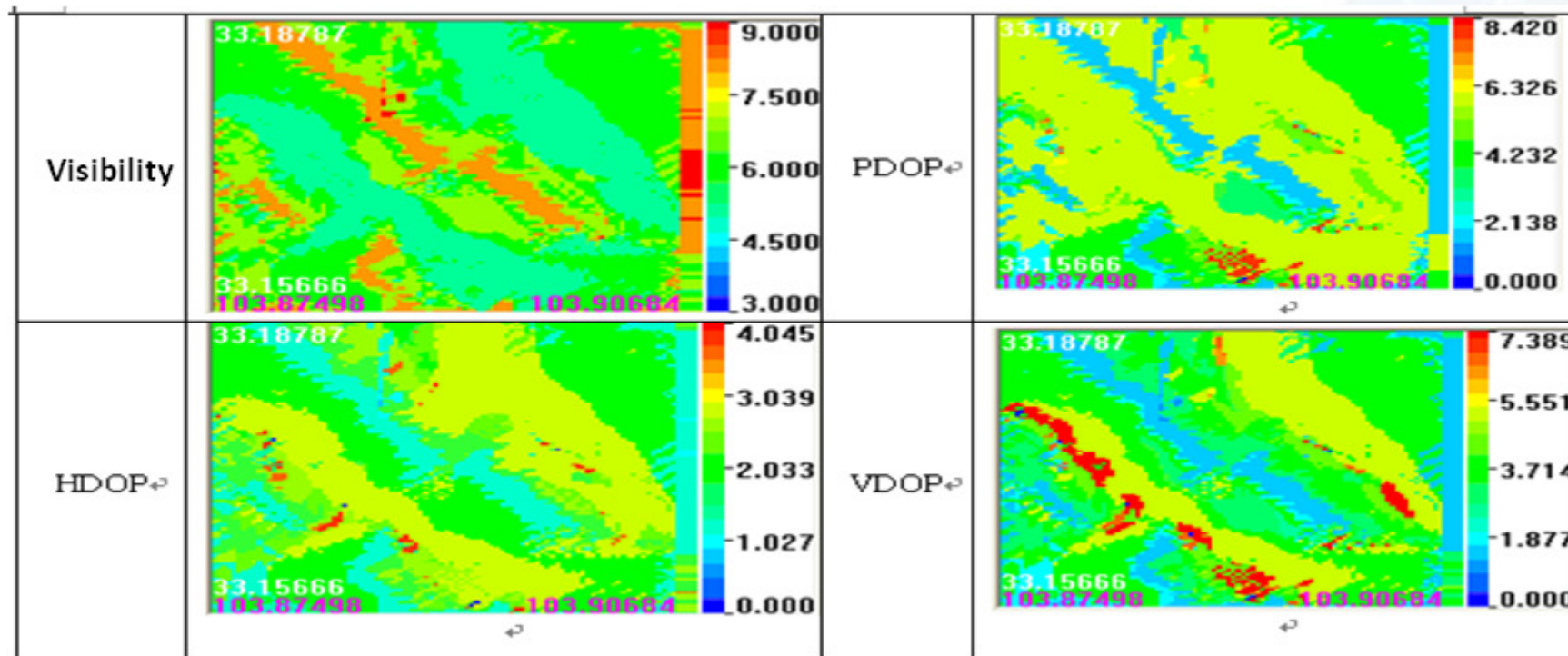
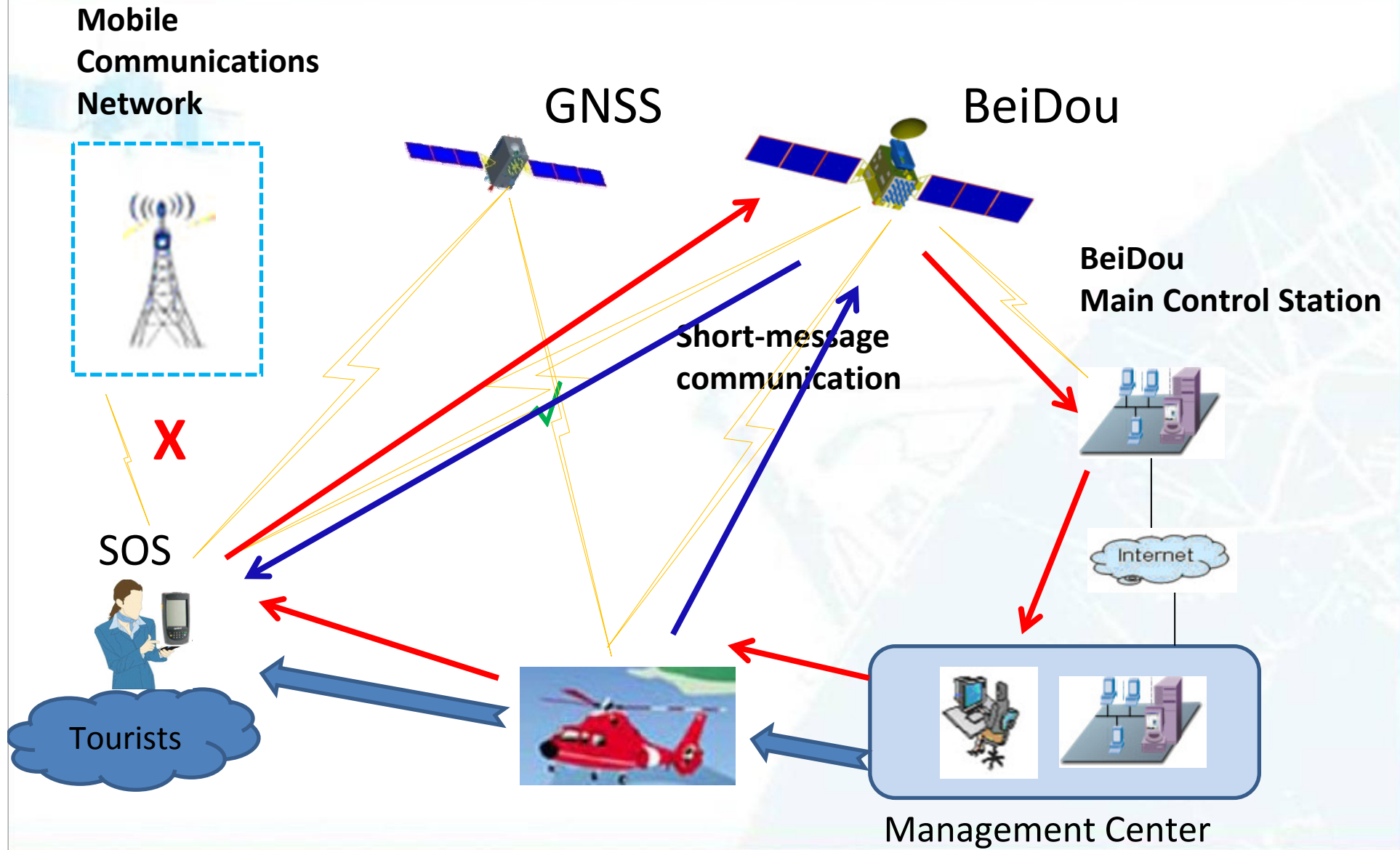


Table 1 Pseudolite coordinates

Index	B	L	H
1	33.18814821	103.87793461	3045.161
2	33.17719688	103.88581724	2865.929
3	33.17226879	103.87465018	2965.229
4	33.18760064	103.90322470	2969.021



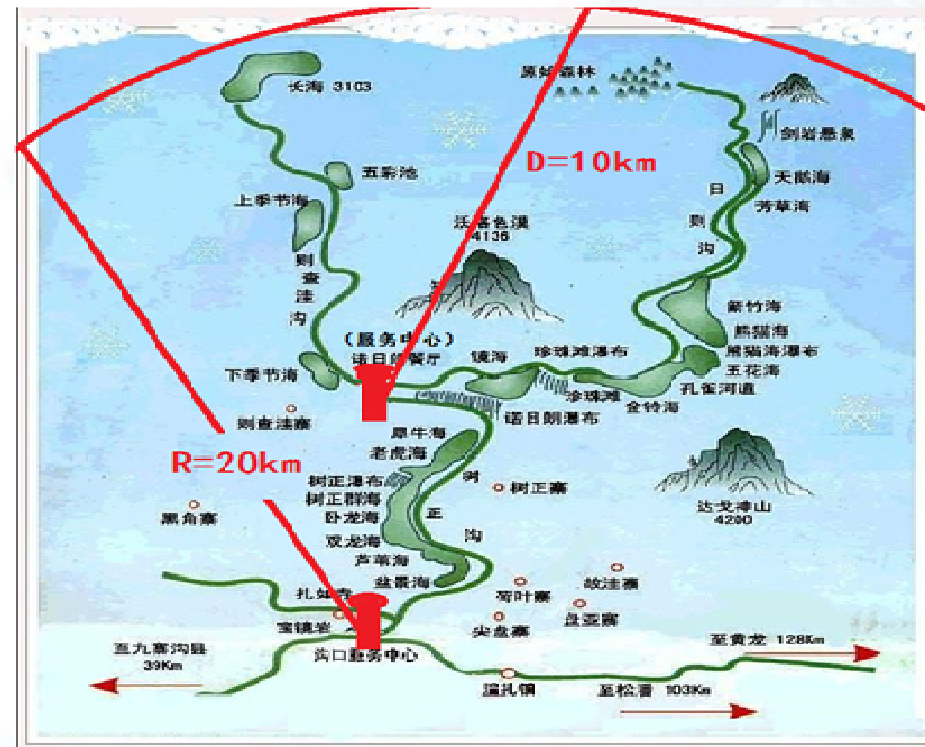
# Realization of communication and SAR services using BeiDou short-message



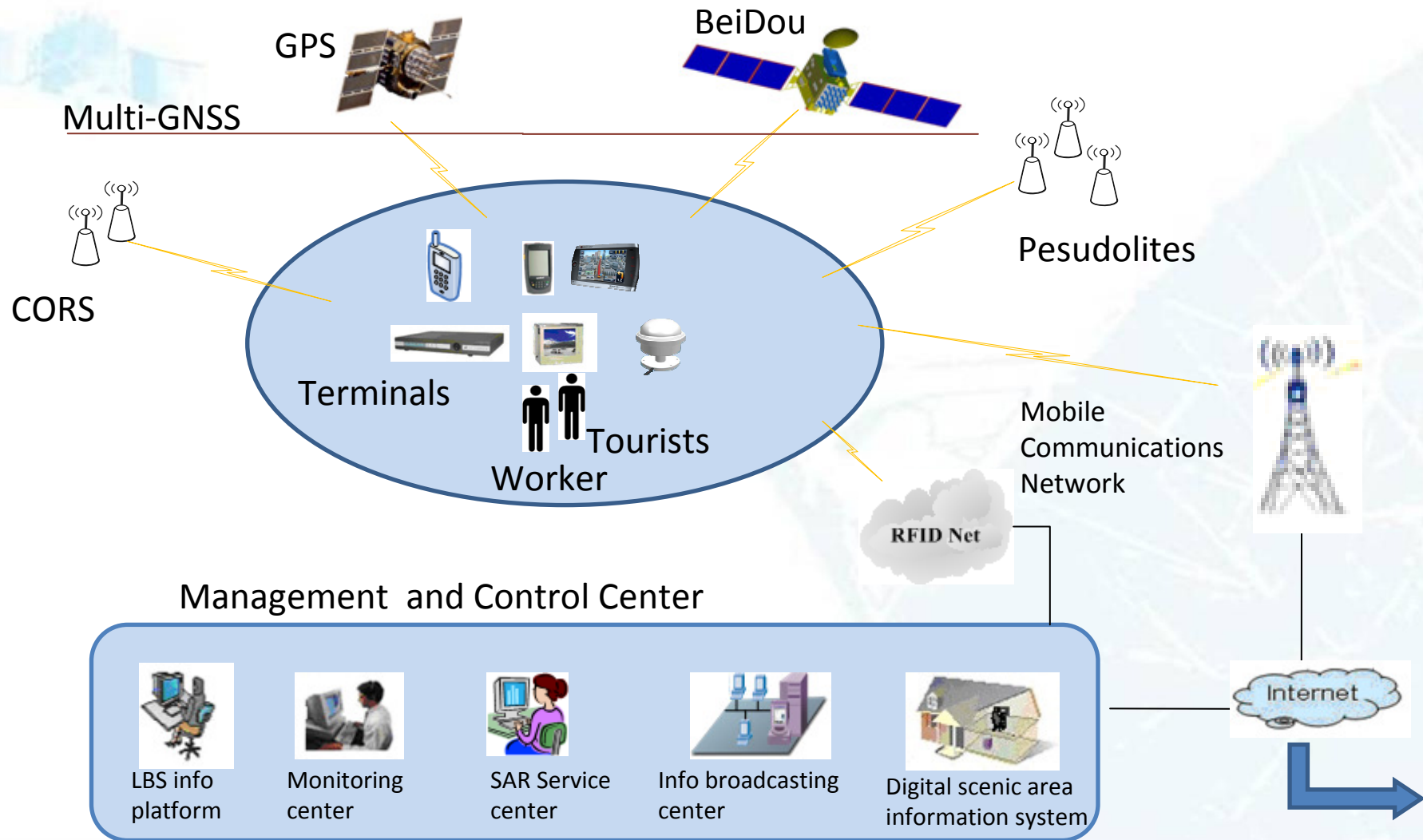
Two multi-mode (BeiDou/GPS) continuous operating reference stations (CORS) will be built in the scenic area which send dual-frequency differential signals simultaneously. High-precision survey terminals receive the differential information and carry out high-precision positioning.

Proposed locations for the two CORSs:

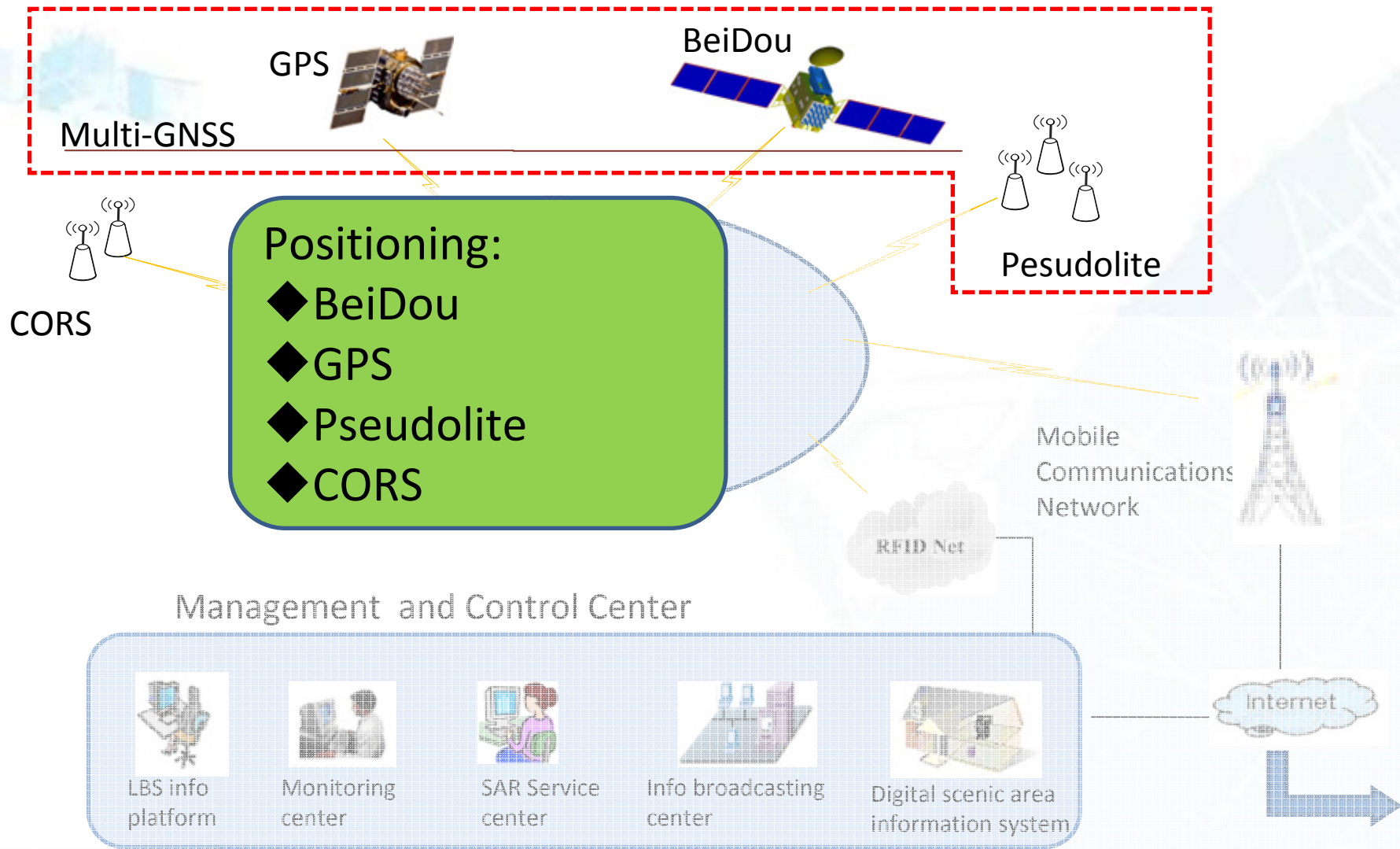
One station is planned to be installed on the rooftop of the Jiuzhaigou information center building. The other will be installed at the Nuorilang tourist center. The distance between the two stations is about 16 km and most of the scenic area can be covered by their signals.



# System structure for Jiuzhaigou intelligent navigation, search and rescue system

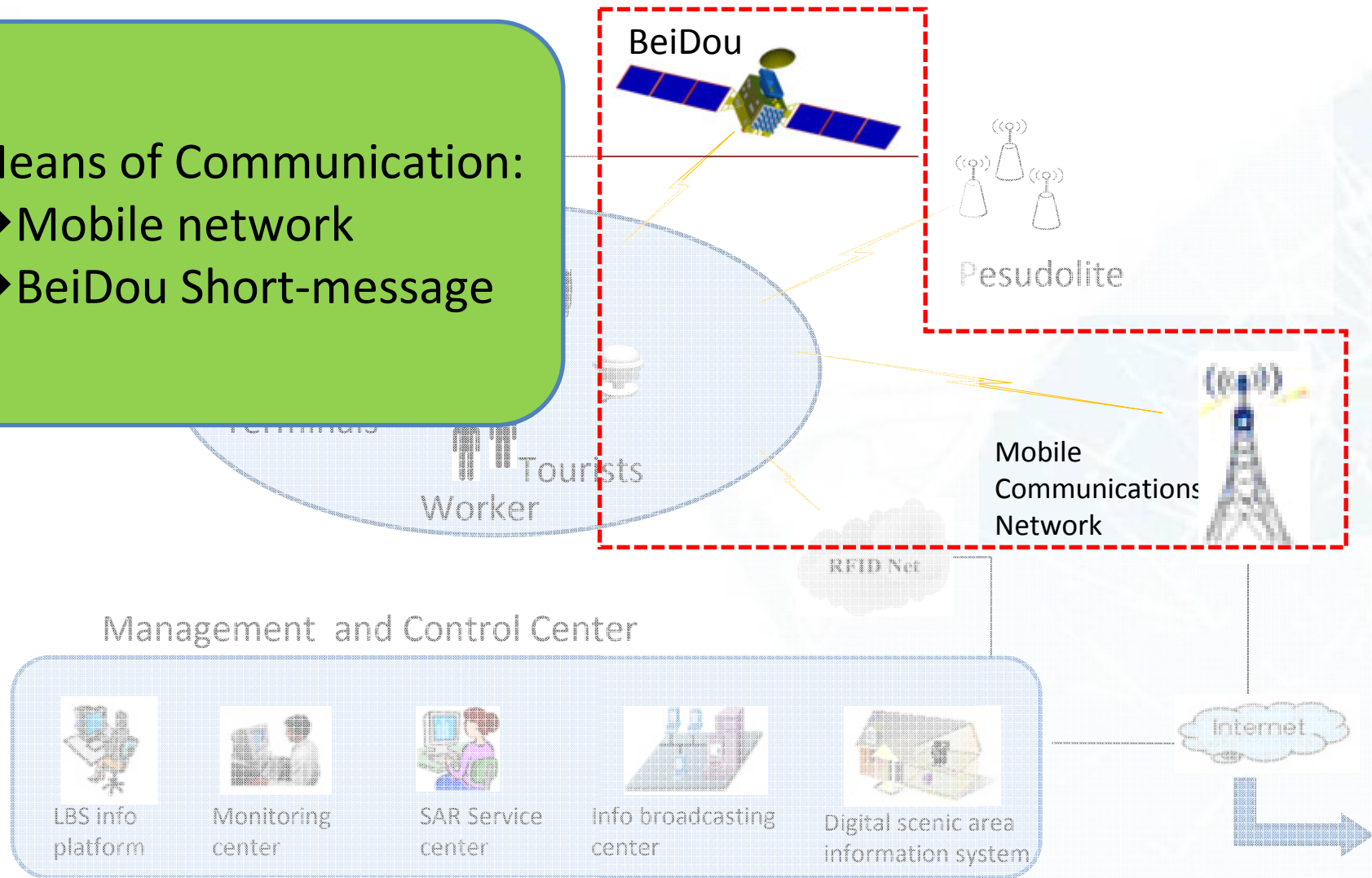


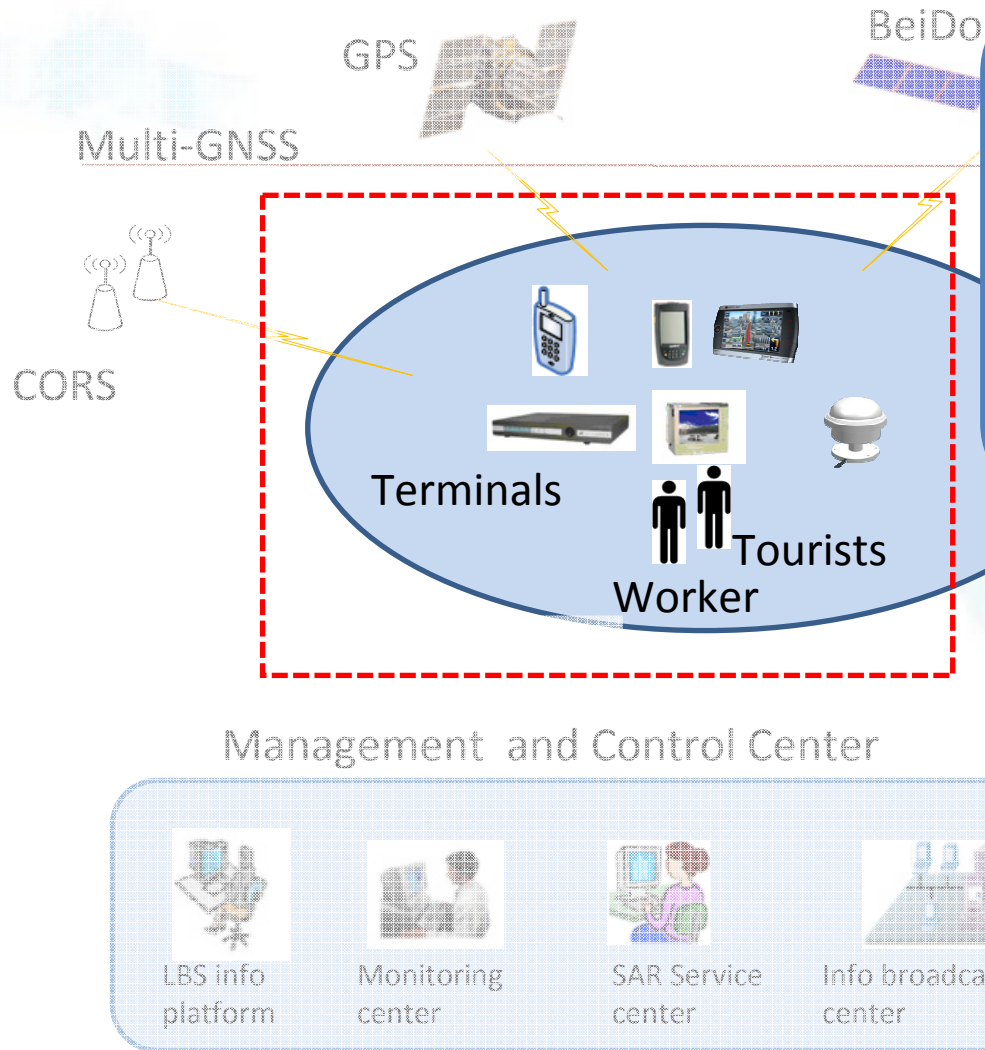




## Means of Communication:

- ◆ Mobile network
- ◆ BeiDou Short-message





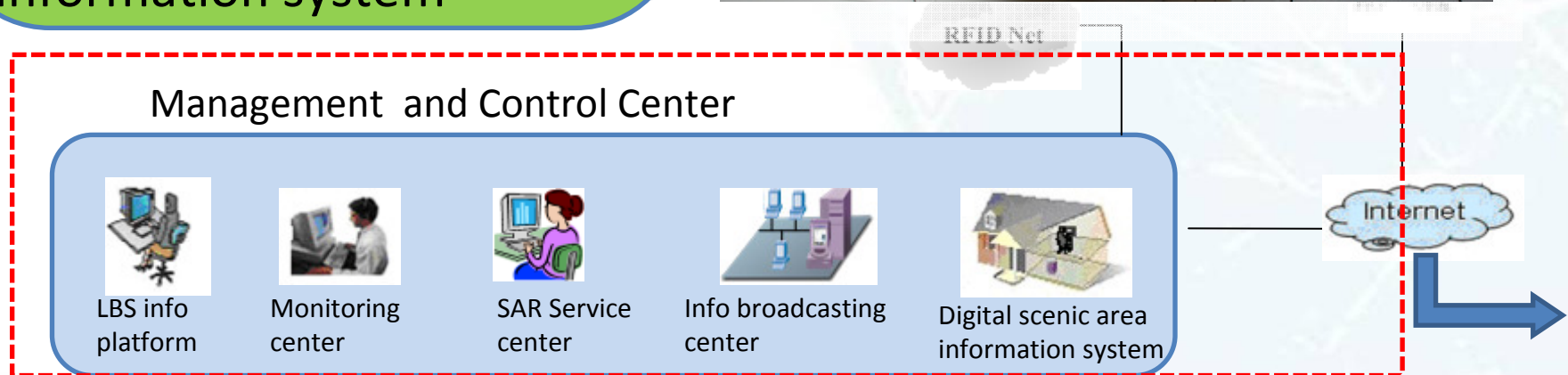
### Terminals:

- ◆ Handheld terminal
- ◆ Vehicle terminal
- ◆ Search & rescue terminal
- ◆ Environment monitoring terminal



Sub-systems:

- ◆ LBS information platform
- ◆ Monitoring center
- ◆ SAR Service center
- ◆ Information broadcasting center
- ◆ Digital scenic area information system



### 3. What services can be provided

Environment Monitoring

Tourist Services

Vehicle Scheduling

Emergency Management

Search & Rescue

This service is for monitoring water, pest, biological diversity and geological disaster.



### 3. What services can be provided

Environment Monitoring

Tourist Services

Vehicle Scheduling

Emergency Management

Search & Rescue

Tour route plan, guide information query, missed tourist searching, danger alarming, etc.



### 3. What services can be provided

Environment Monitoring

Tourist Services

Vehicle Scheduling

Emergency Management

Search & Rescue

Dynamic scheduling of scenic sightseeing vehicles and working vehicles, real-time information query, emergency vehicle management.



### 3. What services can be provided

Environment Monitoring

Tourist Services

Vehicle Scheduling

**Emergency Management**

Search & Rescue

**Disaster alarming,  
emergency  
evacuation,  
rapid response of  
emergency**



### 3. What services can be provided

Environment Monitoring

Tourist Services

Vehicle Scheduling

Emergency Management

**Search & Rescue**

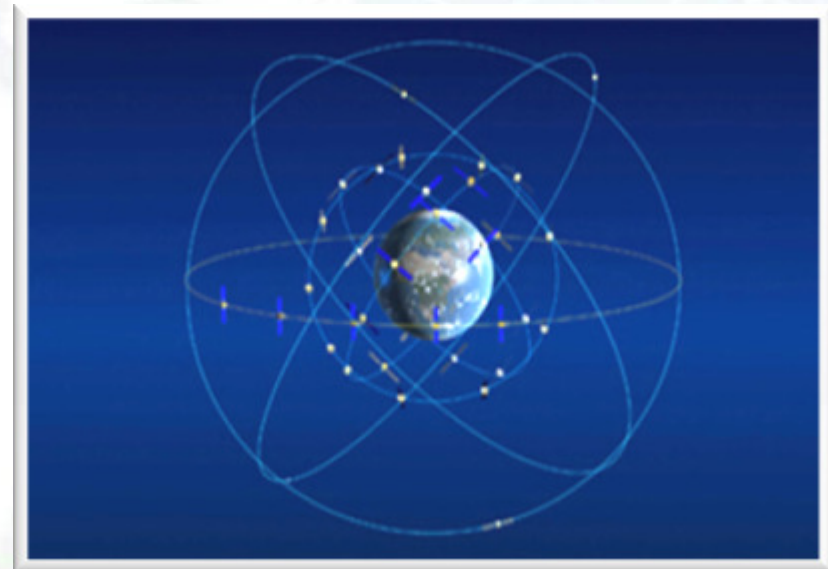
**Scenic Area Fine Management**

**Search and rescue persons in danger, including receiving and processing danger alarms, locating and reporting of danger locations, communicating between the persons in danger and the management and control center, etc.**



## 4. Summary

- ❑ Use of BeiDou short message solves the communications problem at scenic area blind spots.
- ❑ BeiDou/GPS/Pseudolite multi-mode system improves the continuity and accuracy of positioning
- ❑ Provide rapid search and rescue services
- ❑ Improve the level of fine management



### □ Future work

- ✓ Address and resolve key technologies and establish a completed application system
- ✓ Carry out application demonstration at Jiuzhaigou scenic area
- ✓ Form the industrial standard or specifications for regional navigation, search and rescue services.
- ✓ Promote the application of the system in China AAAA-class scenic areas
- ✓ Collaboration and joint research
- ✓ Promote the formation of the international standard for national park multi-mode navigation SAR application system.



**Thanks for your attention !**

**Baoguo Yu  
yubg@sina.cn**

**China Electronics Technology Group Corporation**