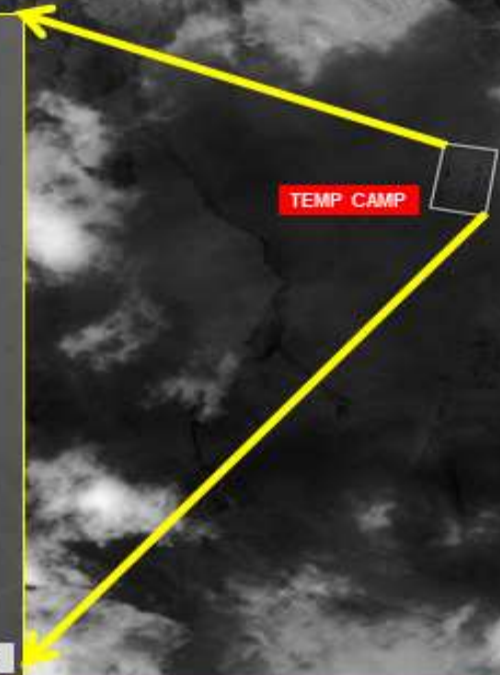
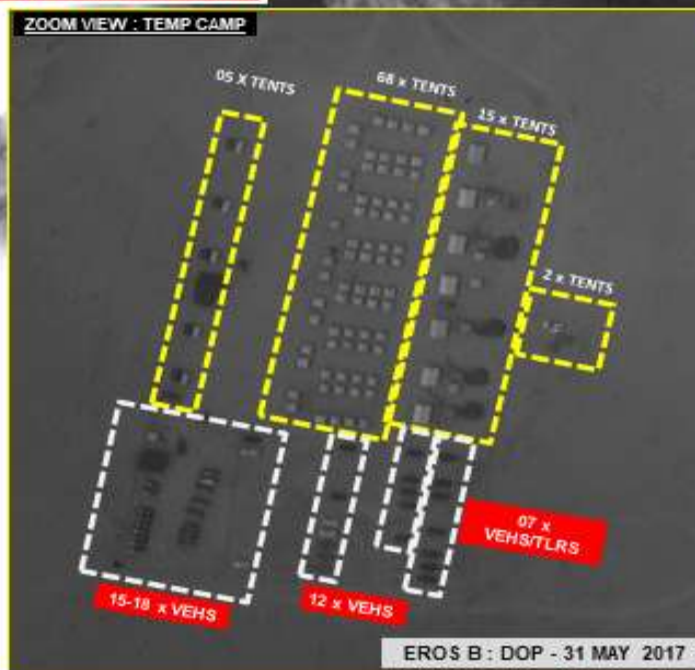
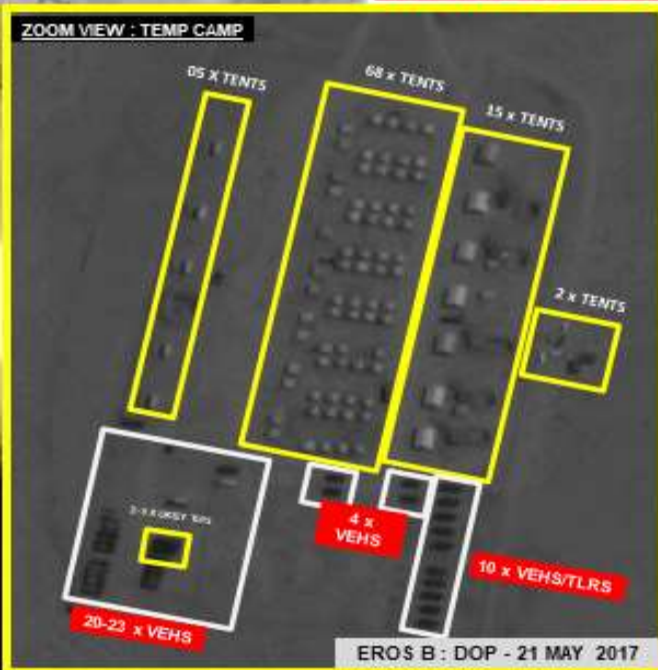


CHANGE DETECTION AT TEMP CAMP



RASTER TOOLS FOR CHANGE DETECTION AND INT GATHERING

- IMAGERY
- EROS B - P...
 - PREVIOUS IMAGERY FEATURE
- PREVIOUS IMAGERY FEATURE
- 28 x MIL VEHS/TLRS
- PRESENT IMAGERY FEATURE DISCERNED
- 90 x TENTS/ SHELTERS
 - 38 x MIL VEHS/TLRS
 - 90 x TENTS/ SHELTERS
 - SOLAR POWER PANT

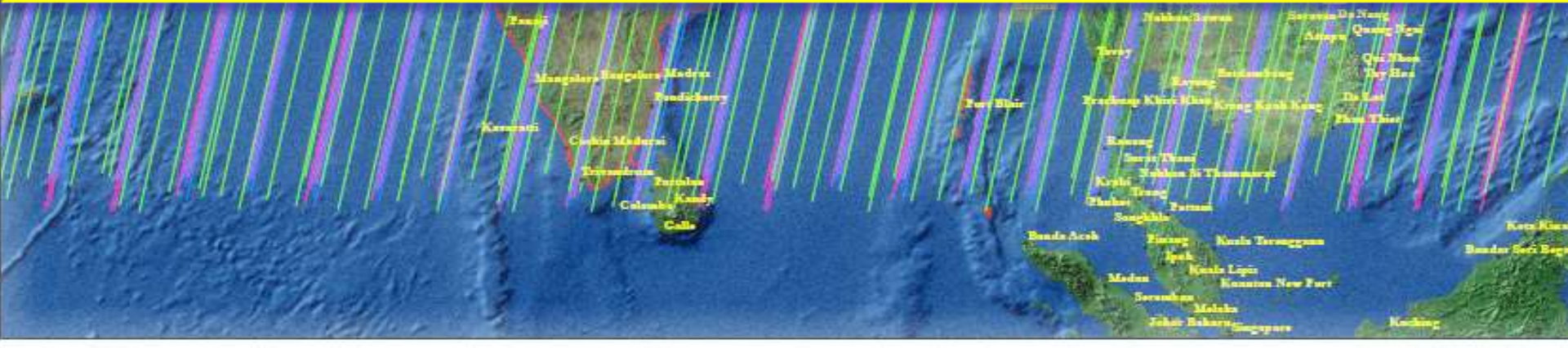
COL PANKAJ SHARMA



**IN THE MODERN WORLD, THE
NATION'S TECHNOLOGICAL
PROWESS HAS BECOME INTEGRAL
TO ITS NATIONAL POWER AND
SECURITY.**



***Technological superiority has been instrumental in
many a victory in battle.***



GEOSPATIAL

A FORCE MULTIPLIER FOR DEF AND INTERNAL SECURITY



RASTER TOOLS FOR CHANGE
DETECTION AND INT GATHERING

PREVIEW

WHAT IS IT

BASIC REQUIREMENTS

TOOLS

WHAT DO WE HAVE

WHAT DO WE NEED

WAY AHEAD

Q & A

THE THREE PARADIGMS OF INT GATHERING

- WHAT - DETECTION / PRESENCE / ABSENCE
- WHERE - LOCATION / CONTEXT / TEMPORAL
- WHEN - TIMESTAMP / TIMELAG

WHY ?

WHAT SHOULD I DO

REMOTE SENSING CYCLE

- ❖ *RS IS THE VITAL SOURCE OF INFO FOR EFFECTIVE **DECISION MAKING**.*
- ❖ *RECENT ADVANCEMENTS BROUGHT NUMEROUS IMPROVEMENT IN VARIOUS FD SUCH AS ENVIRONMENT STUDY, DISASTER MANAGEMENT, DEF AND SECURITY ETC.*

Remote Sensing Cycle



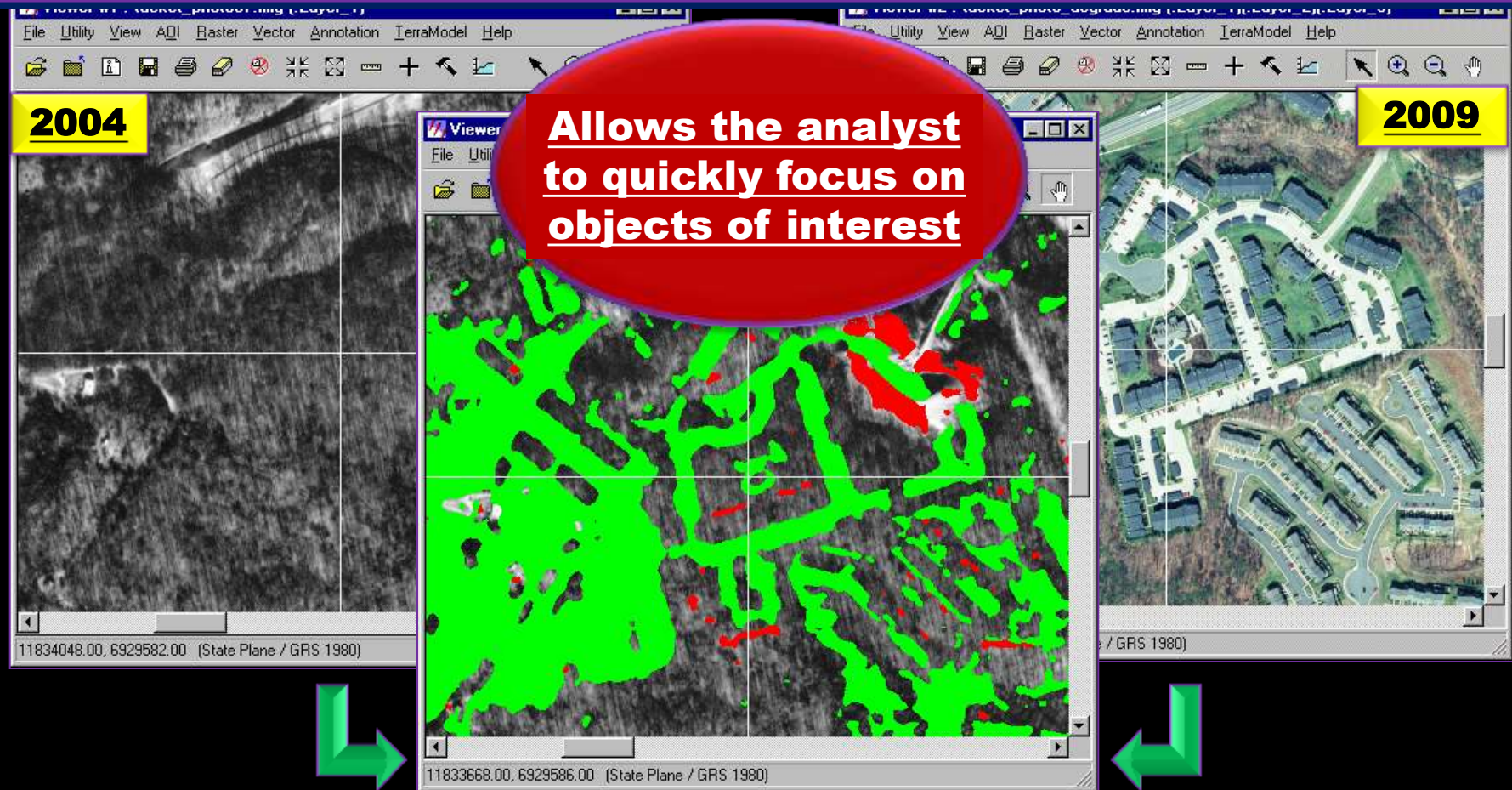
RASTER

World into discrete square or rectangular cells laid out in a grid. Each cell has a value that is used to represent some characteristic of that location, such as temperature, elevation, or a spectral value.



CHANGE DETECTION

Process That Enables To Ascertain The Changes In Specific Features After A Certain Time Frame



CHANGE DETECTION

- ❖ DESCRIBED AS A PROCESS THAT OBSERVES THE DIFFERENCES OF AN OBJECT OR PHENOMENON AT DIFFERENT TIMES.
- ❖ CHANGE DETECTION INVOLVES THE APPLICATION OF MULTI-TEMPORAL DATASETS TO QUANTITATIVELY ANALYSE THE CHANGES.
- ❖ DATA FROM REMOTE SENSING WITH ITS SYNOPTIC AND REGULAR COVERAGE AT SHORT INTERVAL AND CONSISTENT IMAGE QUALITY PROVIDES A VIABLE SOURCE OF UPDATED INFORMATION WHICH CAN BE EXTRACTED EFFICIENTLY AND QUICKLY IN ORDER TO MONITOR TYPES AND EXTENT OF CHANGES.

WHY DO WE NEED IT

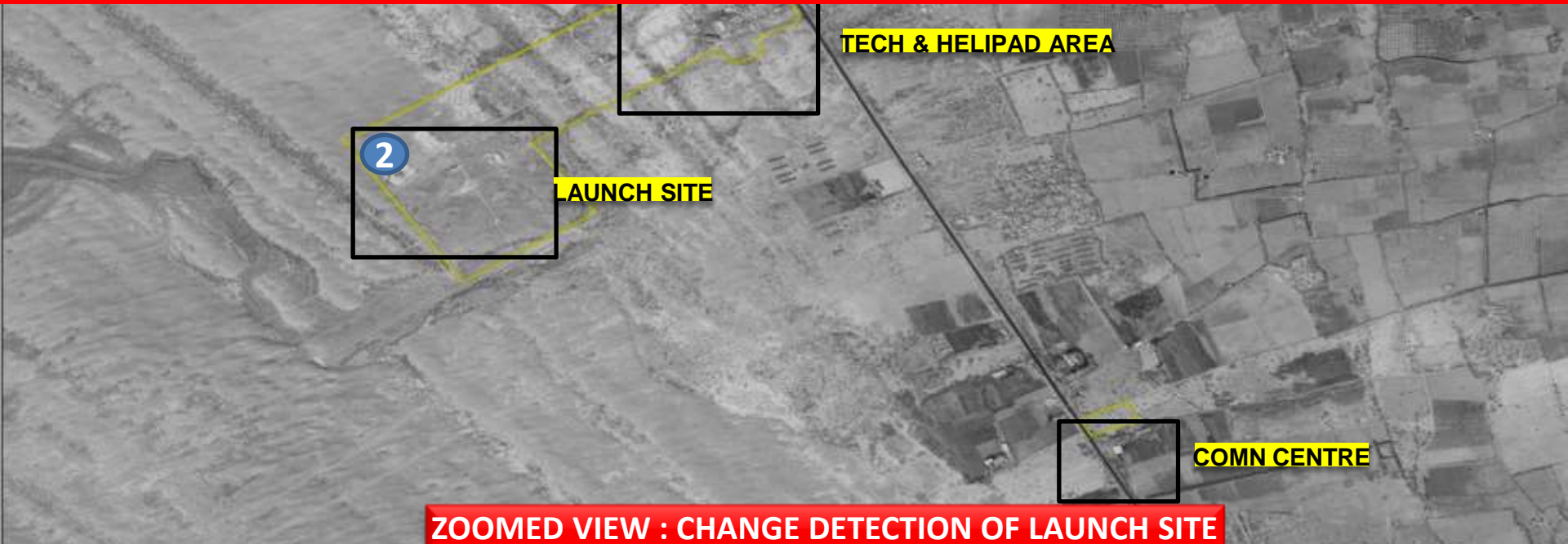
- ❖ **LAND USE LAND COVER CHANGE – MILITARY IMPLICATIONS**
 - ❖ **GOING ANALYSIS**
 - ❖ **DEPLOYMENT ANALYSIS / MANAGEMENT**

- ❖ **HYDROLOGY**
 - ❖ **FLOOD MAPPING FOR FLOODING AND FLOOD CONTROL**
 - ❖ **RUN – OFF ESTIMATION (DISCHARGE RATE)**
 - ❖ **DEFORESTATION (AVAILABLE COVER)**

- ❖ **CHANGES IN INFRASTRUCTURE (PERMANENT)**

- ❖ **CHANGES IN INFRASTRUCTURE (TEMPORARY)**
 - ❖ **WEAPONS AND EQUIPMENT**
 - ❖ **VEHICLES**
 - ❖ **SHELTERS – LIVING AND STORAGE**
 - ❖ **MOVEMENT**

CHANGE DETECTION



ZOOMED VIEW : CHANGE DETECTION OF LAUNCH SITE



BASIC REQUIREMENTS

- ❖ **TWO RASTERS BEING ANALYSED SHOULD BE OF SAME RESOLUTION :-**
 - ❖ **SPATIAL (PER PIXEL RESOLUTION)**
 - ❖ **SPECTRAL (MULTISPECTRAL V/S HYPERSPECTRAL)**
 - ❖ **RADIOMETRIC**
 - ❖ **(TEMPORAL) CHANGE IN PHENOLOGY**
- ❖ **RASTERS SHOULD BE GEO RECTIFIED – SAME PIXEL SHOULD BE AT SAME SPATIAL LOCATION IN BOTH THE IMAGES**
- ❖ **PREFERABLY FROM SAME SENSOR**

TECHNIQUES

CHANGE DETECTION

ALGEBRA

DIFFERENCING

REGRESSION

BAND RATIOING

INDEX BASED DIFFERENCING







CHANGE VECTOR ANALYSIS

TRANSFORMATION

PCA

CHI SQUARE

TECHNIQUES OR TOOLS

- ❖ **VISUAL – VISUAL INTERPRETATION OF CHANGES IN REFLECTANCE IN TWO IMAGES**
 - ❖ **ORTHORECTIFIED**
 - ❖ **CORRECTED FOR ATMOSPHERIC CORRECTIONS**
- ❖ **ALGEBRA BASED CHANGE DETECTION**
 - ❖ **DIFFERENCING** 
 - ❖ **REGRESSION ANALYSIS** 
 - ❖ **BAND RATIOING** 
 - ❖ **USING INDEX VALUES** 
 - ❖ **CHANGE VECTOR ANALYSIS** 
- ❖ **TRANSFORMATION BASED - PRINCIPAL COMPONENT ANALYSIS AND CHI-SQUARE** 

CHANGE DETECTION

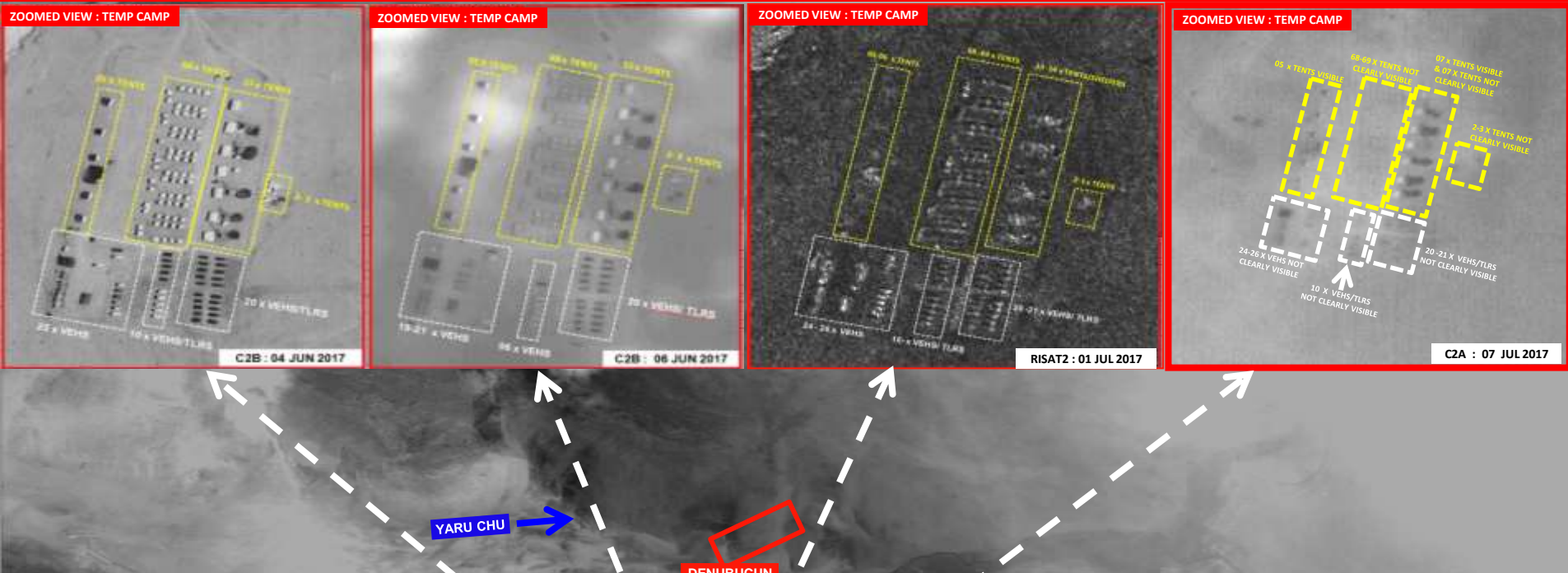
WHAT DO WE HAVE

For Int Gathering

BASIC REQUIREMENTS

- ❖ TWO RASTERS BEING ANALYSED SHOULD BE OF SAME RESOLUTION :-
 - ❖ SPATIAL (PER PIXEL RESOLUTION)
 - ❖ SPECTRAL (PAN, MULTISPECTRAL , HYPER)
 - ❖ RADIOMETRIC (8BIT,16BIT)
 - ❖ TEMPORAL (CHANGE IN PHENOLOGY)
- ❖ RASTERS SHOULD BE GEO RECTIFIED – SAME PIXEL SHOULD BE AT SAME SPATIAL LOCATION IN BOTH THE IMAGES
- ❖ PREFERABLY FROM SAME SENSOR

CHANGE DETECTION)



PREVIOUS IMAGERIES

C2B - 21 MAY 17 & EROS B - 31 MAY 17, EROS B - 01 JUN 17,
C2B - 04 & 06 JUN 17 & (C2C -26 JUN 17 100% CLOUDY IMAGE).

RISAT2 – 01 JUL 2017

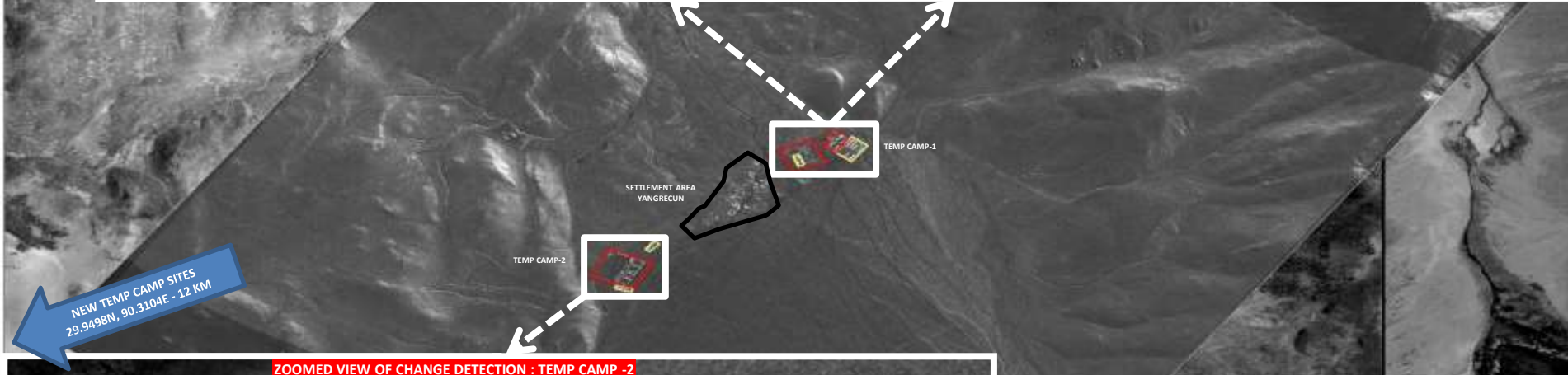
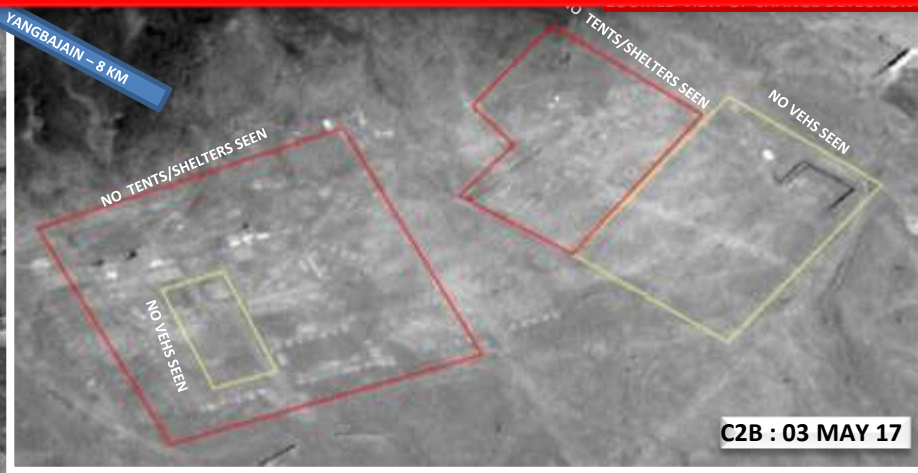
- 54 -57 X VEHS / TLRs.
- 02 X VEHS OBS IN NEW TRS / LIKELY TRG AREA.
- 88-92 X TENTS/SHELTERS.

PRESENT IMAGERY

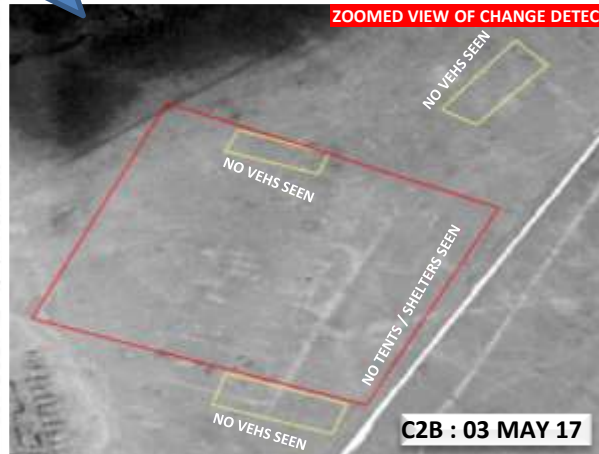
C2A – 07 JUL 2017

- 54 -57 X VEHS / TLRs NOT CLEARLY VISIBLE.
- NO VEHS OBS IN LIKELY TRG AREA.
- 12 X TENTS VISIBLE & BALANCE 78-80 TENTS NOT CLEARLY VISIBLE.

CHANGE DETECTION



ZOOMED VIEW OF CHANGE DETECTION : TEMP CAMP -2



PREVIOUS IMAGERY : C2B 03 MAY 17

- 01 X SETTLEMENT AREA
- 02 X UNOCCUPIED TEMP CAMP SITES

PRESENT IMAGERY : RISAT 2- 05 JUL 17

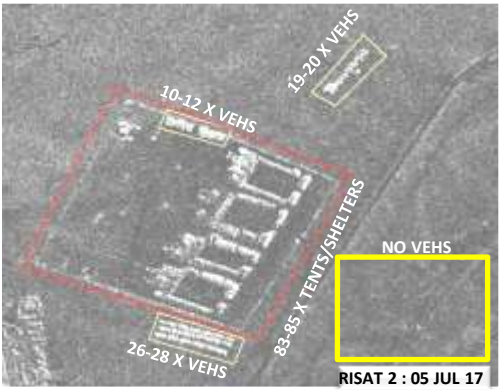
- 175-184 X VEHs / TLRS OBS
- 174 -180 X TENTS / SHELTERS OBS

CHANGE DETECTION : RADIOMETRIC RESOLUTION ??

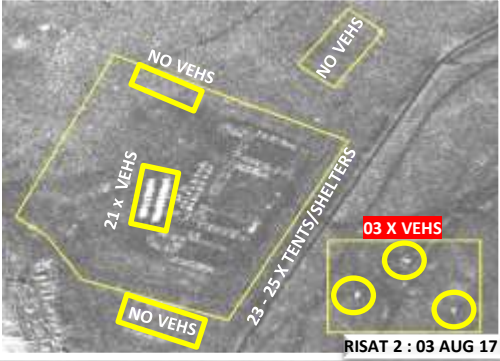
TEMP CAMP 3 VACANT



ZOOM VIEW : TEMP CAMP 2, VEHS AREA AND 03 X VEHS



RISAT 2 : 05 JUL 17



RISAT 2 : 03 AUG 17

PREVIOUS IMAGERY :

C2B 03 MAY 17

• ALL TEMP CAMP SITES UNOCCUPIED

RISAT 2- 05 JUL 17

- 175-184 X VEHS / TLRs OBS
- 174 -180 X TENTS / SHELTERS OBS

PRESENT IMAGERY : RISAT 2- 03 AUG 17

- 27 - 29 X TENTS/ SHELTERS OBS
- 64 -67 X VEHS/TLRS OBS

REDUCTION OF 110 – 113 X TENTS AND 148 - 155 X VEHS/TLRS

VEHS AREA

03 x VEHS

TEMP CAMP 2

05 X VEHS

ZOOM VIEW : TEMP CAMP 1

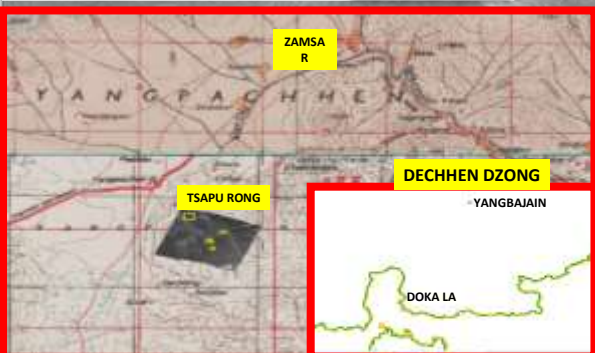


RISAT 2 : 05 JUL 17



RISAT 2 : 03 AUG 17

RISAT 2 : 03 AUG 17



CHANGE DETECTION : CONSTRAINTS

MAP OVERVIEW



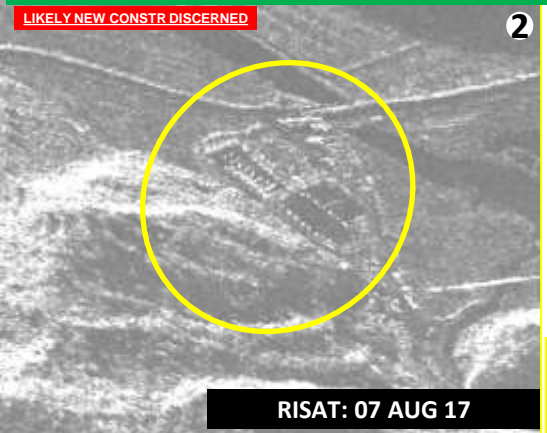
C2C : 15 AUG 17

PREVIOUS IMAGERY : RISAT :07 AUG 17
 • NEW UNIDEN STRUCTURE/CONSTR SEEN
 • LIKELY NEW CONSTR SEEN
 • NO MAJOR CHANGES SEEN IN EXISTING LIKELY PLA CAMPS

PRESENT IMAGERY : C2C : 15 AUG 17
 • NEW CONSTR UNDER PROGRESS AT TWO LOCS.

AREA -1
 • LIKELY 06 X NEW BKS/SHEDS UNDER CONSTR
 • AREA UNDER CONSTR : 150 x 75 M
 • LIKELY CONSTR UNDER PROGRESS

AREA - 2
 • LIKELY 08 x NEW SHELTERS UNDER CONSTR



RISAT: 07 AUG 17



C2C- 15 AUG 17



EXISTING LIKELY COMM COMPLEX
NO CHANGES SEEN

1
LKELY NEW CONSTR
UNDER PROGRES

2
LIKELY NEW
CONSTR DISCERNED

EXISTING LIKELY PLA CAMP
NO CHANGES SEEN



1
NEW UNIDEN STRUCTURE/CONSTR DISCERNED: N OF RUBINKHA

RISAT- 07 AUG 17



1
LIKELY NEW CONSTR UNDER PROGRESS: N OF RUBINKHA

LIKELY CONSTR UNDER PROGRESS

2
LKELY 05 X NEW BKS/SHEDS
UNDER CONSTR
LENGTH - 32 x 7.5 M

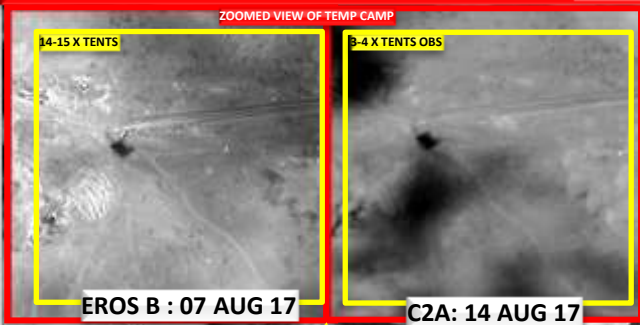
AREA COVERED : 150 x 75 M
UNDER CONSTR

C2C- 15 AUG 17

BASIC REQUIREMENTS

- ❖ TWO RASTERS BEING ANALYSED SHOULD BE OF SAME RESOLUTION :-
 - ❖ SPATIAL (PER PIXEL RESOLUTION)
 - ❖ SPECTRAL (MULTISPECTRAL V/S HYPERSPECTRAL)
 - ❖ RADIOMETRIC
 - ❖ (TEMPORAL) CHANGE IN PHENOLOGY
- ❖ PREFERABLY FROM SAME SENSOR
- ❖ RASTERS SHOULD BE GEO RECTIFIED – SAME PIXEL SHOULD BE AT SAME SPATIAL LOCATION IN BOTH THE IMAGES

CHANGE DETECTION : GEORECTIFICATION??

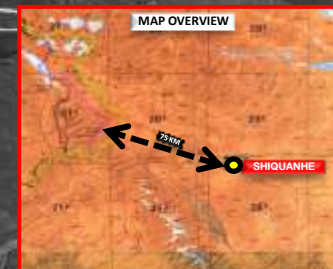
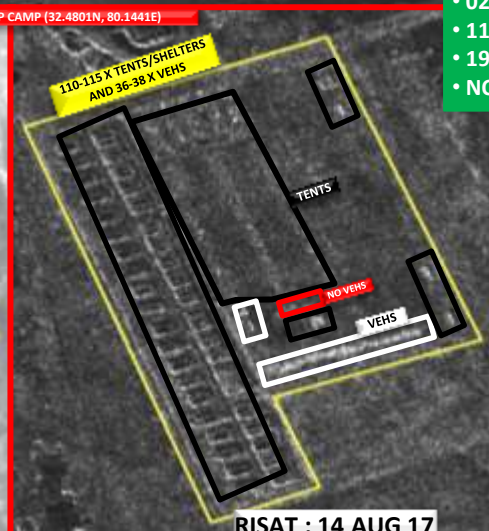
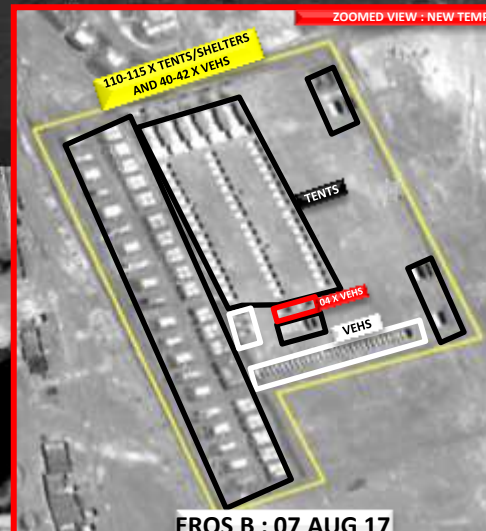


PREVIOUS IMAGE : EROS B - 14 JAN 17, 12 JUL 17 & 07 AUG 17

- HELIBASE
 - HELIRUNWAY (450M X 40M), 07 X HELIPADS & 02 X HEPTRS
 - 5-6 X BLDG AND CONTROL ROOM
- COMPLEX UNDER CONSTR
- 01 X NEW COMN TOWER WITH BTY ROOM
- 01 X NEW HARD STAND (25M X 25M)
- 01 X VOR RADAR
- 125-131 X TENTS/SHELTERS
- 202-212 X VEHs

PRESENT IMAGE : EROS B - 14 AUG 17 & RISAT - 14 AUG 17

- 02 X HEPTRS PRESENT AT HELIBASE
- 115-120 X TENTS/SHELTERS (MINUS 11)
- 198-208 X VEHs (MINUS 04)
- NO OTHER SIGNIFICANT CHANGES OBS



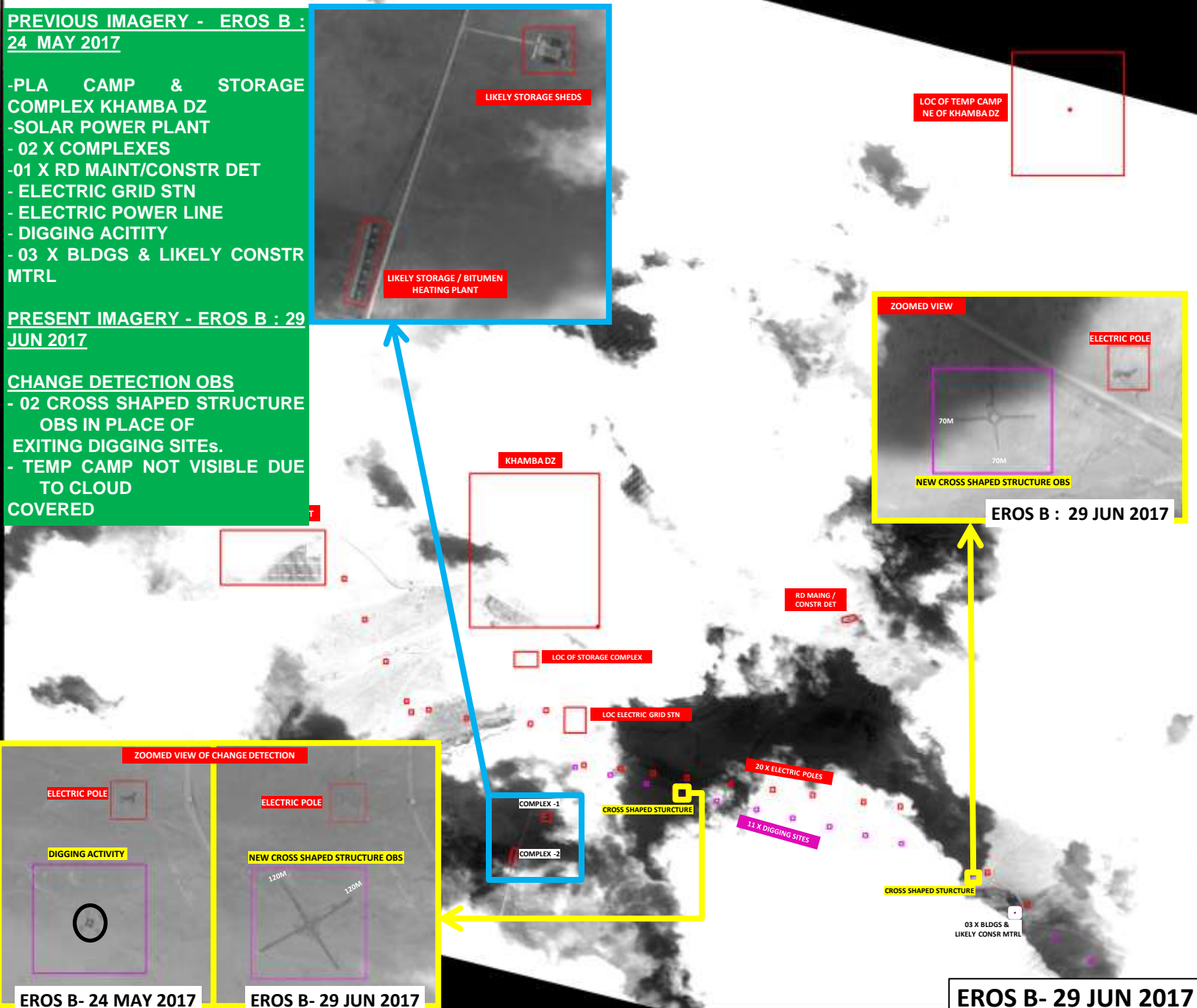
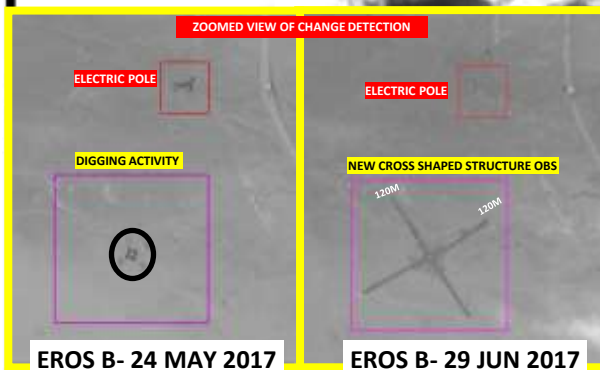
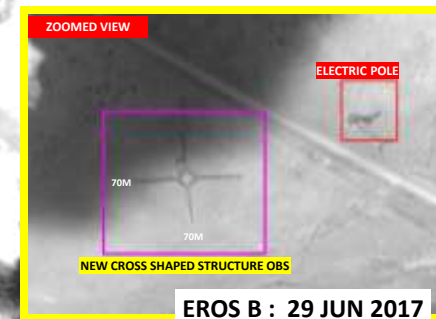
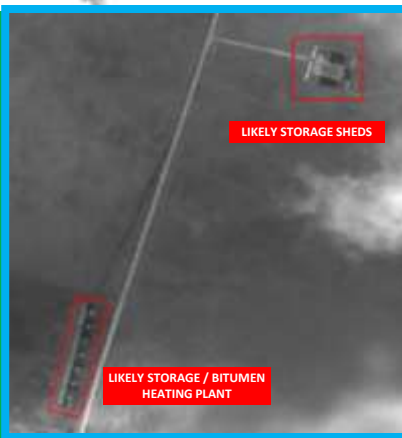
CHANGE DETECTION

PREVIOUS IMAGERY - EROS B : 24 MAY 2017

- PLA CAMP & STORAGE COMPLEX KHAMBA DZ
- SOLAR POWER PLANT
- 02 X COMPLEXES
- 01 X RD MAINT/CONSTR DET
- ELECTRIC GRID STN
- ELECTRIC POWER LINE
- DIGGING ACITITY
- 03 X BLDGS & LIKELY CONSTR MTRL

PRESENT IMAGERY - EROS B : 29 JUN 2017

- CHANGE DETECTION OBS**
- 02 CROSS SHAPED STRUCTURE OBS IN PLACE OF EXITING DIGGING SITES.
 - TEMP CAMP NOT VISIBLE DUE TO CLOUD COVERED



CHANGE DETECTION

PREVIOUS IMAGERY :

ARCHIVE C2B -06 AUG 16,
FRESH EROS B : 24 MAY 2017 & 29 JUN 2017

- PLA CAMP & STORAGE COMPLEX KHAMBA DZ
- SOLAR POWER PLANT
- 02 X COMPLEXES
- 01 X RD MAINT/CONSTR DET
- ELECTRIC GRID STN
- ELECTRIC POWER LINE
- DIGGING ACITITY
- 03 X BLDGS & LIKELY CONSTR MTRL
- 03 X SETTLEMENT AREAS
- BR CUM BUND
- 02 CROSS SHAPED STRUCTURE OBS IN PLACE OF EXITING DIGGING SITES.

PRESENT IMAGERY : C2B - 01 JUL 2017

- 35 -39 X VEHS OBS AT TWO PLACES
- 04 - 05 X VEHS & CONSTR MTRL LIKELY AREA UNDER DEVP
- 09 X STORAGES SHEDS NEAR TANGGO
- 12-13 X STORAGE SHEDS SETTLEMENT AREA 2&3

ZOOMED VIEW



C2B : 01 JUL 2017

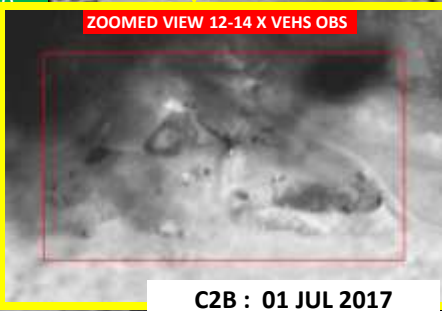
ZOOMED VIEW



C2B : 01 JUL 2017

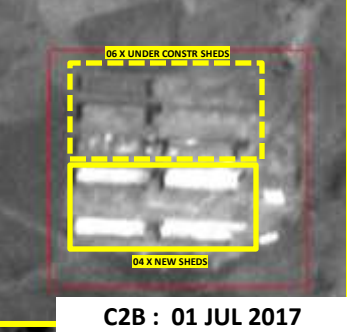


ZOOMED VIEW 12-14 X VEHS OBS



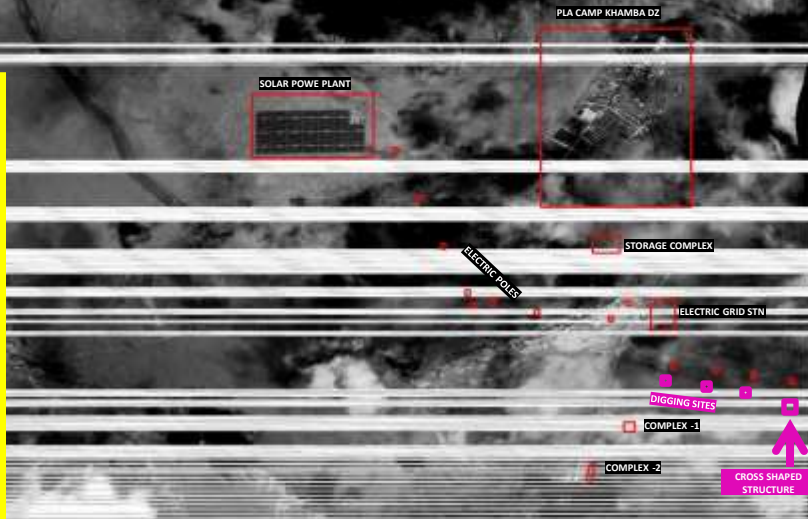
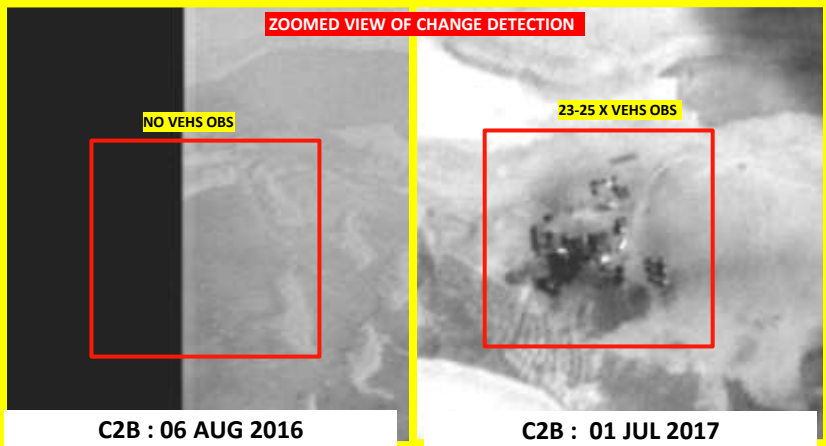
C2B : 01 JUL 2017

ZOOMED VIEW OF 10 X STORAGE SHEDS



C2B : 01 JUL 2017

ZOOMED VIEW OF CHANGE DETECTION



BASIC REQUIREMENTS

- ❖ TWO RASTERS BEING ANALYSED SHOULD BE OF SAME RESOLUTION :-
 - ❖ SPATIAL (PER PIXEL RESOLUTION)
 - ❖ SPECTRAL (MULTISPECTRAL V/S HYPERSPECTRAL)
 - ❖ RADIOMETRIC
 - ❖ (TEMPORAL) CHANGE IN PHENOLOGY
- ❖ PREFERABLY FROM SAME SENSOR
- ❖ RASTERS SHOULD BE GEO RECTIFIED – SAME PIXEL SHOULD BE AT SAME SPATIAL LOCATION IN BOTH THE IMAGES

CHANGE DETECTION

WHAT DO WE HAVE

For Int Gathering

**VISUAL – VISUAL INTERPRETATION OF
CHANGES IN REFLECTANCE IN TWO IMAGES**

TECNOLOGY
ONLY THEORY
&
DEMOS

WHAT DO WE NEED

APPLICATIONS BEYOND THEORY AND DEMONSTRATIONS

VERSATILE

SIMPLE TO USE

WORKING SOLUTION – THERE IS NO “EUREKA” HERE

DYNAMIC – EASY TO DEPLOY

MINIMUM PREREQUISITES

RAPID CHANGE MONITORING

WAY AHEAD

INDUSTRY HAS TO UNDERSTAND THE REQUIREMENTS

APPLICATIONS TO SUIT DYNAMIC NATURE OF INT
GATHERING

DON'T SHOW WHAT YOU HAVE DEVELOP WHAT WE NEED

TEST DATA MUST BE REALISTIC





JAI HIND