

# RAPID

## Radar Acquisition Processing Interconnection and Display

### Introduction

RAPID is a cost-effective and flexible solution for providing modern data processing and visualization capabilities to radar systems. Based on state-of-the-art technology, RAPID maximizes the use of software components and commercial off-the-shelf (COTS) hardware, ensuring easy maintenance and upgrading, and lowering overall system costs.

### Applicability

RAPID can be used as a part of newly designed radars, or as an upgrade kit for existing old generation radars. RAPID significantly increases efficiency of old generation radars and prolongs their operational lifetime by introducing modern data processing algorithms and visualization subsystem, while preserving expensive transmit/receive parts.

RAPID is directly applicable for conventional radars with mechanically rotated antenna, including:

- Military air-surveillance radars,
- Air-traffic control radars,
- Civil marine radars,
- Vessel tracking service radars.

### Key Features

- Radar video acquisition from analog signals,
- Automated target detection and tracking,
- Radar data visualization on high resolution color displays,
- Remote operation from distances up to 500m,
- Ready for use with Russian P series radars and Marconi S-600 radar system.

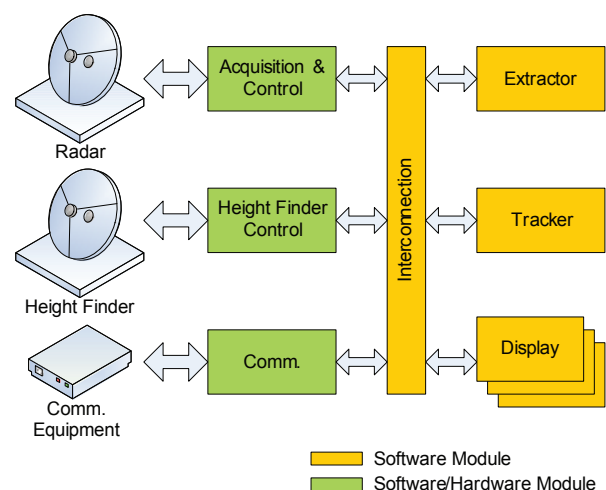
### Main Modules

#### RAPID Acquisition & Control

- Samples analog radar video signal and antenna azimuth signal (using video trigger for synchronization) and converts the sampled data into digital radar video format used throughout RAPID.
- Provides on-line control and status monitoring of radar transmitter, receiver etc.

#### RAPID Extractor

- Analyses digitized radar video and generates plots, which represent potential targets. Its operation consists of three phases:
  - Clutter processing using clutter map,
  - Adaptive thresholding using CA-CFAR, GO-CFAR or LO-CFAR algorithm,
  - Detection of target-like shapes among video samples that passed thresholding.
- Provides on-line status monitoring and configuration of extraction parameters.



#### RAPID Tracker

- Generates tracks, which represent actual targets whose presence is confirmed with a sequence of plots from consecutive radar scans.
- Global Nearest Neighbor (GNN) is used for data association, and it is implemented using Munkres algorithm. Prior to association, ellipsoidal gating is applied.
- Interacting Multiple Model (IMM) consisting of two or three Kalman filters is used as track filter.
- Track initiation and maintenance is implemented through use of M/N logic.
- Provides on-line status monitoring and configuration of tracking parameters.

## RAPID Display

- It is the primary man-machine interface (MMI) of RAPID. It displays:
  - Raw radar video in plan position indicator (PPI) format,
  - Plots,
  - Tracks,
  - Overlay graphics including maps, azimuth and range markers, code grids, air-traffic corridors etc,
  - Raw radar video in A-scan format.
- It is designed to accurately and naturally emulate properties of analog radar displays:
  - Effect of continual fading,
  - Double persistence effect (achieved with two phosphor layers in analog radar displays).



## RAPID Height Finder Control

- Provides on-line status monitoring and control of height finder radar,
- Supports manual and automatic height measurement requests,
- Ready for use with Marconi S-613 height finder radar.



## RAPID Interconnection

- RAPID Interconnection is a set of libraries used for local or remote inter-process communication (IPC). It is based on TCP/IP and it utilizes a distributed version of publish-subscribe design pattern.
- All software modules in RAPID are implemented as separate processes, connected by means of RAPID Interconnection.
- This way, weak coupling of software modules is enabled, increasing system modularity, flexibility and stability.

## RAPID Communication

- Allows continuous real-time plot and track data reporting to superior control center,
- Allows continuous real-time track data acquisition from superior control center and neighboring radars,
- Supports ASTERIX protocol and proprietary Marconi protocols.

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