Navy Combat System Simulation

Paul V. Werme

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UNIVERSITY OF VIRGINIA
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NAVY COMBAT SYSTEM SIMULATION

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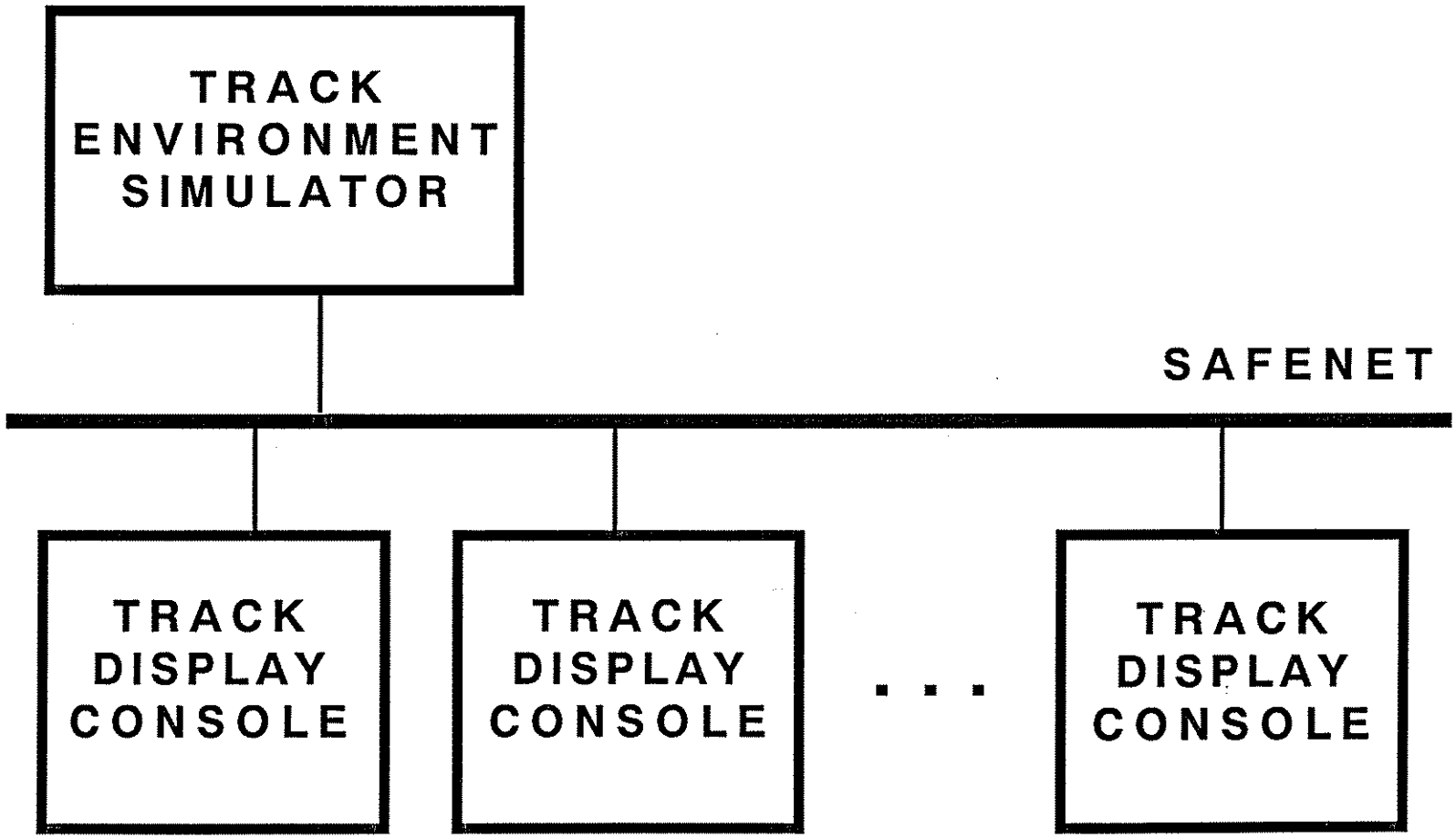
PROJECT MOTIVATION

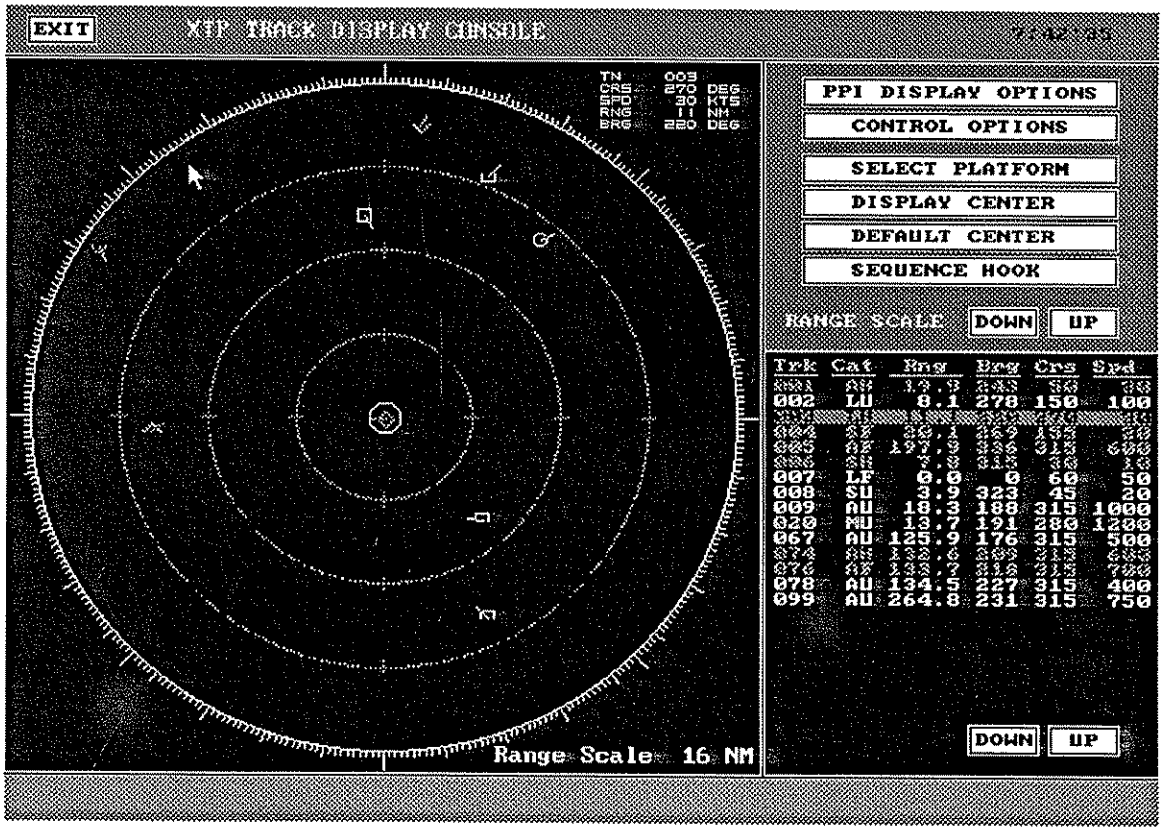
- Developed as part of an on-going effort to produce off-the-shelf XTP and SAFENET demonstration programs.
  - Motion
  - Color
  - Viewer Participation
  - Sponsor Relevance

GENERAL OVERVIEW

- Track File Distribution and Display
  - Demonstrates XTP multicast and unicast capabilities.
  - Distributes a centrally maintained track file to multiple display stations on the network.
  - Allows operators at the display stations to interactively modify the track environment.
- Navy-Oriented Demonstration
  - Sponsor relevance.
  - Provides familar displays for Navy personnel.
  - Demonstrates the ability to use XTP and SAFENET for real-world applications.

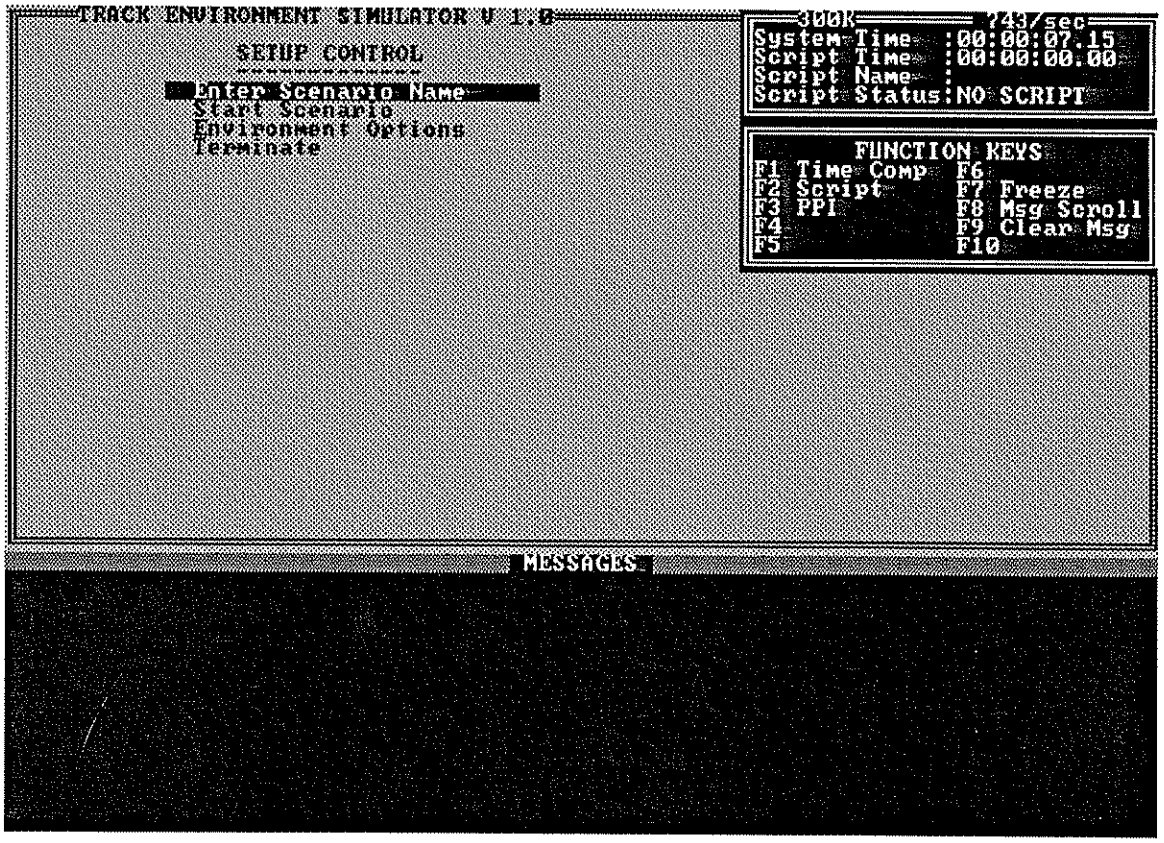
NAVY COMBAT SYSTEM SIMULATION ARCHITECTURE :




EXIT
XTP TRACK DISPLAY CONSOLE
TN 003
CRS 270 DEG
SPD 20 KTS
RNG 11 NM
BRG 220 DEG
PPI DISPLAY OPTIONS
CONTROL OPTIONS
SELECT PLATFORM
DISPLAY CENTER
DEFAULT CENTER
SEQUENCE HOOK
RANGE SCALE
DOWN
UP
Trk Cat Rng Brg Crs Spd
002 LU 8.1 278 150 100
007 LF 0.0 0 60 50
008 SU 3.9 323 45 20
009 AU 18.3 188 315 1000
020 MU 13.7 121 280 1200
067 AU 125.9 176 315 500
078 AU 134.5 227 315 400
099 AU 264.8 231 315 750
DOWN
UP
Range Scale 16 NM

TRACK DISPLAY CONSOLE FUNCTIONS

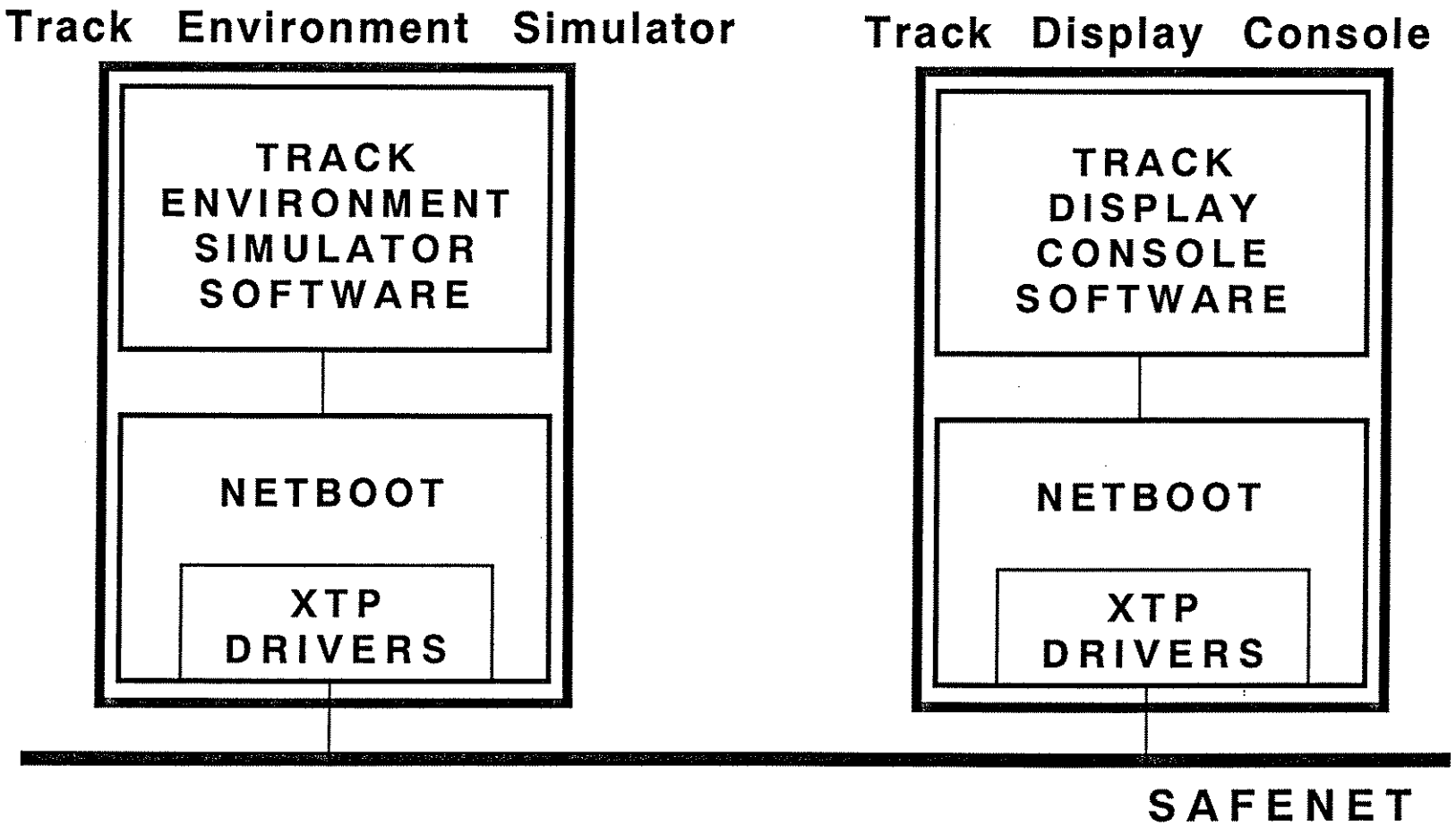
- DISPLAY OF TRACK FILE DATA
  - Up to 100 active tracks.
  - 1 second display update rate.
- OPERATOR ACTIONS
  - Configuring the display console.
  - Controlling the simulated environment
    - Track Entry/Edit
    - Track Maneuvers
    - Missile Engagements
- NETWORK FUNCTIONS
  - Receive track file data from the Track Environment Simulator.
  - Send environment control messages based on operator actions.


TRACK ENVIRONMENT SIMULATOR V 1.0
300K 743/sec
System Time :00:00:07.15
Script Time :00:00:00.00
Script Name :
Script Status:NO SCRIPT
SETUP CONTROL
Enter Scenario Name
Start Scenario
Environment Options
Terminate
FUNCTION KEYS
F1 Time Comp
F2 Script
F3 PPI
F4
F5
F6
F7 Freeze
F8 Msg Scroll
F9 Clear Msg
F10
MESSAGES

TRACK ENVIRONMENT SIMULATOR FUNCTIONS

- MAINTAIN AND UPDATE TRACK FILE
  - Maximum of 100 tracks.
  - Maximum of 50 tracks updated per second.
- LOAD AND RUN SCRIPTED SCENARIOS
- OPERATOR CONTROL OF THE SCRIPTED ENVIRONMENT
- NETWORK FUNCTIONS
  - Build and multicast all track file data once per second to all display consoles on the network.
  - Receive and process environment control orders sent from the display consoles.

SOFTWARE ARCHITECTURE :



NETWORK DESCRIPTION

- o CHANNEL ALLOCATION
  - XTP multicast for track file data.
  - XTP unicast channels for operator orders to modify the simulated environment.
- o TRACK ENVIRONMENT SIMULATOR
  - Multicast write channel for sending track file data.
  - Multiple unicast read channels for receiving control orders from the display consoles.
- o TRACK DISPLAY CONSOLE
  - Multicast read channel for receiving track file data.
  - One unicast write channel for sending control orders to the Track Environment Simulator.

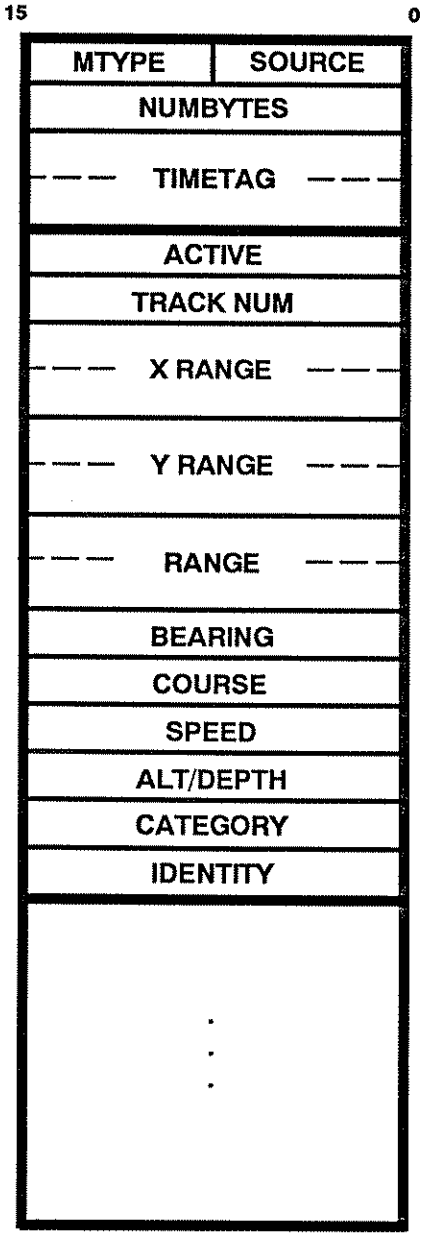
NETBOOT

- IMPLEMENTATION
  - Written in TurboC.
  - Includes XTP drivers.
- FUNCTIONS
  - Initializes the XTP drivers.
  - Opens XTP channels.
  - Spawns either the Track Environment Simulator or Track Display Console software.
  - Communicates with the application program via a software interrupt interface.

NETWORK MESSAGE TRAFFIC

- LOW BANDWIDTH REQUIREMENTS
  - Less than 4KB per second.
- TRACK FILE MESSAGE
  - Multicast by Track Environment Simulator once per second.
  - Message size of 2808 bytes.
- OPERATOR CONTROL ORDERS
  - Sent via unicast channels.
  - Timing is aperiodic based on operator actions at the display consoles.
  - Maximum message size of 46 bytes.

TRACK ENVIRONMENT SIMULATOR
TRACK FILE MESSAGE



Header :

- Message Source = 0 (Simulator)
- Message Type = 0
- NumBytes in Message (2808)
- TimeTag in 1/1024 seconds

Track 0 Data :

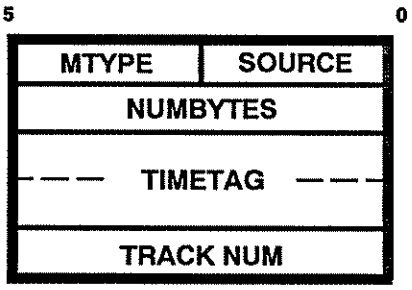
- Track Active Flag (0 or 1)
- Track Number (0 to 99)
- X Range in yards
- Y Range in yards
- Range in yards
- Bearing in 1/100 degrees
- Course in 1/100 degrees
- Speed in 1/10 knots
- Altitude or Depth in yards
- Category of Track
  - 0 = Air
  - 1 = Surface
  - 2 = Subsurface
  - 3 = Missile
- Identity of Track
  - 0 = Hostile
  - 1 = Unknown
  - 2 = Friend

Data for Tracks 1 through 99

Timing: Multicast to all Track Display Consoles at a 1 Hz rate.

Bandwidth Requirement: about 3K/second (2808 bytes/second)

TRACK DISPLAY CONSOLE
DROP TRACK MESSAGE

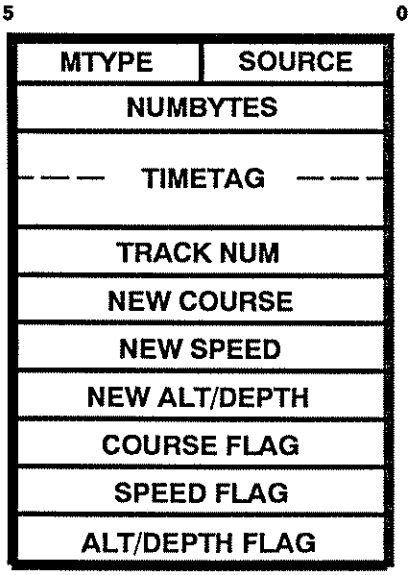


Message Source = 1 (Console)
Message Type = 32
NumBytes in Message (10)
TimeTag in 1/1024 seconds

Track Number to Drop (0 to 99)

Timing: Aperiodic based on operator action.

TRACK DISPLAY CONSOLE
TRACK MANEUVER MESSAGE

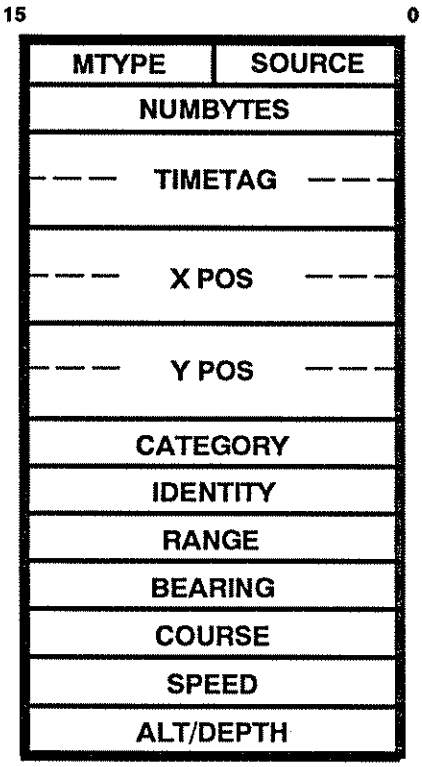


Message Source = 1 (Console)
Message Type = 33
NumBytes in Message (22)
TimeTag in 1/1024 seconds

Track Number to Maneuver (0 to 99)
Come to Course in degrees
Come to Speed in knots
Come to Altitude or Depth in yards
Course Maneuver Flag (0 or 1)
Speed Maneuver Flag (0 or 1)
Alt/Depth Maneuver Flag (0 or 1)

Timing: Aperiodic based on operator action.

TRACK DISPLAY CONSOLE
TRACK ENTRY MESSAGE



Message Source = 1 (Console)
Message Type = 34
NumBytes in Message (30)
TimeTag in 1/1024 seconds

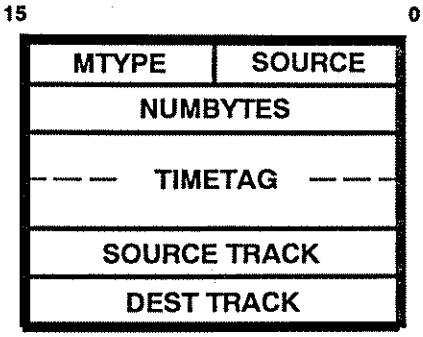
Display Center X Position in yards
Display Center Y Position in yards
Track Category
- 0 = Air
- 1 = Surface
- 2 = Subsurface
- 3 = Missile

Track Identity
- 0 = Hostile
- 1 = Unknown
- 2 = Friend

Track Range from center in NM
Track Bearing from center in degrees
Track Course in degrees
Track Speed in knots
Track Altitude or Depth in yards

Timing: Aperiodic based on operator action.

TRACK DISPLAY CONSOLE
MISSILE ENGAGEMENT MESSAGE

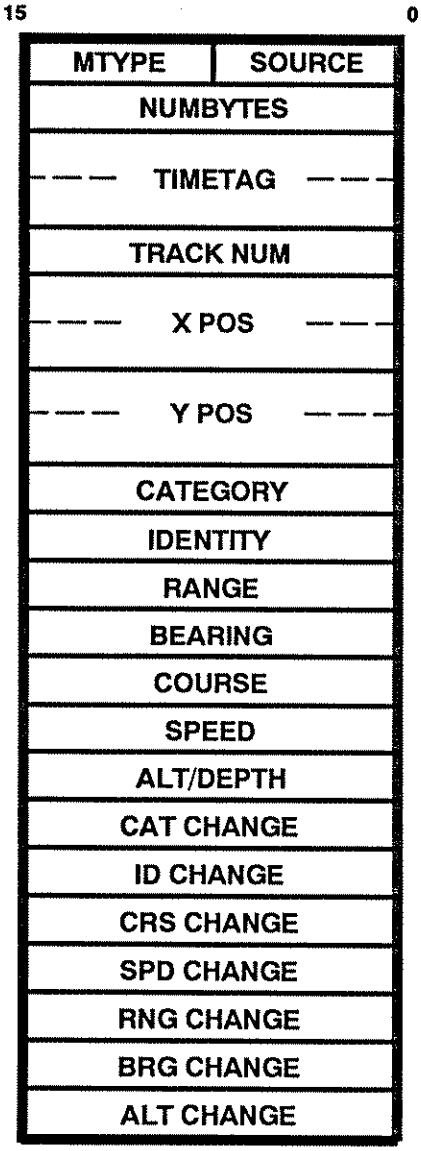


Message Source = 1 (Console)
Message Type = 35
NumBytes in Message (12)
TimeTag in 1/1024 seconds

Source Track Number (0 to 99)
(The track which will launch a missile.)
Destination Track Number (0 to 99)
(the track which is being engaged.)

Timing: Aperiodic based on operator action.

TRACK DISPLAY CONSOLE
TRACK EDIT MESSAGE



Message Source = 1 (Console)
Message Type = 35
NumBytes in Message (46)
TimeTag in 1/1024 seconds

Track Number to Edit (0 to 99)
Display Center X Position in yards
Display Center Y Position in yards
New Category
- 0 = Air
- 1 = Surface
- 2 = Subsurface
- 3 = Missile

New Identity
- 0 = Hostile
- 1 = Unknown
- 2 = Friend

New Range from center in NM
New Bearing from center in degrees
New Course in degrees
New Speed in knots
New Altitude or Depth in yards
Change Category Flag (0 or 1)
Change Identity Flag (0 or 1)
Change Course Flag (0 or 1)
Change Speed Flag (0 or 1)
Change Range Flag (0 or 1)
Change Bearing Flag (0 or 1)
Change Altitude/Depth Flag (0 or 1)

Timing: Aperiodic based on operator action.

PROJECT BENEFITS

- Sponsor relevance.
- Identified several problems in the XTP drivers and documentation.
- Proved the viability of converting the XTP drivers to a TSR.
  - Showed that that the XTP drivers are "well-behaved".
  - Conversion would free developers from being tied to TurboC.
- Provided many software libraries and coding examples.
  - Mouse routines
  - VGA graphics routines
  - Real Time Clock routines